## ILLUSTRATED TRADE REFERENCES

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1	2	3	4	5	6	7	8	9	10	3.1	12	13	14			17		19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		46	47	48	49	50
51 66	52 77	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68 93	69	70	71	72			75
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	91 116	92 117	93 118	94	95 120	96 121		98	99	100
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	122	123 148	124 149	125 150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217		219	220	221	222	223	224	225
226 251	227 252	228 253	229 254	230 255	231 256	232 257	233 258	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250
276	277		279		281		283	259	260 285	261 286	262 287	263 288	264 289	265 290	266 291	267 292	268 293	269 294	270 295	271 296	272 297	273	274	275
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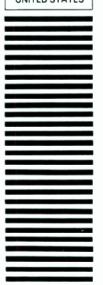


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#### Broadcast Equipment Volume

**PUBLISHER:** Bill Daniels

Executive Vice President, Sales: Mac McCaskill

Vice President, Sales: Fran Rose

Assistant Sales Manager: Brian G. Pyle

#### **Production:**

Kathy Daniels, Debbie Claybaker Glenda Houchins, Bill Thielker

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For additional copies of the 1979 Broadcast Equipment Reference contact the publisher.

#### CONTENTS I. Catalog Section B5-B182 Achro-Video International Sales Ltd......B5 TELEVISION ZOOM LENS SERVICE Reader Service Card 5 ADDA Corporation ......B6 FRAME SYNCHRONIZER WITH TBC AND FREEZE FRAME Reader Service Card 6 MICROPHONES AND HEADPHONES Reader Service Card 7 **BATTERIES AND CHARGERS** Reader Service Card 9 Anvil Cases ......B10 SHIPPING AND CARRYING CASES Reader Service Card 10 Allen Avionics Inc.....B11 VIDEO AND PULSE DELAY LINES Reader Service Card 11 Reader Service Card 12 Anton/Bauer Inc......B13-B16 PROFESSIONAL BATTERY SYSTEMS Reader Service Card 13 PORTABLE COLOR CAMERA, VIDEO NOISE METER, ENVELOPE DELAY MEASURING SET Reader Service Card 200 Beaveronics Inc..... STUDIO PRODUCTION VIDEO SWITCHING SYSTEMS AND MASTER CLOCK SYSTEMS Reader Service Card 20 Beston Electronics Inc......B21 CHARACTER GENERATORS WITH WIDE BAND GEN-LOCK Reader Service Card 21 Reader Service Card 201 Broadcast Video Systems Ltd......B28 SAFE AREA GENERATORS Reader Service Card 28 FM TRANSMITTERS Reader Service Card 29 BROADCAST COLOR TV CAMERAS Reader Service Card 30 CVI Colorado Video Inc......B31-B38 VIDEO INSTRUMENTS FOR DATA ACQUISITION, PROCESSING. **DISPLAY AND TRANSMISSION**

Reader Service Card 38

CVS Consolidated Video Systems Inc	Fujinon
Cases Inc. California	Garner Industries
Reader Service Card 40  Central Dynamics Ltd	Gruber Products Co
Chyron Corp	Hewlett Packard
Columbia Special Products	Hitachi Denshi America Ltd
Cine 60 Inc	Inovonics Inc
Crosspoint Latch Corp	TENSIONING KIT, ACOUSTIC ANALYZER Reader Service Card 73  JVC Professional Video Division, US JVC CORP
DeWolfe Music Library Inc	VIDEO CASSETTE RECORDER/PLAYER SYSTEMS, COLOR VIDEO CAMERAS, ELECTRONIC EDITING SYSTEMS; COLOR VIDEO TAPE RECORDERS, COLOR TV MONITOR/RECEIVERS, COLOR SYNC SIGNAL GENERATORS AND ACCESSORIES  Reader Service Card 208
Bill Daniels Co. Inc	Jamison Film Co
MAILERS, PRODUCT AND PRODUCTION PHOTOGRAPHY  Reader Service Card 1  Di-Tech Inc	Kliegl Brothers
VIDEO SWITCHER, AUDIO MONITOR AMPLIFIER, TRANSMISSION LINE SUPERVISION SYSTEMS, AUDIO/VIDEO/PULSE DISTRIBUTION AMPLIFIERS Reader Service Card 48	Knox Ltd. Video Products
Elcom Engineering CoB49  MODULATION AUDIO PROCESSING GROUP, FREQUENCY MEASURING PACKAGE AND AUTOMATION CONTROL TONES  Reader Service Card 49	Lee-Ray Industries Inc
Electro-Voice	Lenco Inc
Electrohome	Listec Television Equipment Corp
Electronics Diversified Inc	CONSOLES Reader Service Card 211  Multimedia Forum Productions in Crown Center
E.S.EB56-B57  CLOCKS, TIMERS, PROGRAMMERS/COMPARATORS  Reader Service Card 204	STAGE SHOWS, MULTI-MEDIA PRESENTATIONS, COMPLETE COLOR VIDEO STUDIOS AND FREE SCREENING FACILITIES  Reader Service Card 122
Frezzolini Electronics Inc	LOCATION LIGHTING EQUIPMENT  Reader Service Card 108

Marti Electronics Inc	Ramko Research
Microtime Inc	Reader Service Card 214
TIME BASE CORRECTION, IMAGE PROCESSING, NOISE REDUCTION, COLOR CORRECTION, VELOCITY CORRECTION AND DROPOUT COMPENSATION  Reader Service Card 113	SAKI Magnetics Inc
Micro-Trak Corp B114  AUDIO CONSOLES, TONE ARMS, FURNITURE  Reader Service Card 114	Sennheiser Electric Corp
Microtran Co. Inc	Shure
Reader Service Card 115	Skotel Corp
Minneapolis Magnetics Inc	Smith-Victor
Modular Audio Products	Reader Service Card 216
COMPLETE LINE OF MODULAR EQUIPMENT, BROADCAST CONSOLES, AUDIO DISTRIBUTION AMPLIFIERS  Reader Service Card 117	Sonar Radio Corp
Monroe Electronics Inc	Spin Physics Inc
Fred A. Nudd Corp	Steinberg Electronics Inc
O'Connor Engineering Labs Inc	Telemation, A Div. of Bell and Howell B154-B156 MULTIPLEXERS, MODULAR VIDEO/PULSE/AUDIO DISTRIBUTION AMPLIFIERS, SYNC GENERATORS AND TERMINAL EQUIPMENT, VIDEO/AUDIO DISTRIBUTION SWITCHING SYSTEMS Reader Service Card 217
Opamp Labs Inc	TentelB157  HAND HELD TAPE TENSION GAGE  Reader Service Card 157
Panasonic, Video Systems Division	Trompeter Electronics
BROADCAST QUALITY COLOR PRODUCTION SYSTEMS, SPECIAL EFFECTS GENERATORS, CHROMA KEY GENERATORS, COLOR SYNC GENERATORS, BLACK AND WHITE MONITORS, LENSES AND ACCESSORIES  Reader Service Card 212	Thomas J. Valentino Inc
Perrott Engineering Labs Inc	VAMCO Engineering CoB160-B162 VIDEO TAPE TIMERS, VIDEO AND AUDIO SWITCHERS Reader Service Card 218
QRK	Versa-Count
Quick-Set Instrument-Positioning Equipment	Video Aids Corp. of Colorado
RTS Systems	Video Components Inc

Videomedia
Videotek Inc
Vitex Co
The Winsted Corp
II. Product/Service

Product/service categories with the names of companies who supply these products/services and who responded to our questionnaire. The companies who are advertisers in the **Catalog Section** of this book are in large type with reference to the pages on which their products appear. If the manufacturer advertises in our other references, the name will appear in bold with no page number.

Index

B183-B220

#### III. Technical Data/ Information B220-B283

Wire/Cable Terminology
BUHL         8230           35mm Projection Charts         8231           Designer's Projection Charts         8231           Projection Format Focal Length Formulas         8232           16mm Projection Charts         8233
DA-LITE SCREEN CO. INC. Lens-Screen Size Charts B234
KODAK           Legibility-Artwork to Screen         B235-B236           Legibility Requirements         B237           Advantage of Standardization         B238-B239           Artwork Size and Formats         B238-B239           Special Applications         B239-B241           Legibility Calculator         B242
SENNHEISER ELECTRONIC CORP. Microphone and Headphone Data
TACO/JERROLD         8249           Vind Velocity Vs. Load         8249           Ice-Loading Map         8249           Distance to Horizon from Antenna         8249           Construction of a 300 Ohm Reference Dipole         8249           dBm Voltage Chart         8249           dB to Voltage Conversion Chart         8249           dBmV to Voltage Conversion Chart         8249

dB Ratio Chart for Voltage and Power         B           Voltage or Power Addition         B           TV Channel Data         B           TV Frequency Chart         B           FCC Radiation Standards         B           Cascaded System Noise Chart         B           VSWR Chart         B           Yagi Spacing to Phase Out Unwanted Signals         B           Preferred UHF to VHF Conversions         B           Cable Attenuation Data         B           Useful Formulas         B	250 250 250 251 251 251 251 251 251
UNIVERSITY SOUND           Sound Columns         B           Selecting the Proper Loudspeaker System         B274-B           Reference Chart for 70V Systems         B           Adjusting Power Capacity and Cut Off         B           Sound Pressure Level (SPL) Charts         B           Sound System Design Chart         B	3276 3276 3276
REFERENCE DATA         B253-E           Conversion Tables         B256-E           Tube Letter Symbols         B256-E           Semi Conductor Letter Symbols         B258-E           Electronics Symbols         B258-E           Color Code for Transformers         E           Electronics Color Coding         E           Periodic Table of the Elements         E           Table of Logarithms         E           Table of Trigometric Functions         B267-E           Squares/ Cubes/ Square Roots/ Cube Roots         B270-E           Prefixes and Symbols for Powers of Ten         E           Classifications of Emissions         E	3256 3258 3262 3263 3264 3265 3265 3266 3269 3272
FEDERAL COMMUNICATIONS COMMISSION RULES AND REGULATIONS Subpart B — Criteria for determining whether applications for radio towers require notification of proposed construction to Federal Aviation Administration	B283
THE VIDEO CONSUMER BS	310

# IV. Telephone Directory

B284-B317

**Industry Telephone Directory** of manufacturers, distributors, dealers, contractors, maintenance/service companies, consultants, production companies provided as a service to those who require this information.

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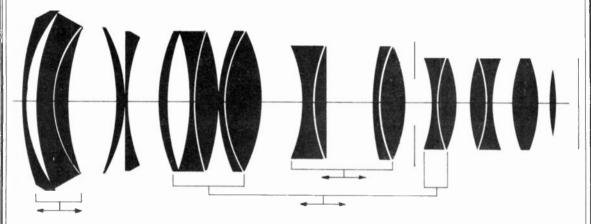


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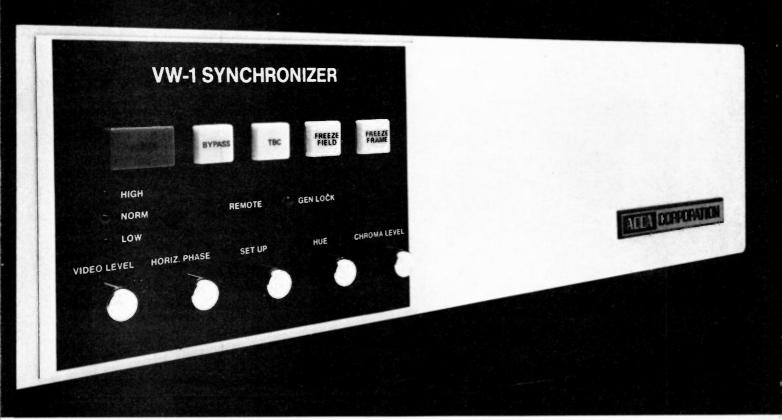
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ADDA CORPORATION

#### D-109 Lavalier Dynamic

\$75.00

Lightweight microphone for public address, television and motion picture applications. Includes: 291/2 ft. field-replaceable cable with stripped-andtinned leads at free end; nylon cord; lavalier clip with tie clasp; and case. Net wgt. 51/2 oz. w/cable. Matte nickel finish.

#### D120E...\$70.00 D-120E/ES Cardioid **Dynamics**

D120ES...\$75.00

\$170.00

Smooth-response, general purpose microphone with wire-mesh windscreen. Includes: SA-23/2 snap-out stand adapter; and case. (D-120ES same as D-120E but with integral on/ off switch.)

#### **D-140E** Cardioid Dynamic

Equally suited to studio or on-location uses. Optimally designed with a shock-suspended transducer and integral wire-mesh windscreen. Includes: integral bass roll-off switch to reduce proximity effect or low-frequency feedback; SA-25/1 stand adapter; and case.

#### D-160E1 \$80.00 **Omnidirectional** Dynamic

Exceptional microphone for vocal recording and broadcast use. The "ideal" ambiance and round table mic. Includes: W-20 foam windscreen; SA-23/2 stand adapter; and case.

#### \$115.00 D-170E Supercardioid Dynamic

Rugged microphone specially designed for rock vocalists. Internally shock-suspended transducer and wire-mesh windscreen for natural sounding close vocal pickups. Supercardioid pattern reduces feedback. Includes: SA-12/1 stand adapter; and

190E...\$80.00

190ES...\$85.00

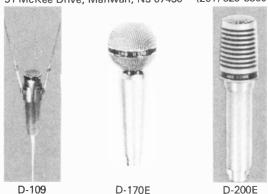
#### D-190E/ES Cardioid **Dynamics**

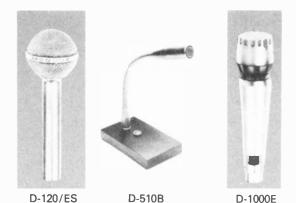
Excellent general-purpose, P.A., recording and live performance microphones. With sintered bronze wind/ pop filter. Cardioid pattern reduces feedback. Includes: SA-11 stand adapter; and case. (D-190ES same as D-190E but with integral on/off switch.)

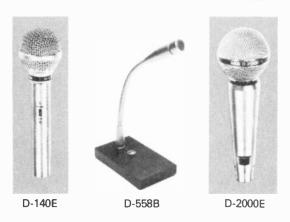


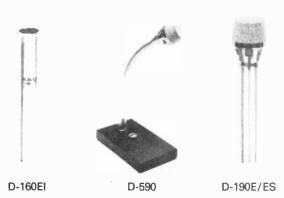
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Prices and Specifications Subject to Change Without Notice.

#### D-200E1 \$115.00 Two-Wav Cardioid Dynamic

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#### \$90.00 D-1000E Adjustable-Response Cardioid Dynamic

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#### D-2000E \$140.00 Adjustable-Response Supercardioid **Dvnamic**

The ultimate professional entertainers' microphone. Combines feedback-rejecting supercardioid pattern, smooth response and 3-position bass rolloff and on-off switch. High reliability construction. Includes: SA-12/1 stand adapter; and case

#### D-510B \$85,00 **Omnidirectional Dynamic**

Designed for radio/TV/recording "announce booth" applications. Overall length is 123/16". Flexible gooseneck shaft permits convenient positioning. Includes: 33/4 ft. shielded cable; and mounting hardware

#### \$90.00 D-558B Differential Noise-Cancelling **Dynamic**

For working distances of about 2", such as in radio newsrooms, industrial paging, studio talk-back, and radio dispatchers. Convenient, flexible gooseneck shaft. Includes: 33/4 ft. shielded cable; and mounting hardware. Overall length 123/16".

#### D-590 \$100.00 Cardioid Dynamic

Designed for sound reinforcement, paging and broadcast applications where ambient noise and feedback are considerations but where a greater working distance than 2" is required. Flexible shaft. Overall length 111/4". Includes: 33/4 ft. cable; and mounting hardware.

#### C-501E \$150.00 Electret-Condenser Cardioid "Combo"

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# C-502E \$150.00 Electret-Condenser Omnidirectional "Combo"

Designed for extra "hall" ambience, extended low-frequency response and for grouping around one mic. Consists of same components as the C-501E except with CE-2 electret-condenser capsule.

#### C-505E \$155.00 Electret-Condenser Cardioid "Combo"

Ideal for pop and rock vocalists, standup comics, emcees and other "closetalking" applications. Consists of SE-5E basic powering module; CE-5 electret-condenser capsule with shocksuspended transducer and fixed wire mesh wind/pop filter; SA-11/1 stand adapter; battery; and case.

#### C-510E \$180.00 Electret-Condenser Lavalier "Combo"

Miniature lavalier for film, TV, lecturehall and other "hands-free" uses. Consists of 2¾ oz. CE-10/1 electret-condenser capsule; 4 ft. cable with adapter to SE-5E; SE-5E powering module; two W-6 foam windscreens; battery; H-16 belt clip; and case.

CE-1 Cardioid Electret-Con- \$60.00 denser Capsule. Use with SE-5E.

CE-2 Omnidirectional Electret- \$60.00 Condenser Capsule. Use with SE-5F

CE-5 Shock-Mounted Cardioid \$70.0 Electret-Condenser Capsule with wire-mesh wind/pop filter. Use with SE-5E.

CE-8 Short-Shotgun Electret- \$105.00 Condenser Capsule. Use with SE-5E.

CE-10/1 Miniature Lavalier \$105.00 Electret-Condenser Capsule.
Capsule size: 7/6" X 9/16". Net wt. 23/4 oz. incl. cable. Cable length: 4'.
Use with SE-5E.

SE-5E Powering Module for use with all CE-series capsules. Requires one PX-23 mercury battery (included). Battery life: Approx. 550 hours continuous use. On-off switch. May be phantom powered.



PHILIPS AUDIO VIDEO SYSTEMS CORP.

C-502E

C-510E

C-501E

C-505E

مناشاته

CE-1

CE-5

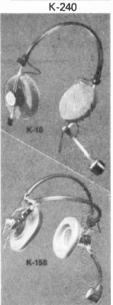
CE-10/1

SE-5E











#### K-40 \$24.00 Supra-Aural Stereo Headphone

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# K-140S \$49.00 Supra-Aural Professional Monitoring Headphone

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# K-240 \$79.00 Deluxe Circumaural Stereo Headphone

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K-18 Ultra-Lightweight Boom Set. Consists of two monophonically connected dynamic earphones and boom arm with noise-cancelling dynamic microphone. Headphone impedance matches 4-300 ohm outputs. Nominal microphone impedance: 200 ohms, matched by all low-impedance, unbalanced (25-1000 ohms) inputs. With 3½ ft., non-detachable cable with stripped-and-tinned leads. Wt.: 3½, oz.

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K-158 Boom Set. Consists of two independently wired earphones and boom arm with noise-cancelling dynamic microphone. Designed for on-the-air and intercom use in TV/radio broadcasting, industrial and general applications. Headphone impedance matches 4-600 ohm outputs. Nominal microphone impedance: 200 ohms, suitably matched by all low-impedance, balanced (25-1000 ohms) inputs. With 6½ ft., detachable 6-conductor shielded cable with headset connector and stripped-and-tinned leads. Wt.: 12 oz.

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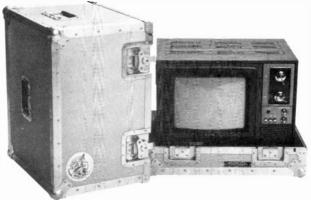
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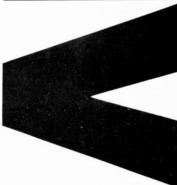
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and back covers remove to provide full access to controls and connections. Adequate ventilation for proper equipment operation is designed into the case.

For more information and the location of your nearest ANVIL Dealer—call us, ANVIL CASES, INC., 4128 Temple City Blvd., (P.O. Box 888), Rosemead, CA. 91770 (213) 575-8614













#### **ALLEN AVIONICS, INC. VIDEO & PULSE DELAY LINES**

224 EAST SECOND STREET, MINEOLA, NEW YORK 11501

Phones: (516) 248-8080 or (516) 747-5450

Allen Avionics, an established leader in the design and manufacture of Electromagnetic Delay Lines and L-C Filters has now developed a specialized group of products for the video market.

In color television broadcasting, accurate timing of signals is essential. This was initially achieved by the use of 75 ohm coaxial cable. The cost in time and materials to accomplish precise trimming and the lack of a rapid and convenient method of changing delays is currently responsible for the decline in cable usage. Television studios, studio equipment manufacturers and others engaged in the video industry are changing from 75 ohm cable to a more suitable method of achieving precise short delays. Allen Avionics now offers a line of Video Units for this purpose. Their use will result in a reduction of size, weight, installation cost and an overwhelming saving in time and effort to make delay changes.





Models VPO635 and VP1270 are padded to provide a flat loss of .5db and 3db, respectively. As a result of this padding, both units will exhibit a maximum variation of ±.2db at any delay setting.

Model VP0010 was designed specifically to be used as a delay trimmer in conjunction with our other delay units or any 75 ohm system. It offers .5 nanosecond switching resolution with excellent amplitude flatness up to 5.5 MHz.

These new delay units feature extremely flat amplitude response to 5.5 MHz, small increments of delay variation, low signal distortion and tight delay tolerance. The delay networks are ideal for pulse applications because of their fast rise times and low distortion. Amplitude equalization is employed to achieve excellent flatness over the video frequency range. The delayed output of any model in this group is the summation of individual lines. It is not the result of a tapped line. This feature insures that output pulse distortions are minimized. Units will match to any 75 ohm system and can be directly connected into the video signal path by means of BNC connectors.

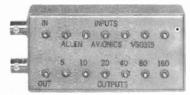


Part No.	Delay Range (Nano- Sec.)	Delay Steps (Nano- Sec.)	Method of Variation	Maximum Insertion Loss @ 100 KHz (db)	Amplitude Flatness At Any Delay Setting 100 KHz to 5.5 MHz (db)	Max. Rise Time (Nano- Sec.)	Package Size (Inches)
VP0010	0-10.5	.5	Toggle	.15	.2 Max.	3	4 3/8 x 2 3/8 x 1 1/6
VP0127	0-127	1.0	Toggle	.15	.3	14	4 % x 2 % x 1 %
VP0255	0.255	1.0	Toggle	.15	.3	16	4 % x 2 % x 1 1/6
VP0317	0.317.5	2.5	Toggle	.15	.3	20	4 3/8 x 2 3/8 x 1 1/6
VP0635	0.635	5.0	Toggle	.50	.4	25	411/6 x 311/6 x 211/6
VP1270	0.1270	10.0	Toggle	∘3.00	.4	30	41116 x 37116 x 211/16
VP1100	0-1100	10.0	Rotary	1.25	.4	30	411/6 x 311/6 x 211/6
VS0315	0.315	5.0	Strap	.25	.4	28	4 x 2 x 1 ½
VS0635	0.635	5.0	Strap	.60	.5	33	5 x 2 x 1 1/4
VS1275	0-1275	5.0	Strap	1.25	.5	33	5 x 3 x 1 1/4

Impedance: 75 ohms.

Pulse Distortion: Less than 4% with an input pulse rise time of 20 nanoseconds.

Return Loss: 20db minimum. Delay Tolerance: 5% or 1 nanosecond, whichever is greater. Working Voltage: 100 volts Max.



- .2db variation at any delay setting.

All Models Stocked in our plant in Mineola, N.Y.



#### **TYPE AV-397**

MAXIMUM DELAY: 2.075 microseconds ±3% variable in .025 µs. steps from .025 to 2.075 microseconds.

TIME DELAY OF INDIVIDUAL LINES: 1, .5, .2, .2, .1, .05, .025 microseconds. RISE TIME FOR ENTIRE LINE: .06 microseconds maximum.

FREQUENCY RESPONSE: 3db down at 5 megahertz for 2.075 microseconds delay.

DISTORTION: 2% maximum with .2 microsecond input pulse. IMPEDANCE: 75 ohms ±5%. WORKING VOLTAGE: 100.

TEMPERATURE COEFFICIENT: 50 parts/million/°C from -55°C to 105°C.

ATTENUATION: 7% maximum for 2.075 microsecond delay

MECHANICAL: Hermetically sealed in a steel can 2" x 2½" x 5½".

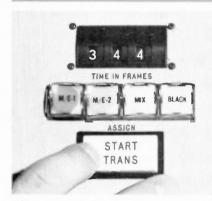


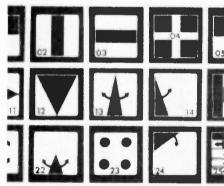
#### **American**

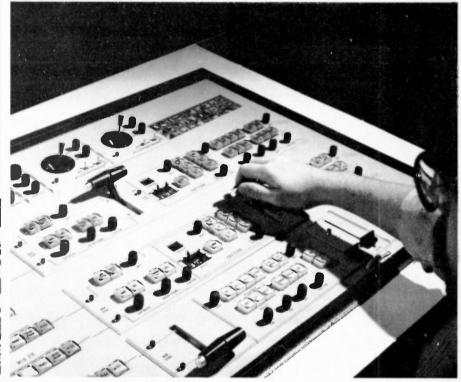
#### Data

Research Park P. O. Box 5228 Huntaville, Alabama 35805 USA Phone (205) 837-5180 TWX 810 726-2125

A North American Philips Company

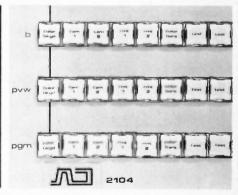


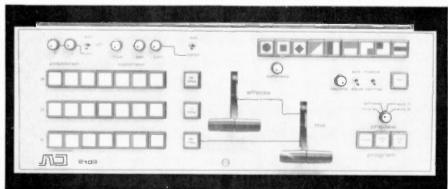




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No matter what your company's production specialty, news, commercial programming, or instructional television, the American Data complete line of field proven production switchers have the features you'll need to do the job.





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ADC MIDWEST P.O. Box 27324 Indianapolis, IN 46227 (317) 784-3000

# Perpetual Power

#### The First & Only **Battery System That Never Runs Down**

It is a fact that every battery must eventually run down, and usually does during your most important shot. We have changed all that. The new Anton/Bauer battery system will never run out of power, not during your most important shot, not during any shot.

#### The First **System Approach**

There are a lot of companies that make batteries, but only Arton/Bauer makes a battery system. Consider what happens when a conventional battery runs down, the cameraman must remove the camera from his shoulder, find a place to put it down, unplug the camera cable from the battery, unbuckle the battery, put on a fresh battery, fumble with the camera cables and lift the camera back on his shoulder. Now consider what this means in terms of a lost shot or even worse, an eternity of dead air. Now consider the Anton/Bauer System.

#### **Quick-Change Modular System**

Pull out the depleted battery module. push in a fresh one. The Anton/ Bauer System is that simple and that direct. No plugs, no buckle, no fumbling. A fresh battery module in one second. But sometimes even one second is not good enough.



#### Anton/Bauer inc.

66 Center St., Shelton, CT 06484, (203) 735-3305 We're a little powerhouse.

#### **Perpetual Power**

An important part of the Anton/Bauer System is our perpetual power belt which holds two battery modules. When the first is depleted, the camera is automatically, or manually switched to the second battery instantaneously without any loss of power. At any convenient moment, the cameraman can then take a second to replace the depleted battery with a fresh one. As before, when the second battery

> is depleted the camera will now draw once again from the fresh battery in position 1. And so it goes... no missed shot, no dead air, perpetual power. But there is even more to the Anton/Bauer System, like a variety of charges to fit any application, a selection of battery holders for any shooting style and battery modules tailored to the specific power requirements of virtually every portable Video camera.

Anton/Bauer... the first to design a Professional Battery System

for the Video Industry — modular design—rugged LEXAN cases silverplated contacts welded cell construction —

> It all adds up to a system that does not run down, or let vou down either. Write or call for complete brochure.



(914)356-3700



#### Anton/Bauer Inc.

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Anton/Bauer is the first and only company to make PROFESSION-AL battery systems for the video industry. All Anton/Bauer systems feature cases of injection molded, fibre glass reinforced unbreakable LEXAN®, silver plated contacts, metal-to-metal screws, welded cell construction, and belts of heavy gauge genuine cowhide. This rugged construction is designed to withstand the heavy use and abuse that portable equipment must endure in the field. While there are other companies that make batteries, only Anton/Bauer offers complete battery systems. The Quick-Change, modular design provides unlimited flexibility. An Anton/Bauer battery can be worn inconspicuously on a pants belt, attached to a camera or VTR, or coupled with a PERPETUAL POWER BELT for unlimited and uninterrupted power. It can be charged fast, slow, one at a time or in groups of four or more. The slim compact design allows extra batteries to be carried in small cases, pockets, or almost any where.

There are four complete Anton/Bauer battery systems. Each is designed to cover a wide range of applications. Please see our individual information sheets for complete specifications and description of each system. The following is a brief guide to the general application of each system. The application chart and product/price list on the following pages may also prove helpful.

#### "COM-BATT"

Compact Battery System — Ni Cad 1.6 amp hour Modular, quick-change design. Full line of accessories including PERPETUAL POWER BELTS, mounting brackets for camera or VTR, quick-chargers and case chargers. Designed primarily for cameras drawing 15 watts or less but will still deliver ample power to cameras drawing up to 25 watts. Smallest and lightest of the Anton/Bauer Systems.

# Professional Battery Systems

#### "SUPER D"

Heavy Duty System — Ni Cad 4 amp hour Modular, Quick-change design. Similar to Com-Batt system but with over 2½ times the power. Full line of accessories including PERPETUAL POWER BELTS, DUAL VOLTAGE BELTS, FAST CHARGERS and quick release mounting brackets for cameras and VTRs. For virtually all camera and VTR applications.

#### "SV SILVER SYSTEM"

Silver Zinc — 12 amp hours. Modular, Quick-change design. Most power for size and weight. About 2½ times the power density of Nickel Cadmium. Full line of accessories including PERPETUAL POWER BELTS, Automatic Quick chargers and quick release mounting brackets for cameras and VTRs. The sophisticated ANTON/BAUER silver chargers employ the latest state-of-the-art electronics and represent the first Silver Systems that really work.

"VIDEO BELTS"— Heavy Duty, Ni Cad 4 A.H. and 8 A.H. All Anton/Bauer battery belts feature heavy duty genuine cowhide belts, aircraft style aluminum quick release buckles, and LEXAN® battery cases. All belts include charge sensors in every module monitoring the charge state of every cell in the belt, an ANTON/BAUER exclusive. This provides foolproof fast charging with the accessory fast charger. All belts include circuit breakers, zener diode expanded meters and built-in overnight chargers. All camera belts include protective relay that prevents the charging voltage from damaging the camera. Three models, each designed for a specific application:

LB 30 - 4 AH 30 VOLT LIGHTING BELT

VB 12 - 4 AH for cameras requiring + 12 volts

DB 13 - 8 AH double capacity belt for most 12 to 14 volt applications.



'D' System — Battery, Metered Unipack and DC 12 charger.

#### 'D' System — Battery, Metered Unipack and DC 12 charger.

Basic 'Super D' battery system. Pictured is SD12 battery module, UMD-2 Uni Pack with meter and DC 12 micro-charger. A wide range of accessories are available.

#### Silver Charger and Battery

SV Silver Battery and Charger. Quickchange modular design allows battery to be snapped onto belt, camera or VTR. Most important, battery snaps onto charger during charging assuring mandatory upright position.

#### Camera and BVU W/Battery

The Anton/Bauer QRB Quick Release Bracket allows all models of Uni-Pack holders to be snapped onto virtually any camera, recorder or portable monitor.

#### Video Belt

Anton/Bauer Battery Belts for portable lights and camera applications.





Camera and BVU W/Battery



Video Belt



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Silver Charger and Battery



#### Anton/Bauer Inc.

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#### We're a little powerhouse.

#### **Professional Battery Systems**

SUPER D 4 Amp Hour Ni Cad Heavy Duty Modular Quick-Change COM-BATT 1.5 Amp Hour Ni Cad Compact Modular Quick-Change

SV-SILVER 10 Amp Hour Silver Zinc Modular Quick-Change VIDEO BELTS Heavy Duty 4 AH and 8 AH Ni Cad

we re a fittle powe	Watts	Volts	Model	Running Time Hr.	Model T	nning ime Hr.	Model	Running Time Hr.	Model	Running Time Hr.
Ampex BCC-14	27	14.4	SD-14	2	SV-13	5			DB-13	4
Asaca ACC2000	30	+/- 7.2	SD-14	1.6						
Cinema Products MNC-71CP	30	+ /- 7.2	SD-14	1.6						
Fernseh KCA 90 Fernseh KCN	30 135	+ /- 7.2 + /-14.4	SD-14	1.6	SV-13*	2				
Hitachi FP-3030 Hitachi FP-1020 Hitachi SK-80 Hitachi SK-90	12 22 48 35	12 12 + /-14.4 12	SD-12 SD-12 SD-14* SD-12	3.5 2 2 1.2	SV-13 SV-13 + SV-13* SV-13 +	10 6 5 3.5	QP-3	1.3	DB-13 + DB-13 +	
Ikegami HL-79A Ikegami HL-77 Ikegami HL-35	23 36 70	13.2 + /- 7.2 + /-14.4	SD-13 SD-14 SD-14*	2 1 1.5	SV-13 SV6-2 SV-13*	6 3 3.5			DB-13	4
JVC CY-8800U JVC CR-4400U	34 14	13.2 12	SD-13 SD-12	1.2 3	SV-13 SV-13+	3.5 8			DB-13 DB-13	2.5 ⊦ 6
Panasonic AK750P/EN Panasonic WV-3800	23 14	13.2 13.2	SD-13 SD-13	2	SV-13 SV-13	6 9	QP-4	1.2	DB-13 DB-13	4 6
Philips LDK-14 Philips LDK-11 Philips Video 80	27 60 50	14.4 + /-12 + /-12	SD-14 SD-12* SD-12*		SV-13 SV-13* SV-13* +	5 4 5			DB-13 VB-12 VB-12	4 1.5 1.8
RCA TK-76	42	14.4	SD-14	1	SV-13	3			DB-13	2
Sharp XC530 Sharp XC320U	22 22	12 12	SD-12 SD-12	2 2	SV-13 + SV-13 +	6 6			DB-13 - DB-13 -	
Sony BVU-100 Sony BVU-50 Sony DXC1610 Sony BVH-500 Sony BVP-300	23 12 11 48 21	12 12 12 12 14.4	SD-12 SD-12 SD-12 SD-14	2 3.5 4	SV-13 + SV-13 + SV-13 + SV-13 +	6 10 10 2.5 6	QP-3 QP-3	1.3 1.5	DB-13 - DB-13 - DB-13 - DB-13 - DB-13	+ 7 + 8
Thomson Microcam	21	14.4	SD-14	2	SV-13	6			DB-13	4
Portable Lights (Sun Guns)	100 150 250 350	12 30 30 30	SD-12	25 min					LB-30 LB-30 LB-30	45 min 30 min 20 min

<sup>\*</sup>Requires special dual power belt which holds two batteries, one for (+) voltage, the other for (-) voltage. Running times are for the pair.

<sup>+</sup> Requires special voltage reducing cable or bracket.





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Bassani Adadida

#### Anton/Bauer Inc.

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#### **PRICE LIST**

#### "COM-BATT" COMPACT **BATTERY SYSTEM**

N. Cad 1.6 A.H.

uies	
12 Volt Quick Pack\$	180.00
14.4 Volt Quick Pack	220.00
Uni-Pack Quick-Change Single Battery Holder	48.00
Uni-Pack w/Meter for QP-3	85.00
Uni-Pack w/Meter for QP-4	85.00
Perpetual Power Belt — Automatic	275.00
Quick Release Bracket for Camera or VTR	50.00
Micro Charger — Overnight for QP-3 Only	35.00
Quick Charger — 4 hr. Charge for QP-3 Only	85.00
Quick Charger — 4 hr. Charge for QP-4 Only	85.00
Case Charger — Overnight for 4 QP-3 Batteries	195.00
Case Charger — Overnight for 4 QP-4 Batteries	210.00
Case Charger — Overnight for 6 QP-3 Batteries	225.00
Case Charger — Overnight for 6 QP-4 Batteries	240.00
	12 Volt Quick Pack  14.4 Volt Quick Pack  Uni-Pack Quick-Change Single Battery Holder Uni-Pack w/Meter for QP-3 Uni-Pack w/Meter for QP-4 Perpetual Power Belt — Automatic Quick Release Bracket for Camera or VTR  Micro Charger — Overnight for QP-3 Only Quick Charger — 4 hr. Charge for QP-3 Only Quick Charger — 4 hr. Charge for QP-4 Only Case Charger — Overnight for 4 QP-3 Batteries Case Charger — Overnight for 4 QP-4 Batteries Case Charger — Overnight for 6 QP-3 Batteries

#### **SUPER D SYSTEM** Heavy Duty, Modular, Quick-Change N. Cad 4. Amp Hr.

SD 12R	12 Volts Super D Regular Charge\$	320.00
SD 12F	12 Volts Super D Fast Charge	360.00
SD 13F	13 Volts Super D Fast Charge	390.00
SD 14R	14.4 Volts Super D Regular Charge	360.00
SD 14F	14.4 Volts Super D Fast Charge	410.00
Holders		
UP-D	Uni-Pack Quick-Change Single Battery Holder	60.00
UMD-2	Uni-Pack with Meter — 12 Volts	90.00
UMD-3	Uni-Pack with Meter — 13 Volts	90.00
UMD-4	Uni-Pack with Meter — 14.4 Volts	90.00
PPA	Perpetual Power Belt — Automatic	285.00
PPM	Perpetual Power Belt - Manual	245.00
PPCT	Perpetual Power Belt — w/Center Tape ( + /- Voltage)	275.00
DPD	Dual Power Belt Holds 2 Batteries for + /-12 or + /-14 Volts	245.00
DPD/SK80	Dual Power Belt — Includes Bracket for SK80 Electronics Module and Cable to Module	315.00
QRB	Quick Release Bracket for Mounting Uni-Packs on Camera /VTR	50.00
Chargers		
DC-12	Micro Charger — Overnight — 12 Volts Only	60.00
DC-13	Micro Charger — Overnight — 13 Volts Only	60.00
DC-14	Micro Charger — Overnight — 14.4 Volts Only	60.00
FC-D	Fast Charger	285.00
DC4M	Case Charger — Overnight — for 4 Batteries (Chassis Only)	545.00
DC4M-T	Case Charger — As Above in Heavy Duty Case	675.00
Brackets		
QRB/HL-77	Quick Release Bracket Installed On Customers HL-77 Rear Side Plate	95.00
QRB/TK-76	Quick Release Bracket Installed On Special Plate for	30.00
	Mounting on Rear of TK-76 A or B. No Modification to Camera	95.00
QRB/BVU-50	Quick Release Bracket Installed on Special Wrap Around Protection Plate for Mounting on BVU-50. No Modification	22.00
	to Recorder	95.00

QRB/	Quick Release Bracket Installed o
BVU-100	on Side of BVU-100 VTR. No N
CD-50	Cassette Door Replaces Standard
	Allowing Storage of 20 Minute

duick release Bracket Installed on Special Plate for Mounting						
on Side of BVU-100 VTR. No Modification to Recorder	95.00					
Cassette Door Replaces Standard Battery Door on BVU-50						
Allowing Storage of 20 Minute Cassette in						
Battery Compartment	55.00					

#### SV SILVER SYSTEM

Modular, Quick-Change, Silver Zinc 12 Amp Hr.

Battery Modu	iles	
SV-13	Silver Zinc 13.5 Volts — 12 AH	895.00
SV 6.2	Silver Zinc + /-6 Volts — 12 AH	895.00
Holders		
UPSV/HL-77	Single Battery Holder With Belt Loops and Integral	
	Power Cable for HL-77	130.00
UPSV/TK-76	(Same as above) for TK-76	165.00
UPSV/HL-79	(Same as above) for HL-79	130.00
UPSV/CY8800	O(Same as above) for JVC CY-8800	130.00
UPSV/	(Same as above) for Thompson Micro Cam and	
MC-BVP	Sony BVP-300	130.00
DPSV/SK-80	Dual Power Belt — Includes Bracket and Cable for SK 80	320.00
PPSA	Perpetual Power Belt — Automatic (F/SV 13 Only)	295.00
PPCTS	Perpetual Power Belt — Manual (F/SV6.2 Only)	275.00
DPSV	Dual Power Belt (Holds Two SV-13 for + /-13.5 Volts)	250.00
QRSV	Quick Release Plate for Camera or VTR Mounting	55.00
Chargers		
SVDC 6.2	Fast/Slow for One SV 6.2 Battery	1595.00
SVDC 13	Fast/Slow Dual Charger for Two SV 13	
Brackets		
QRSV/	Quick Release Bracket for SV-13 — Installed on Special	
TK-76A and	Plate for Mounting on Rear of TK-76A or B Includes	
TK-76B	Integral Shorty Power Cable. No Modification to Camera	165.00
QRSV/	Quick Release Bracket for SV-13 — Installed on Special Plate	
BVU-100	for Mounting on Side of BVU-100. No Modification to	
	Recorder	125.00
QRSV/	Quick Release Bracket for SV-13 — Installed on Special Wrap	
BVU-50	Around Plate for BVU-50. No Modification to Recorder —	
	Includes Integral Power Cable to Recorder	135.00

#### **VIDEO BELTS** Heavy Duty N. Cad 4 A.H. and 8 A.H.

All Video belts have built-in overnight Chargers, Zener Diode expanded volt meters, circuit breakers and fast charge capability with FC-L fast charger.

Belts LB-30 LB-30D DB-13 Chargers	Lighting Belt — 30 Volts — 4 AH	675.00
FC-L	Fast Charger — One Hour — For All LB, VB, DB Belts	250.00
TFC-L	Fast — Slow Charger. One Hour Transformer Type — 115 or 230 Volts for All LB and DB Belts	325.00

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Prices and specifications subject to change without notice

B-16



#### ASACA CORPORATION OF AMERICA

1289 Rand Road, Des Plaines, Illinois 60016 Tel: (312) 298-4380 Telex: 72-6351

ASACA designed and developed its new

This camera can either be used as a one-

By making use of a gen-lock circuit, 2-line contour circuit and an

automatic adjustment circuit, the camera's mobility is enhanced and its picture quality is increased. In

addition, these features give the

Another main feature of this camera is its

#### **Modular Type** Portable Color **TV Camera** ACC-2000

#### **Features**

1. New modular camera configuration The camera can be used as one-piece

or as two-piece. The camera is constructed so as to allow the head pack and the process pack to be separated, the two individual units being linked by a camera cable.

#### 2. Lens selection

The camera is provided with C, bayonet and Arriflex (using a replaceable adaptor) lens mounts, and this enables a wide variety of lenses to be used.

#### 3. Effective battery operation

Thanks to the streamlined design of the circuitry, the power consumption of the camera is a mere 30W when a +7.2V Ni-Cd battery is used. This means that the camera can be powered for more than two hours at a stretch.

#### 4. Automatic functions for improved operation

The camera is provided with an automatic white control, an automatic iris control and flare compensation which make the camera handle like a dream.

#### 5. Gen-lock operation

It is possible to operate a multiple number of cameras in sync with black burst signals supplied from an external source. Furthermore, there is a built-in phase shifter for the subcarrier and sync signals.

#### 6. Full 2-line contour enhancement

The adoption of a 2-line system enables pictures to be obtained which have been contour-compensated from the balance. Also featured is a circuit configuration which is equipped with a horizontal and vertical compensation adjustment function, a crispening function and a level dependent function.

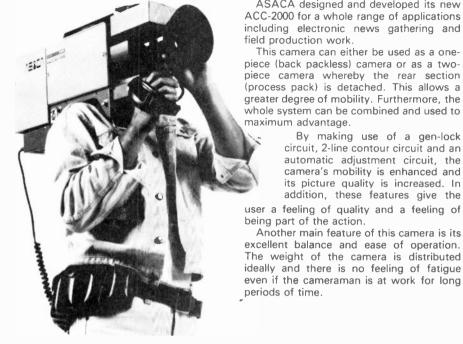
#### 7. Remote control function

If the remote control unit is employed, it is possible to control the cable compensation (maximum length: 1000 ft.), iris, gen lock, registration and master pedestal functions at the base station.

#### 8. Perfectly balanced

Circle (17) on Reader Service Card

The design of the camera has been made to conform to the principles of human engineering, and so the camera features perfect balance and just the right distance from your shoulder to the grip. This means that you're not aware of the color camera's actual weight.



#### **UNIT COMPOSITION**

[Basic configuration]

- Camera head with 3 pick-up tubes (2/3 inch plumbicon® or saticon®)

  • 1.5" viewfinder
- AC pack
- Carrying cases
- Cords and accessories

#### [Options]

- DC pack with Ni-Cad batteries
- Belt battery
- DC-DC convertor for car battery use
- Battery charger
- 15 ft camera cable
- (When used as a 2 piece type camera)
- Conversion connector kit
- (When used as a 2 piece type camera)
- Remote control unit
- (Iris, black level, painting, gen-lock)
- Zoom lens; F 2.2 12 120mm
- ARRI conversion adaptor
- External zoom control box
- 5" viewfinder
- 9" picture monitor (B/W)
- Waveform monitor
- Head set
- Test charts
- Rain cover
- Cold-protective cover
- Microphone (600 ohm, balanced)
- Tripod
- Tripod mounting plate
- Tripod adaptor for 5" viewfinder

#### **SPECIFICATIONS**

- Input signals
- 1) Ext gen-lock signal/
- VBS 1Vp-p or black burst signal 2) Aux video signal/VBS 1Vp-p
- 3) Mic input signal/ -60 dBm, 600 ohm, balanced 4) Tally/24V DC
- Output signals
- 1) Video signal/VBS 1Vp-p, 1 output

- 2) Monitor output/VBS 1Vp-p, 1 output
- 3) Mic output/-22dBm,600ohm, balanced 4) VTR control/Switched voltage comparable with SONY VO-3800
- 5) Intercom/2 wire system
   Rated voltage

- 1) AC power/ AC 117V 50/60Hz 50VA (Approx ) 2) Battery/±7.2V 30W
- Optical system/Dichroic mirror system
- Filter/No.1 Clear 3200°K
   No.2 6000°K → 3200°K ND25%
   No.3 6000°K → 3200°K ND10%
  - No.4 Cap
- Pick-up tube/ 2/3 inch Plumbicon® or Saticon® Viewfinder/1.5" electronic VF (B/W)

- C mount, special bayonet mount Lens/Power zoom lens, F2.2 12-120mm
- - 1) Camera head: 19,1 lbs (8,7 kg) 2) Viewfinder: 2,2 lbs (1,0 kg)
- - 1) Over 500 TV lines at picture center 2) Over 400 TV lines at picture corners
- S/N ratio/
- More than 50 dB (Y channel) G channel signal current: 150 nA
- F 4+0.5 at 200 fc (2000 lux)
- Minimum illumination/
- 30 fc (300 lux) F 2.2 +9dB

- Geometric distortion/ Less than 1.5% of picture height
- Resistration/
  - \*Circle 80% of picture height ..... within 0.1%
- \*Circle 100% of picture height .... within 0.2%
- \*Remaining area ..... within 0.4%
- Usable ambient temperature range/ 0 40°C (With cold-protective cover, camera usable down to -20°C)
- Quick start/Within 10 sec.

Telex: 72-6351

Tel: (312) 298-4380



Video Noise Meter



The 925C video noise meter measures the units' video noise voltage generated in television transmission equipment, television cameras, video tape recorders, video disc units, digital image processors, and the like.

One conventional method of measuring such noise is to use a video noise meter that employs a power meter. In contrast, the Shibasoku noise meter supplements the conventional meter functions with a new function that allows operators to measure the chroma noise of color signals.

In particular, the Shibasoku model is especially designed to measure the several-kilo-hertz-order color shading noise that is generated inhelical video tape recorders.

Measurements of video noise and chroma noise using this model are conducted with the equipment under test subjected to exactly the same conditions as in actual operation.

Employed for the measurement of video band noise is a white signal of the desired level with a sync signal added to it. Chroma band noise is measured with a single-color signal of the desired level that contains both a sync signal and a color burst signal.

Chroma noise can be split into AM (amplitude modulation) and PM (phase modulation) components which can be measured separately.

At the point of measurement, all the blanking, sync signals and color burst signals that were added to the test signals are canceled out within the unit. Also, this miss pulse, created when head switchover takes place on a 2-head video tape recorder, is also eliminated.

The loss of the noise energy of the extracted component is compensated for at the power meter.

#### **Operating Instructions** Example of measuring VTR noise اللانيات 0 1 $\overline{a}$ 8 00 A 0 0 0 0 0 0 00 6 9 @ ... 00000 0 0 0 000 0 0 0 0 000 0 0 :0 ۰۰ سس

TELEVISION SYSTEMS 925C/1 System-M 925C/2 System-I

SPECIFICATIONS Kinds of measured video notice

Chroma band AM noise and Chroma band

Noise measurement range Video band noise Visual weight noise

Chroma band noise

0.1 kHz to 10 MHz T = 0 245 μs filter at CCIR REPORT 410 I (Doc. CMTT/273-E 1974) furnished to

standard type, but change of it is acceptable by required 925C/1. 3 58 MHz + 0 5 MHz 925C/2. 4.43 MHz + 0 5 MHz

ecting function for noise measuring band Low band cut-off frequency (HPF)

0.1/1/10/50/100 kHz switchable

High band cut-off frequency (LPF)

0.5/1/3/4 MHz/THROUGH switchable 925C/1. 925C/2; 0.5/1/4/5 MHz/THROUGH switchable

Input waveforms

Noise measurement of

video band

0 to 1 Vp-p white signal which the composite sync pulse and blanking pulse is provided, and the color burst included in the signal is acceptable.

Single-color signal that the chroma signal of 0.2 Vp-p to 1 Vp-p is superimposed on chrome band white signal from 0 to 1 Vp-p

Sag adjusting range

Sync level range Input impedance

• 5% of linearity sag (switch is selected to H or V) 75 Ω · 3% or HIGH (1 MΩ 20 pF) selection

Input level correcting range Adjustable within • 3 dB Vrms and S/N. dBp-p/rms Indication of noise level

Definition of noise level (S/N) Noise level defined by S (Vp-pl/N (Vrms) and indicated by dB 925C/1: Video band noise

S=0.714 Vo-o. 0 dBp-p/rms=0.714 Vrms S=0.7 Vp-p, 0 dBp-p/rms=0.7 '/-ms

Effective voltage of PM side band is 0.714 Vrms=0 dBp-p/rms
Effective voltage of PM side band is Chroma PM noise

0.714 Vrms=0 dBp-p/rms

Measurement of noise voltage 0.3 mVrms to 100 mVrms

Amplitude response Frequency response

< : 0.5 dB at measurement band ≤ + 0.5 dB at -- 20 to -- 60 dB

**RMS** voltmeter Detection methods Scale indication Meter scale

Detection of true RMS value Vrms and dBp-p/rms Voltage: 10~1/3~0.5 (Two scale at upward and down ward) dB. +3 to -12

-20/-30/-40/-50/-60 dB Range switch

Reference value of Input voltmeter

Noise signal output Output level Output waveform Output impedance Attenuation Sync selection

Internal sync External sync

Input impedance Input and output connector Power supply

Accessories Supplied

925C/1 . 0 dB = 0.714 Vrms 925C/2. 0 dB = 0.7 Vrms Meter scale. 0 to 1 Vp-p Indication (Vp-p) and calibration for the

white signal and the chroma signal Approx 0.5 Vp-p at full scale H/2 Sin² gate waveform 75 Ω + 3%

(Internal or External) Sync separating method Composite sync pulse input: 1 Vp-p to 4 Vp-p High impedance, bridge connection

AC 100/115/200/230V : 10%, 50/60 Hz. approx 50 VA 430(W) x 149(H) x 335(D) mm, (inch) 16 9 x 5 9 x 13 1 approx 15 kg Coaxial cables (BNC, 3C2V) Extension printed board for P C.B

M-BNC plug Rack mounting adaptor

Prices and Specifications Subject to Change Without Notice.

Circle (18) on Reader Service Card



ASACA CORPORATION OF AMERICA

1289 Rand Road, Des Plaines, Illinois 60016 Tel: (312) 298-4380 Telex: 72-6351

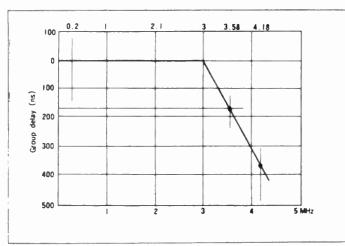


Measuring Set

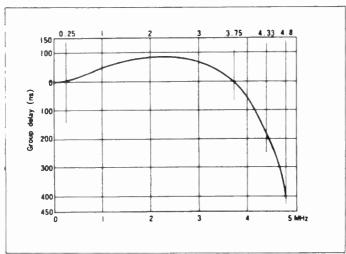


The 201-1 is expressly designed for measuring the envelope delay incurred in equipment used in the transmission and reception of color television signals.

It contains a built-in sweep signal generator which obviates the need for separate signal sources. Direct measurements are possible thanks to the graticule with the appropriate television system's standard gradations which is attached to the surface of the cathode-ray tube in the display section. The model features a choice of signal source between sweep signals and wave signals. Direct read-out is possible even with spot frequencies ranging from about 200 KHz to 10 MHz.



System-M, Color-PAL, NTSC (525 Line)



System-B.G, Color-PAL (625 Line)

#### **FEATURES**

- Built In Sweep Generator It can determine sweep measurement and CW (point by point delay of descrete frequencies).
- Sweep Speed Is Adjustable.
- Built In Sync and Blanking Circuit Since the unit has its own sync and blanking circuit, one is also able to measure GROUP DELAY.
- Direct Read-Out by 7 Inch Square CRT It is possible to show simultaneously a dual trace for the envelope delay and frequency versus amplitude characteristics.
- Internal and External Marker It has its own fixed internal marker as well as a connector for an external marker.

#### **SPECIFICATIONS**

	0. 201110	ATIONS
•	Measuring signal generator Frequency range	Sweep, 100 kHz to > 5 MHz
		CW . $100 \text{ kHz to} > 5 \text{ MHz}$
	Output frequency response	± 0.5 db at 100 kHz to 5 MHz
	CW accuracy	< ± 3%
	Marker frequency	0.2/1.0/2.1,3.0/3.58/4.18/5.0 MHz
	Sweep rate	Approx 1 Hz to 5 Hz continuous variable
	Output impedance	75 ↑ unbalanced < + 10/7
	Output level	
	without sync and blanking.	0 to 10 Vp-p, continuous variable
	with sync and blanking:	Video 0.1 to > 0.7 Vp-p Set-up approx 0.07V Sync 0.1 to > 0.4 Vp-p
	Line frequency	15 734 kHz < 5 x 10 <sup>-4</sup>
	Split frequency	$20 \text{ kHz} < 5 \times 10^{-4}$
	CW output	Vp·p ( <   k^)
•	Envelope delay measuring section Measuring frequency range	Sweep, 200 kHz to > 5.0 MHz CW = , 200 kHz to > 5.0 MHz
	Measuring range	+ 100 ns to 500 ns
	Phase control	0 ~ 10 μs
	Accuracy	< ± 10 ns (at input level variation of within 6 dB)
	Measuring input level	0.1 Vp-p to 1.1 Vp-p
	Noise	< + 10 ns (at without sync signals)
	Vertical display calibrated signal	100 ns + ₹♡
•	Display section Display methods	Dual trace display by chopper method
	Vertical sensitivity	100 ns/div (1 div = 14 mm), with MAG $\propto 2$
	Effective scale	118 x 84 mm
	C.R.T.	7 inches square tube, persistence (B-7), magnetic deflection method
•	Others Power supply Dimensions	AC 100/117 V ± 1077, 50 60 Hz 430 (W) x 150 (H) x 335 (D) mm Approx 16 N x 5 N x 13 L m ls

 763 NA — Same unit less sync and blanking circuit available at reduced price.

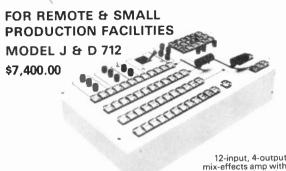
Approx. 16.9 x 5.9 x 13.1 inch

• SHIBASOKU Equipment - sister company of ASACA.



#### Beaveronics, Inc. STUDIO PRODUCTION VIDEO SWITCHING SYSTEMS

8 Haven Avenue Port Washington, New York 11050 Tel: (516) 883-4414



mix-effects amp with downstream mixer, includes downstream preset & program busses with cut bar, RGB chroma key

#### Standard Features

- 12 inputs including Black-burst and Color
- Built-in Black Burst Generator
- **Built-in Colorizer**
- Built-in RGB Chroma keyer
- Four Switching busses
- Downstream Preset and Program Busses
- Rack-mounted electronics
- Adjustable Soft Wipe
- Adjustable Border edges
- Color Matte
- Vertical Interval switching thru-out
- Illuminated Momentary Contact push buttons
- Internal, external, Chroma-key, and matte inputs to keyer

- Built-in pattern modulator with frequency and amplitude controls
- Full Tally
- Pattern symmetry control
- Illuminated Momentary contact push buttons for effects selection
- Normal/Reverse/Normal-reverse wipe transitions
- Pattern limit controls for presetting size of patterns or varying vertical and horizontal aspect ratio
- Loop-through inputs
- Input amplifiers with clamping
- · Synchronous/Non-synchronous inhibit
- Modular construction with front access plug-in modules

#### **Options:**

Downstream Kever

#### FOR MODERATE SIZE FACILITIES **MODEL B1-154**



FOR SOPHISTICATED FACILITIES **MODEL B1-156** 



15-input, 6-bus with two full mix/ eff/key systems & dir. pgm & pre busses: many options available, DSK, quad. etc.

#### MODELS 154 & 156

#### STANDARD FEATURES

 Switcher Models 154 and 156 are of the same basic design and utilize the same electronic sub assemblies. These switchers have the same standard basic features, differing only in the number of busses and in the number of mix/effects units. The basic standard features include 32-pattern mix/effects, color black and color matte background generator, and a mix/key unit in the case of the Model 154.

#### 2. Input Amplifiers

put Ampiriters

loop through high impedance input • gain equalization for 1000' cable • 22° sub carrier phase control • clamped inputs (10% to 90% APL) • sync addition on non composite signals if desired.

#### 3. Tallies

isolated dry contact relay closure on all inputs (2 amps at 50 v.)

#### Mix-Effects Units (Includes Keying Function) One (1) used in Model 81-154 Two (2) used in Model B1-156.

- Two (2) used in Model B1-156.
   Fades (or Supers), Wipes, Keys may be produced.
   Positioner Joystick for each M/E positions patterns.
   Pattern Modulation may be accomplished by an internal waveform generator. Modulating sources may be either (1) sine wave, (2) square wave, (3) saw tooth, or (4) an external customer generated source.
   Mix Key and Wipe Key available.
- Soft Wipe and Soft Key available with adjustable variations.

  Push to Preview obtained by depressing knob on clip potentiometers (provides for
- M/E monitor outputs.

  Wipe Mode—3 interlocked buttons select "NOR", "REV" or "N/R".

  Hard Wipe, Soft Wipe or Border can be selected with degree of softness made by "Edge" control adjustment. Border may be Colorized by adjustment of "Hue" and "Luminance" control.
- Symmetry of Pattern may be adjusted by "SYM" knob.

  Preset Wipe Limits are set by potentiometers. "H" and "V" vertical preset limits
- activated by Pattern Limit button Spotlight alternate action push button produces a 6 db. level difference between "A"

- and "B" input channels in the "Wipe" mode. (Operates on all patterns.)

  Pattern Assignment is made by depressing "ASSIGN" button. Pattern select feature may be "locked" to pattern matrix by depressing the "ASSIGN" button a second time on the same pattern. Patterns assigned appear on LED display on M/E control panel.
- control panel.

  Non-Synchronous Inputs. An "NS" indicator is provided. Tearing is prevented by not allowing a non-synchronous signal to be switched except at extreme position of fader handle where a "cut" transition occurs.

  Key Input Sources may be either (1) "A" bus video for self keying, (2) preview Key bus, (3) chroma key, or (4) an external key source.

  Key Invert selector provided to accommodate either positive or negative video as a

- keying source.

  Key Fill may be either "A" video for self keying or a colorized matte.

  Mix/Key provided a lieu of second Mix/Effects system for Model B1-154 switching system. Provides for all mix and keying functions of mix/effects system (as previously described) except for the pattern effects.

#### **OPTIONAL FEATURES**

May be added at any time (required control panel wiring already installed)

Chroma Keyer (C.K.)

\*950.00

\*Hue – selects hue of keying color \* Gain – adjusts the amplitude \* Clip – adjusts the clip level for keying \* Camera (4 x 1) input switcher – selects RGB output of any one of 4 cameras to feed C.K.

\*\*Down Stream Keyer (DSK)

\*\*Keys in titles, inserts, or fades to black with or without insert \* Color matte background

\*\*Key serures\*\* (1) Wil/Effect (2) Choma Kay (3) External \*\* Purch \*\* Ordination (Manitaria)

\*\*Key Surgers\*\* (1) Wil/Effect (2) Choma Kay (3) External \*\* Purch \*\* Ordination (Manitaria)

\*\*Key Surgers\*\* (1) Wil/Effect (2) Choma Kay (3) External \*\* Purch \*\* Ordination (Manitaria)

Key sources: (1) Mix/Effect, (2) Chroma Key, (3) External • Push to Preview (Monitor)

 Border – black edge around insert
 Shadow – black edge on right side and bottom of Quad Split

Provides four (4) variable size quadrants from ten possible sources with variable width

All Beaveronics Switching Equipment Carries a Two Year Warranty

#### OTHER ITEMS AVAILABLE FROM BEAVERONICS FAVAG MASTER CLOCK SYSTEMS

- Master control switchers AFV with audio breakaway Routing switchers with AFV

#### CHECK BEAVERONICS FOR: Specialized custom switchers

· Selected terminal equipment



B-20



Available with accuracy better than 1 second/yr.



Write or phone for details.







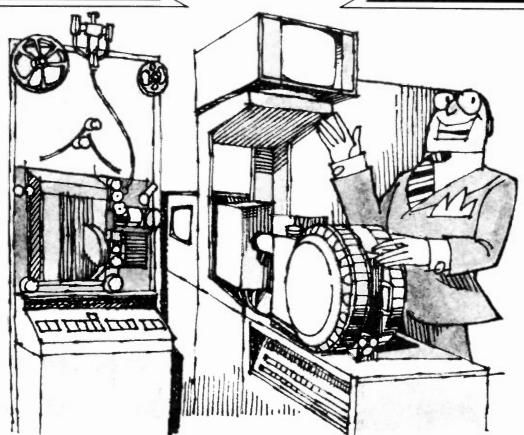
Surface Mtg.

Semi-flush

Beaveronics, Inc.

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4100 NORTH 24TH STREET • P.O. BOX 3606 • QUINCY, IL 62301 U.S.A. TELEX: 25-0142 • CABLE: SPOTMASTER

#### Series 3000 Tape Cartridge Machines



Model 3100P



Model 3300P



Model 3200RP

The Series 3000 cartridge machine incorporates an automatic release deck with a large air damped solenoid. Total power consumption is so low that the Series 3000 is the coolest running unit in the industry. Modern integrated circuits are used extensively, card edge connectors have gold plated contacts and all audio sections are internally shielded. Long head life is provided by Nortronics® Duracore® heads. Stereo units are equipped with the unique Phase-Lok III head bracket with independent azimuth adjustment for extremely tight control of stereo phasing. The Series 3000 is available in a full range of mono and stereo models to fit all cartridge sizes. Units can be desk top or rack mounted.

Model 3100 is available in mono or stereo playback units which accept A size cartridges. Three 3100 models can be placed in a 19"

Model 3200 is available as playback only or record/playback in either mono or stereo. The 3200 accepts both A and B cartridges so that two units mount in a 19" rack. Model 3300 is available in the same configurations as the 3200 but accepts A, B, and C cartridges. A 3100 player may be mounted next to the 3300 in the same rack panel. Delay models are available in mono versions of the 3200 and 3300 Series.

#### SERIES 3000 TAPE CARTRIDGE MACHINES

	MARIA	Durana (i) Handal	
(With Duracore® Heads)			
3100P	906-3100	Mono, Playback Only. A Size Cartridges	
3100PS	906-3101	Stereo, Playback Only, A Size	
2.77.		Cartridges	
3200P	906-3200	Mono, Playback Only, A & B Size	
		Cartridges	
3200RP	906-3201	Mono, Record/Payback, A & B Size	
		Cartridges	
3200PS	906-3202	Stereo, Playback Only, A & B Size	
44001 0		Cartridges	
3200RPS	906-3203	Stereo, Record/Playback, A & B Size	
3200111 3	300 3200	Cartridges	
2000000 1201	000 2004	Mono, Delay Programmer, A & B Size	
3200RP/DL	906-3204		
		Cartridges	
3300P	906-3300	Mono, Playback Only, A, B, & C Size	
		Cartridges	
3300RP	906-3301	Mono, Record/Playback, A, B, & C	
		Size Cartridges	
3300PS	906-3302	Stereo, Playback Only, A, B, & C Size	
3300F3	300-3302	Cartridges	
*****	906-3303	Stereo, Record/Playback, A, B, & C	
3300RPS	906-3303		
		Size Cartridges	
3300RP/DL	906-3304	Mono, Delay Programmer, A, B, & C	
		Size Cartridges	

#### FACTOR

		Size Cartridges
Υ	INSTALLED	OPTIONS
	906-3000	Q Trip I & II (150 Hz and 8 kHz). Play- Back Only Models
	906-3001	Q Trip I & II (150 Hz and 8 kHz), Record/Playback Models
	906-3002	Adjustment of Equalization to IEC/ CCIR Specifications
	906-3003	Microphone Input Option, Mono Record/Playback Models
	906-3004	Microphone Input Option, Stereo Record/Playback Models
	906-3005	Manual Fast Forward, All Models, without Q Trip I & II
	906-3006	Automatic and Manual Fast Forward, Playback Only Models with Q Trip I and II (150 Hz and 8 kHz)
	906-3007	Automatic and Manual Fast Forward, Record/Playback Models with Q Trip I and II (150 Hz and 8 kHz)
	906-3008	Additional cost for 117 VAC/50 Hz; or 220 VAC/240 VAC/50 Hz
	906-3009	Additional cost for alternate 3.75 IPS

#### ACCESSORIES

906-301		int Shelt for I		JUK
471-009		r for 906-3013		
lote: If series 3000 m	achines are to be	e mounted in	906-3013	Rack-
Shelf, order 471-005	98 Top Cover.			
EU3 UU3	2 Rack She	If Filler Panel	1/4 Rack	

Rack Shelf Filler Panel, 1/2 Rack Extender, P.C. Boards Transistor/IC kit for 3200P/RP

Note: Accessory remote controls listed on next page



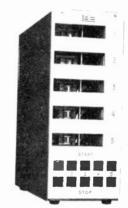
4100 NORTH 24TH STREET • P.O. BOX 3606 • QUINCY, IL 62301 U.S.A. TELEX: 25-0142 • CABLE: SPOTMASTER

#### Series 5000 Multi-Deck Tape Cartridge Machines



#### Model 5300B

The most up-to-date monaural or stereo three deck cart machine available. Rugged machined deck, quiet airdamped solenoid, unique cartridge guidance system, drop down front panel, modular electronics, and long life Nortronics. Duracore. heads. Companion recording amplifier available.

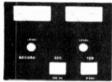


#### Model 5500

A new 5-decker with rugged machined deck, dependable direct-drive hysteresis synchronous motor, air damped solenoid and the latest electronics. An optional sequencer is available

#### Series 4000 Cartridge Machines







The Series 4000 is equipped with an automatic release deck with direct drive and air damped solenoid. Yet the machine operates cool and quietly. The unique Phase-Lok III head bracket is standard. It provides accurate phase response and simple adjustment. Long head life is provided by Nortronics® Duracore® heads. Available in mono and stereo playback or record/playback models for all size cartridges, and also available in space saving mono and stereo playback for A and B cartridges. Options include fast forward, auxiliary cue tones, mike input to record units, alternate tape speeds, rack mounting, and tape fault/splice detector in record models.

#### SERIES 5500 FIVE-DECK TAPE CARTRIDGE MACHINES

(With Duracore · Heads)			
5501	906-5501	Mono Playback (A Size)	
5502	906-5502	Mono Playback (A Size) with Cue	
5503	000 5500		
	906-5503	Stereo Playback (A Size)	
5504	906-5504	Stereo Playback (A Size) with Cue	
		Tones	
SERIES 5300B THREE-DECK TAPE CARTRIDGE MACHINES			
(With Duracore - Heads)			
5301B	906-5301B	Mono Playback (A & B Size)	
5302B	906-5302B	Mono Playback (A & B Size) with Cue	
		Tones	
5303B	906-5303B	Stereo Playbact (A & B Size	
5304B	906-5304B	Stereo Playback : A & B Size! with Cue	

ACCECCON	FC /FOB FF0	6
SW5F SW5E	904-5000 904-5001 906-5309	Er 5300 SERIES) Audio Switcher for 3 Decker Audio Switcher for 5 Decker Recorder, Mono for 3 Decker, without
	906-5309A	Q Trip Option Recorder, Mono for 5 Decker, without
	906-5310	Q Trip Option Recorder, Stereo for 3 Decker, without
	906-5310A	Q Trip Option Recorder, Stereo for 5 Decker, without
	906-5311A	Q Trip Option Secondary (150 Hz) and Tertiary (8 kHz)
	906-53118	Q Trips for Mono Recorder Secondary (150 Hz) and Tertiary (8 kHz)
	906-5506	Q Trips for Stereo Recorder Rack Shelf for (1) to (3) Units, 5 Decker
	906-5507 906-5306 906-5307	13 Rack Filler Panel, 5 Decker Rack Mount (1) Unit, 3 Decker Rack Mount (2) Units, 3 Decker
	906-5508	Additional Cost for 220V 50 Hz Power
	919-1806	Source Extender PC Board
	(With D	E CARTRIDGE MACHINES uracore · Heads)
4200P 4200PS	906-4200 906-4202	Mono, Playback Only, A & B Cartridges Stereo, Playback Only, A & B Size
4300P	906-4300	Cartridges Mono, Playback Only, A, B, &C Size
4300RP	906-4301	Cartridges Mono, Record Playback, A, B, & C
4300PS	906-4302	Size Cartridges Stereo, Playback Only, A, B, & C Size
4300RPS	906-4303	Cartridges Stereo, Record Playback, A, B, & C Size Cartridges
FACTORY IN	STALLED OF	TIONS
	906-4001	Q Trip I & II (150 Hz and 8 kHz), Playback Only Models
	906-4002	Q Trip I & II (150 Hz and 8 kHz), Record/Playback Models Adjustment of Equalization to
	906-4003	IEC CCIR Specifications Microphone Input Option, Mono
	906-4004	Record/Playback Models Microphone Input Option, Stereo
	906-4005	Record Playback Models Manual Fast Forward, All Models,
	904-4006	without Q Trip I and II Automatic and Manual Fast Forward,
		Playback Only Models with Q Trip I & II (150 Hz and 8 kHz)
	906-4007	Automatic and Manual Fast Forward, Record/Playback Models with Q Trip I & II (150 Hz and 8 kHz)
	906-4008	Additional cost for 117 VAC/50 Hz; or 220 VAC/240 VAC/50 Hz
	906-4009	Additional cost for alternate 3.75 IPS tape speed
ACCESSORII		Rack Mount for EIA 19" Rack, for
		mounting two 4200 Series Rack Shelf Filler Panel, ½ Rack
	906-4014	Mounting Ears for Rack Mounting 4300 Series
	919-1504 919-1703	Extender Card, Recorder PCB Section Extender Card, Playback PCB Section
	ry remote con	trols listed below.
BE-102	904-0102	OTE CONTROL 400 Series, 500 Series, Remote Control
BE-106	904-0106	3 start/stop functions w/15 ft. cable 605 Remote Control, 5 start/stop
		functions and sequencing indicator, illuminated buttons w/15 ft. cable
3000	906-3016	3000 Remote Control Panel, START for 5 Units
3000	906-3019	3000 Remote Control Panel, Single Record/Playback Model
	906-3020	Remote Control Panel, Single Playback (with cue tones)
	906-3021	Remote Control Panel, Single Playback (without cue tones)
3000	906 3028	Remote Control Panel with start/stop and fast forward switches for 5 Series
4000	906-4015	3000 or Series 4000 machines 4000 Remote Control Panel, START for
4000	906-4016	5 Units 4000 Remote Control Panel, Single
5300	927 0047	Record Playback Model Remote Control Panel for 5300
5300	927-0048	A B Series Remote Control Panel for 5300 A/B
		Series with Companion Record Amplifier
SW58	SEQUENO 904-0005	in the subsection of the subsection of the subsection of the sudio channels to program line; 600 ohm transformer equipped (use only with emitter follower output units 902-0605 or 902-0606; two
SW5C	904-0012	required for 902-0610) 400 500 Audio Switcher for up to 5
SW5E	904-5000	units 5300 Audio Switcher for 3-Decks
SW5F	904-5001	5500 Audio Switcher for 5-Decks

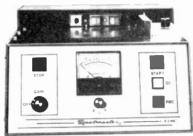
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4100 NORTH 24TH STREET • P.O. BOX 3606 • QUINCY, IL 62301 U.S.A.

TELEX: 25-0142 • CABLE: SPOTMASTER

#### Series 400/500 Tape Cartridge Machines



500D Mono Recorder/Playback

Spotmaster's 500D cart machines are traditional favorites that meet or exceed NAB specifications. These units have automatic cueing, automatic record cancel, built in mike pre-amp and full auxiliary cue tone options. A wide range of desk top and rack mount units are available including mono and stereo playback, mono and stereo record/playback and mono combined record/playback/delay. The record/playback/delay unit records, stores and plays back any program material for predetermined length on standard cartridges, as well as normal record/playback functions.

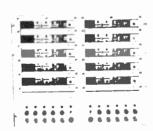


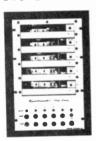
**500DR.** Rack Mount 500 D in 7" panel height. Chassis rolls out for access. Optional mike pre-amp.



**505DR.** Rack mount mono playback unit accepts A, B or C size cartridges.

#### Models 605 C and 610 CR





Spotmaster® Five-Spot and Ten-Spot multiple cartridge units are capable of manual operation, or they may be incorporated into programmed automation systems making use of one, two or three NAB standard cue tones.

Except for the common tape drive capstan, each tape deck is an independent unit — both electrically and mechanically. Each reproduce channel has its own separate electronics including cue amplifier(s) and a program amplifier. All channel output levels are separately adjustable to +4 dBm by means of locking type control. All amplifiers are plug-in modular units, and enclosed plug-in relays are used throughout. In the Ten-Spot, each module of five decks is separate from the other five-deck module.

Rear panel remote controls and inter-connections between channels are provided to permit automatic sequencing from channel to channel.

500D	900-0500	Monaural Record / Playback Unit,
500DR	901-0500	Compact Monaural Record/Playback Unit, Rack
505D 505DR	900-0505 901-0505	Mounting with Slides Monaural Playback Unit, Compact Monaural Playback, Rack Mounting
500D/DL 400B	900-0502 900-0400	with Slides Delay, Record/Playback Unit, Compact Monaural Record Playback Unit,
405B	900-0405	Compact Monaural Playback Unit, Compact
Note: Tran	sformer output o	optional in 400B and 405B.
FACTORY	900-0508	Additional cost for 117 VAC 50 Hz; or 220 VAC/240 VAC/50 Hz.
	900-0509	Additional cost for alternate 3.75 IPS tape speed. Installed Cue Trip I Sensor (500D)
	840-0004	Series) (150 Hz)
	840-0005	Installed Cue Trip 1 Generator (500DR) (150 Hz)
	840-0006	Installed Cue Trip I Generator (500D) (150 Hz)
	840-0007	Installed Cue Trip II Sensor all models (8 kHz)
	840-0008	Installed Cue Trip II Generator all models (8 kHz)
	841-0010	Option (Models 400B, 500DR Series)
	841-0002	Installed 600 ohm output transformer (400B, 405B)
previous	s page.	Controls, audio switcher, listed on
	830-0100	ITS FOR 500/505D SERIES Field Installation Kit, Cue Trip I Sensor (all units) (150 Hz)
Note: Dua	il tone sensor repl le sensor under v	aces standard single sensor. Credit issued varranty.
	830-0101	Field Installation Kit, Cue Trip I Genera- tor (500/505 D Series) (150 Hz)
	830-0102	tor (500/505 D Series) (150 Hz) Field Installation Kit, Cue Trip I Genera- tor (500D, 500D/DL) (150 Hz)
	830-0200	(All Units) (8 kHz)
5151 5 141	830-0201	Field Installation Kit, Cue Trip II Generator (All Units) (8 kHz)
FIELD IN	830-0100A	ITS FOR 400B SERIES Field Installation Kit, Cue Trip I Sensor (150 Hz)
	830-0101	Field Installation Kit, Cue Trip I Gen- erator (150 Hz)
MODEL 0 605C	902-0605	5 Channel Playback Unit in Formica Cabinet w/Emitter Follower Output
605C	902-0605A	5 Channel Playback Unit in Formica Cabinet w/Transformer Output
605CR	902-0606	5 Channel Playback Unit, Rack Mount- ing, w/Cartridge Storage Cubicle,
605CR	902-0606A	Emitter Follower Output 5 Channel Playback Unit, Rack Mounting, w/Cartridge Storage Cubicle and Transformer Output
610CR	902-0610	
610CR	902-0610A	Mounting, Emitter Follower Output 10 Channel Playback Unit, Rack Mounting w/Transformer Output
FACTOR	Y INSTALLED	OPTIONS
	387-0041	Installed Power Conversion, 220V/50 Hz, 7.5 IPS, w/220V/117V step- down transformer (Models 600C)
	387-0044	605CR) (Requires two for 610CR) Installed Speed Conversion, 117V/60 Hz, 3.75 IPS (Models 605C, 605CR) (Requires two for 610CR)
	840-0011	Installed Cue Trip I Sensor (per deck) (150 Hz)
	840-0012	Installed Cue Trip II Sensor Option, les Sensors (Models 605C, 605CR) Includes separate enclosure
	840-0013	Installed Cue Trip II Sensor Option, les Sensors (Model 610CR) includes separate enclosure
	910-0032A	Cue Trip II Sensor (up to 5 required with 605C and 605CR; up to 10 wit 610CR) (8 kHz)
	949-0605	Installed Cue Trip Sequencing Cable for 605B
Note: Co W/ MRM-60	610CR model if	mounted externally. 840-0012 may be use only 5 sensors required. Installed Record Module, plug-in replacement for any 605/610 Play- back Deck, w/record head
	840-0014	back Deck, w/record head Installed Cue Trip I Generator for MRM-600A (150 Hz) Installed Cue Trip II Generator for MRM-600A (8 kHz)
	840-0015	Installed Cue Trip II Generator for MRM-600A (8 kHz)
	840-0016	Installed Microphone Preamplifier for MRM-600A
EB101 Note: A	919-1010 ccessory remote ous page.	Test Extender PCB Module control and Audio Switcher are listed on

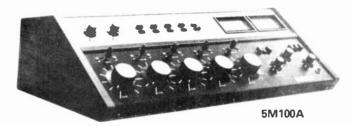
SERIES 400/500 TAPE CARTRIDGE MACHINES



4100 NORTH 24TH STREET • P.O. BOX 3606 • QUINCY, IL 62301 U.S.A. TELEX: 25-0142 • CABLE: SPOTMASTER

#### **Audio Consoles**

#### 100A/200A Series Mono



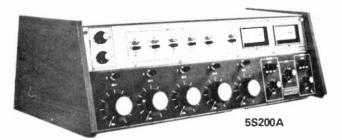
The monaural 100A and 200A Series are high quality full dual channel audio consoles. Pushbutton selected inputs are available to high or low level (switchable) plug-in preamps. Mixers are precision ladder attenuators (200A Series) or sealed long-life potentiometers (100A Series). Selection of audition or program channels is by FET's for fast, quiet and distortion-free operation. Both output channels are continually monitored by individual 3½" illuminated VU meters. Both audition and program channels have transformers balanced outputs rated at over + 18 dBm peak, and are on interchangeable plug-in PC cards.

These consoles have full built-in monitoring capabilities. The eight watt monitor amplifier delivers sharp, true sound to three individually muted outputs. Program, audition, and external (Off-Air) sources are front panel selectable. The separate headphone amplifier has both front panel and internal outputs. The cue amplifier (relay muted) drives a built-in or external speaker.

Three muting relays (two 100 Series) are provided for user convenience. Each can be wired to any mixer (channels 1, 2 and 3 are standard). Relay No. 1 mutes the cue speaker, and all relays control a monitor speaker output and a normally-open contact for warning lights, etc.

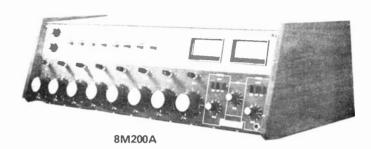
All internal connections are to screw-type barrier strips (except relay contacts and station ground) through two access openings in console bottom.

#### 100A/200A Series Stereo



These stereo consoles feature stereo mixers with pushbutton selection of high or low level inputs. Each preamp can also provide in-phase stereo from a mono source (switchable) to eliminate jumpers, impedance mismatch and phase errors. Mixers are long-life, low noise sealed pots (100A Series) or precision step attenuators (200A Series). Switching is accomplished with FET's for fast, quiet, low maintenance operation. Two 3½" illuminated VU meters continually monitor the program outputs (100A Series). On the 200A Series the meters are switchable to either the program or audition outputs. Program (and optional audition) plug-in mixer-line driver cards provide a transformer-balanced + 18 dBm output.

Built-in amplifiers are provided for stereo monitoring capabilities by speaker or headphones of the program, optional audition, external ('Off-the-Air'), and cue circuits. The cue bus features a composite of both the left and right channels for positive preview of stereo sources.



	100A SERIES	MONO AUDIO CONSOLES
5M100A	938-0510	5-Mixer Monophonic Console, sealed Pots, Dual Channel
8M100A	938-0810	8-Mixer Monophonic Console, sealed Pots, Dual Channel
OPTIONS A	AND ACCESS 838-0200	ORIES
		Additional Cost for 230 VAC/50 Hz Power Source
	938-0230	Step Type Attenuators Installed in 5M100A
	938-0231	Step Type Attenuators Installed in 8M100A
	270-0007	Second Muting Relay For 5M100A and 8M100A
	MA SEDIES O	*Supplied with one muting relay STEREO AUDIO CONSOLES
5S100A	938-0520	5-Mixer Stereophonic Console, sealed Pots
8\$100A	938-0820	8-Mixer Stereophonic Console, sealed Pots
OPTIONS A	838-0200	
		Additional Cost for 230 VAC/50 Hz Power Source
	938-0232	Step Type Attenuators Installed in 5S100A
	938-0233	Step Type Attenuators Installed in 8S100A
	918-3602	Mono Matrix Card for 5S100A and 8S100A
	918-3604	Line Amplifier for Stereo Audition Channel 5S100A and 8S100A
	270-0007	(2 Required) Second Muting Relay for 5S*00A and 8S100A
	200A SERIES	*Supplied with one muting relay MONO AUDIO CONSOLES
5M200A	938-0511	5-Mixer Deluxe Monophonic Console, Step Type Attenuators, Dual Channel
		Duai Cilamiei
8M200A	938-0811	8-Mixer Deluxe Monophonic Console, Step Type Attenuators, Dual Chappel
	ND ACCESS	Step Type Attenuators, Dual Channel
		Step Type Attenuators, Dual Channel DRIES Additional Cost for 230 VAC/50 Hz Power Source
OPTIONS A	ND ACCESS 838-0200	Step Type Attenuators, Dual Channel  ORIES  Additional Cost for 230 VAC./50 Hz
OPTIONS A	838-0200	Step Type Attenuators, Dual Channel  DRIES  Additional Cost for 230 VAC/50 Hz Power Source  "Supplied with 3 muting relays  TEREO AUDIO CONSOLES  5-Mixer Deluxe Stereophonic Console.
OPTIONS A	ND ACCESS 838-0200	Step Type Attenuators, Dual Channel  DRIES  Additional Cost for 230 VAC /50 Hz Power Source  *Supplied with 3 muting relays  ITEREO AUDIO CONSOLES  5-Mixer Deluxe Stereophonic Console, Step Type Attenuators  8-Mixer Deluxe Stereophonic Console
OPTIONS A 5S200A 8S200A	838-0200 800A SERIES S 938-0521 938-0821	Step Type Attenuators, Dual Channel  DRIES Additional Cost for 230 VAC/50 Hz Power Source "Supplied with 3 muting relays ITEREO AUDIO CONSOLES 5-Mixer Deluxe Stereophonic Console, Step Type Attenuators 8-Mixer Deluxe Stereophonic Console Step Type Attenuators DRIES  DRIES
OPTIONS A 5S200A 8S200A	838-0200 800A SERIES S 938-0521 938-0821 800 ACCESSO 838-0200	Step Type Attenuators, Dual Channel  DRIES Additional Cost for 230 VAC./50 Hz Power Source  *Supplied with 3 muting relays  ITEREO AUDIO CONSOLES 5-Mixer Deluxe Stereophonic Console, Step Type Attenuators 8-Mixer Deluxe Stereophonic Console Step Type Attenuators  DRIES Additional Cost for 230 VAC./50 Hz Power Source
OPTIONS A 5S200A 8S200A	838-0200 800A SERIES S 938-0521 938-0821	Step Type Attenuators, Dual Channel  DRIES  Additional Cost for 230 VAC/50 Hz Power Source  *Supplied with 3 muting relays  TEREO AUDIO CONSOLES 5-Mixer Deluxe Stereophonic Console, Step Type Attenuators 8-Mixer Deluxe Stereophonic Console Step Type Attenuators Bories  Additional Cost for 230 VAC/50 Hz Power Source Mono Matrix Module for 5S200A and 8S200A Stereo Consoles
OPTIONS A 5S200A 8S200A OPTIONS A	ND ACCESS( 838-0200 200A SERIES S 938-0521 938-0821 ND ACCESS( 838-0200 918-3602	Step Type Attenuators, Dual Channel  DRIES Additional Cost for 230 VAC/50 Hz Power Source "Supplied with 3 muting relays  ITEREO AUDIO CONSOLES 5-Mixer Deluxe Stereophonic Console, Step Type Attenuators 8-Mixer Deluxe Stereophonic Console Step Type Attenuators DRIES Additional Cost for 230 VAC/50 Hz Power Source Mono Matrix Module for 5S200A and 8S200A Stereo Consoles "Supplied with 3 muting relays NDS, REPLACEMENTS FOR 100 AND
OPTIONS A 5S200A 8S200A OPTIONS A	ND ACCESS(838-0200)  000A SERIES S 938-0521  938-0821  ND ACCESS(838-0200)  918-3602  ODULE BOAF 200 SERIES C; 100A AND 21	Step Type Attenuators, Dual Channel  DRIES  Additional Cost for 230 VAC./50 Hz Power Source  "Supplied with 3 muting relays  ITEREO AUDIO CONSOLES  5-Mixer Deluxe Stereophonic Console, Step Type Attenuators  8-Mixer Deluxe Stereophonic Console Step Type Attenuators  DRIES  Additional Cost for 230 VAC./50 Hz Power Source Mono Matrix Module for 5S200A and 85200A Stereo Consoles  "Supplied with 3 muting relays  RDS, REPLACEMENTS FOR 100 AND DOA SERIES CONSOLES
OPTIONS A 5S200A 8S200A OPTIONS A	838-0200 800A SERIES S 938-0521 938-0821 IND ACCESSO 838-0200 918-3602 ODULE BOAR 200 SERIES CO 100A AND 20 918-3600	Step Type Attenuators, Dual Channel  DRIES Additional Cost for 230 VAC/50 Hz Power Source "Supplied with 3 muting relays  TEREO AUDIO CONSOLES 5-Mixer Deluxe Stereophonic Console, Step Type Attenuators 8-Mixer Deluxe Stereophonic Console Step Type Attenuators ORIES Additional Cost for 230 VAC/50 Hz Power Source Mono Matrix Module for 5S200A and 85200A Stereo Consoles "Supplied with 3 muting relays RDS, REPLACEMENTS FOR 100 AND DNSOLES, AND USED IN DIA SERIES CONSOLES Mono Preamplifier Module
OPTIONS A 5S200A 8S200A OPTIONS A	ND ACCESS(838-0200)  000A SERIES S 938-0521  938-0821  ND ACCESS(838-0200)  918-3602  ODULE BOAF 200 SERIES C; 100A AND 21	Step Type Attenuators, Dual Channel  DRIES Additional Cost for 230 VAC/50 Hz Power Source "Supplied with 3 muting relays  TEREO AUDIO CONSOLES  5-Mixer Deluxe Stereophonic Console, Step Type Attenuators 8-Mixer Deluxe Stereophonic Console Step Type Attenuators DRIES Additional Cost for 230 VAC/50 Hz Power Source Mono Matrix Module for 5S200A and 8S200A Stereo Consoles *Supplied with 3 muting relays  NDS, REPLACEMENTS FOR 100 AND DNSOLES, AND USED IN DOA SERIES CONSOLES Mono Preamplifier Module Stereo Preamplifier Module Stereo Preamplifier Module Mono Matrix Card for 5S100A and
OPTIONS A 5S200A 8S200A OPTIONS A	ND ACCESS(838-0200)  200A SERIES S 938-0521  938-0821  ND ACCESS(838-0200)  918-3602  ODULE BOAR 200 SERIES C: 100A AND 20 918-3601  918-3601  918-3602	Step Type Attenuators, Dual Channel  DRIES  Additional Cost for 230 VAC./50 Hz Power Source  "Supplied with 3 muting relays  ITEREO AUDIO CONSOLES  5-Mixer Deluxe Stereophonic Console, Step Type Attenuators  8-Mixer Deluxe Stereophonic Console Step Type Attenuators  DRIES  Additional Cost for 230 VAC./50 Hz Power Source Mono Matrix Module for 5S200A and 85200A Stereo Consoles  "Supplied with 3 muting relays  RDS, REPLACEMENTS FOR 100 AND DNSOLES, AND USED IN  DAS SERIES CONSOLES  Mono Preamplifier Module Mono Matrix Card for 5S100A and 8S100A  Stereo Monitor Amplifier Module
OPTIONS A 5S200A 8S200A OPTIONS A	000A SERIES S 938-0521 938-0521 938-0521 938-0821 IND ACCESSO 838-0200 918-3602 ODULE BOAR 200 SERIES C 100A AND 20 918-3601 918-3601 918-3602	Step Type Attenuators, Dual Channel  DRIES  Additional Cost for 230 VAC./50 Hz Power Source  *Supplied with 3 muting relays  ITEREO AUDIO CONSOLES  5-Mixer Deluxe Stereophonic Console, Step Type Attenuators  8-Mixer Deluxe Stereophonic Console Step Type Attenuators  DRIES  Additional Cost for 230 VAC./50 Hz Power Source Mono Matrix Module for 5S200A and 85200A Stereo Consoles  *Supplied with 3 muting relays  RDS, REPLACEMENTS FOR 100 AND DOA SERIES CONSOLES Mono Preamplifier Module Mono Matrix Card for 5S100A and 8S100A  Stereo Preamplifier Module Line Driver Amplifier Module Line Driver Amplifier Module Line Driver Amplifier Module Mono Cue / Headphone Amplifier
OPTIONS A 5S200A 8S200A OPTIONS A	838-0200 800A SERIES S 938-0521 938-0821 IND ACCESSO 838-0200 918-3602 ODULE BOAF 200 SERIES CO 100A AND 20 918-3601 918-3602 918-3602 918-3603 918-3603 918-3604	Step Type Attenuators, Dual Channel  DRIES  Additional Cost for 230 VAC./50 Hz Power Source  *Supplied with 3 muting relays  **ITEREO AUDIO CONSOLES  5-Mixer Deluxe Stereophonic Console, Step Type Attenuators  8-Mixer Deluxe Stereophonic Console Step Type Attenuators  DRIES  Additional Cost for 230 VAC./50 Hz Power Source Mono Matrix Module for 5S200A and 85200A Stereo Consoles  *Supplied with 3 muting relays  RDS, REPLACEMENTS FOR 100 AND  DNSOLES, AND USED IN  DON SCHES CONSOLES  Mono Preamplifier Module  Stereo Preamplifier Module  Mono Matrix Card for 5S100A and 8S100A  Stereo Monitor Amplifier Module  Line Driver Amplifier Module  Mono Cue / Headphone Amplifier  Module  Stereo Cue / Headphone Amplifier
OPTIONS A 5S200A 8S200A OPTIONS A	800 A SERIES S 938-0521 938-0521 938-0821 ND ACCESS( 838-0200 918-3602 ODULE BOAF 200 SERIES C 100A AND 2 1918-3600 918-3601 918-3602 918-3603 918-3604 918-3604 918-3605	Step Type Attenuators, Dual Channel  DRIES  Additional Cost for 230 VAC/50 Hz Power Source  "Supplied with 3 muting relays  TEREO AUDIO CONSOLES  5-Mixer Deluxe Stereophonic Console, Step Type Attenuators  8-Mixer Deluxe Stereophonic Console Step Type Attenuators  DRIES  Additional Cost for 230 VAC/50 Hz Power Source Mono Matrix Module for 5S200A and 8S200A Stereo Consoles  "Supplied with 3 muting relays RDS, REPLACEMENTS FOR 100 AND DNSOLES, AND USED IN DNSOLES, AND USED IN DNSOLES AND USED IN DNSOLES CONSOLES Mono Preamplifier Module Stereo Preamplifier Module Stereo Monitor Amplifier Module Line Driver Amplifier Module Line Driver Amplifier Module Mono Que / Headphone Amplifier Module



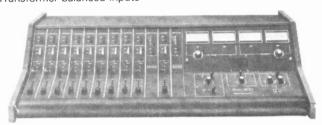
4100 NORTH 24TH STREET • P.O. BOX 3606 • QUINCY, IL 62301 U.S.A. TELEX: 25-0142 • CABLE: SPOTMASTER

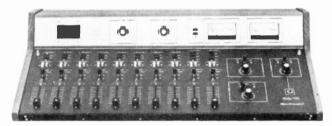
**Audio Consoles** 

#### 12-Mixer, Vertical Fader, Dual Channel Models ML-4000 Mono, SL-4100 Stereo

Features: • Vertical Faders • Completely shielded input modules

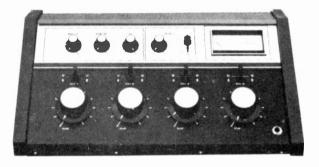
- Low-noise reed relay bus selection
   12-input channel capability
- Dual-channel output, mono or stereo
   Modular plug-in electronics
- Transformer balanced inputs





#### 4M50

Selectable high/low input sensitivity, all channels. Individual monitor, headphone and cue amplifiers. High reliability sealed potentiometer-type mixer controls. Two Inputs per mixer.



#### 4V50

10 inputs to 4 mixers. Cue switches, all mixers. For broadcast, A/V, CCTV, CATV applications. Switchable microphone/high level inputs. Integral tone generator. 1.0 watt rms headphone and cue amplifiers.



4000	SERIES SLIC	E MIXER AUDIO CONSOLES
200	028 4000	Monaural dual-channel console (

ML 4000	938-4000	Monaural dual-channel console chassis with provision for accepting up to 12 input modules (Select modules as required.)
SL 4100	938-4100	Stereo dual channel console chassis with provision for accepting up to 12 input modules. (Select modules as required.)
4021	980-4021	Mono Input Mixing Module, with muting logic.
4023	980-4023	Mono Input Mixing Module, less muting logic.
4025	980-4025	Mono Remote Input Module (feeds mono input Mixing Module).
4022	980-4022	Stereo Input Mixing Module, with muting logic.
4024	980-4024	Stereo Input Mixing Module, less muting logic.
4026	980-4026	Stereo Remote Input Module (feeds stereo Input Mixing Module.)
3602	918-3602	Mono mix-down module for stereo (4100) units.
	828-0200	Additional Cost for 230Vac Power Option (either model).
	980-4008	Module Filler Panel (for unused module space.)

Note: Mono mix-down module — When used, two modules required (one for MIX-1, one for MIX-2). Mix-down module is necessary to use feed function of remote modules in SL-4100 Stereo Console

only.
Note: To determine selling price of complete 4000 Series consoles, add to basic console price any combination of input modules up to

- (1) ML-4000 Monaural Audio Console, Dual Channel with slide controls with 12 input modules, to include:
  (1) 938-4000 Basic Console Chassis
  - (2) 980-4025 Mono Remote Input Modules

  - (6) 980-4021 Mono Input Mixing Modules with muting logic (4) 980-4023 Mono Input Mixing Modules less muting logic

#### 10-Mixer, Vertical Fader, Dual Channel Models SL-3110 Stereo, ML-3010 Mono

Features: • 22 inputs to 10 slide faders • Modular plug-in electronics • Dual channel output • Mono or stereo models • Contact-free, FET bus selection . Economical price

#### 3000 SERIES SLIDE MIXER AUDIO CONSOLES

ML-3010	938-3010	10-Mixer, slide-fader, dual-channel
		monaural console 115V, 50/60 Hz
SL-3110	938-3110	10-Mixer, slide-fader, dual-channel
		stereo console 115V, 50/60 Hz
3602	918-3602	Mono matrix module for SL-3110
	838-0200	Additional Cost for 230Vac Power
		Source

#### **4S50**

Stereo version of the 4M-50. Fully metered outputs. Simple, straightforward installation. Efficient, professional performance. Cue Switches, all mixers.

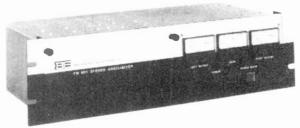


50 SERIES MONO AND STEREO CONSOLES						
4M50	938-0450	MONO FOUR 4-mixer Monophonic				
		Console				
4M50R	938-0451	MONO FOUR Rack Mount 4-Mixer				
		Monophonic Console				
4S50	938-0452	STEREO FOUR 4-Mixer Stereophonic				
		Console				
4S50R	938-0453	STEREO FOUR Rack Mount 4-Mixer				
		Stereophonic Console				
	838-0201	Additional Costs for 230Vac/50 Hz				
Power Source						
VERSA CON AUDIO CONSOLE						
4V50	938-2000	4 Mixer Mono Console with Rack				
		Mount Adapters. Additional Cost for				
		220Vac/50 Hz Power Source				



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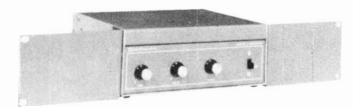
#### Models FM-600, FM-601 FM AGC/Limiters



This advanced design Stereo AGC/Limiter does everything an FM broadcaster needs to maximize and improve his FM signal. Unique signal processing including peak/average comparator, fast 5 usec attack time, audio gating to minimize unwanted noise and return to normal gain circuitry does it all. Everything is in one compact package.

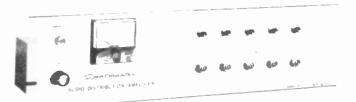
One stereo processor does the work of two conventional AGC's and two limiters. Monaural Model FM-600 replaces one AGC and one limiter.

#### Model BEM-10 Monitor Amplifier



The BEM-10 is a conservatively rated wide band amplifier capable of delivering from 10 to 15 watts RMS. Electronic muting is incorporated to enable the microphone and mute the program channel for paging operation.

### AD1B Audio Distribution Amplifier



The AD1B distributes audio signals within a studio or to telephone lines. VU meter and aural monitoring of the input signal is provided, as well as separate monitoring and level controls for each output. The five highly isolated output channels are expandable up to 25 by the addition of AD1B-X Extenders, which also contain the same aural monitoring facilities as the AD1B. Both units are available with either optional output transformers or standard unbalanced emitter follower output. Input circuitry may be operated either bridging or matching and balanced or unbalanced.

## Model AM-500 AM Compressor/Limiter/Expander



The AM-500 combines compressor, limiter and expander functions with selectable asymmetrical or symmetrical limiting. This newly designed audio processor provides automatically controlled clean, crisp audio with over-modulation protection. Signal processing is smooth and quiet.

As a compressor/limiter/expander, the AM-500 has all characteristics of traditional gated automatic gain control amplifiers and fast acting peak limiters. Only three controls; input, output and return rate control.

#### Model AM-400 AM Compressor/Limiter



Economy priced, this new compressor/limiter for AM maintains high average modulation and protects against over modulation. Contains switchable control for symmetrical or asymmetrical peak limiting. May be operated in three modes: (a) compression and limiting, (b) compression only or (c) as a fixed gain conventional line amplifier. Features 1 microsecond attack time and +20 dBm output capability.

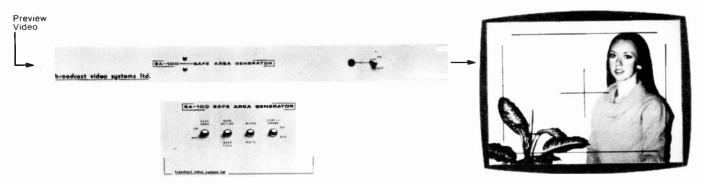
#### AUDIO PROCESSING AND DISTRIBUTION AMPLIFIERS

THE TOTAL THE DIGITIES OF THE TEND				
AM-500	937-0500	AM-500 Compressor-Limiter-Expander		
		for AM Broadcasting		
FM-600	937-0600	FM AGC/Limiter for Mono		
FM-601	937-0601	FM AGC/Limiter for Stereo		
FM-600E	937-0605	FM-600, for Mono-European STDS		
FM-601E	937-0606	FM-601, for Stereo European STDS		
	919-1908	Extender Board		
AM-400	937-4001	Compressor-Limiter Amplifier, rack mounting, Mono		
AD1B	903-0010	Audio D.A.; 1 in, 5 out, rack mounting, Emitter Follower Output		
AD1B T	903-0011	Audio D.A; 1 in, 5 out, rack mounting, Transformer Outputs		
AD1BX	903-0012	5-Channel Extender for AD1B, rack mount, Emitter Follower Output		
ADIBX T	903-0013	5-Channel Extender for AD1B, rack mount, Transformer Output		
	903-0018	Additional Cost for 230Vac/50Hz AM-400, AM-500; AD-1B		
BEM-10	837-0100	Monitor Amplifier, 10 watt, in cabinet		

#### broadcast video systems ltd.

#### AT LAST, A STATE-OF-THE-ART METHOD TO ENSURE CORRECT POSITIONING OF PICTURE INFORMATION REGARDLESS OF MONITOR SCAN.

#### THE SA-100 SAFE AREA GENERATOR\*



The SA-100 eliminates the guesswork of where to position graphics and other important information in a television picture. Vertical and horizontal borders, 120 nanoseconds wide, are generated and non-additively mixed into the composite video connected to the SA-100 input. This "safe area" pattern, keyed into video, will appear at the SA-100 output for display on a picture monitor. The pattern can be remotely switched from Safe Title to Safe Action area substantially as specified in SMPTE Recommended Practice No. RP27.3.

Also included is a cross-hair pattern showing the exact picture center.

Both patterns can be switched on or off, black or white, from the remote panel included with the unit.

No external drives are required as all system timing is derived from program sync. This ensures that Safe Area is always correct, regardless of monitor scan adjustments.

A second output is provided which delivers a pattern signal only (not keyed into video) for in-house distribution.

\* patent pending

#### broadcast video systems ltd.

1050 McNicoll Ave., Agincourt, Ont., Canada (416) 497-1020 Tix. 065-25239

#### Manufacturers of:

SA100 Safe Area Generator

**Exclusive North American Distributors for:** 



#### MICHAEL COX ELECTRONICS LTD.

- Video production switchers
- Chroma keyers (RBG and encoded)
- Downstream keyers
- Special effects systems
- Quad split
- Encoders, decoders, transcoders
- -- Custom video systems



#### **ELECTRONIC VISUALS LTD.**

- Waveform monitors
- Vector monitors
- Color picture monitors



#### BAL LTD.

- Video and pulse delay lines

#### **ASTON**

#### ASTON ELECTRONIC DEVELOPMENTS LTD.

- VICE (Vertical Interval Communications Equipment)
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- UHF modulators

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- Sync generators
- Video test generators
- Video processing amplifiers
- Video and Pulse distribution amplifiers
- Sync assignment switchers

#### broadcast video systems ltd.

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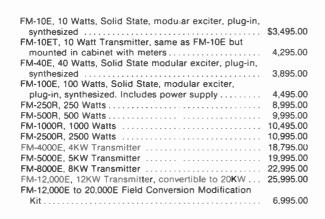
# THE "BEST-SELLING" FM TRANSMITTER EVER — "The Little Rascal" — from CCA Electronics!

# FM2500R - 2.5 KW **\$10,995.00**

- Compact size only 5'7"h
   ... 22"w ... 24"d.
- One tube.
- 40-watt solid-state plug-in synthesized exciter.
- Type-accepted from 500 to 3000 watts.
- Wired for local or remote control.
- Power line transient protection.

Proof-positive good things come in small packages. No compromise has been made. Our 100% solid-state modular exciter, combined with the added enhancement of the optional CCA FM-Optimod assures the most competitive signal available today. Advanced control system includes built-in filament preheat, recycling overload protection, status lights and remote control interface as standard. Automatic high VSWR protection can be added easily with the CCA Watchdog II.

# Phone CCA Electronics toll-free — 800-257-8171 — about the FM2500R or any of these CCA FM transmitters:





FM250DR Broadcast Transmitte



#### **ELECTRONICS CORPORATION**

Box 5500 • Cherry Hill, N.J. 08034 • Call toll-free: 800-257-8171 • Telex: 845200 • In N.J. call collect.



CEI-310 Broadcast Color

**Television Camera System** 

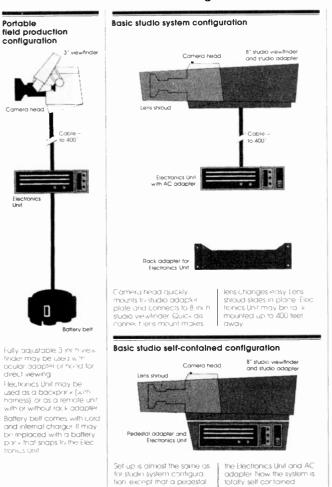
The CEI-310 was designed for electronic field production, with all the lightweight portability, all the conveniences, all the operating features, all the power sources, all the versatility, all the low light level sensitivity, all the video quality that belongs in field production. But until now has been unavailable.

- The CEI-310 camera head operates with just one cable—up to 400 feet from its electronics unit. Plenty of room for the cameraman to roam wherever he wants, to get just the shot he wants. And the absence of a myriad of cables not only makes setup easy, but gives him a new freedom of movement. If 400 feet isn't enough, your cameraman can go another 2500 feet with a Systems Integration Unit.
- The CEI-310 has a program quality microphone input built right into the camera head (and another at the Electronics Unit) - but no requirement for separate audio cables!
- The CEI-310 camera head has simple operational controls for automatic white balance and iris. The cameraman can quickly react to changing situations. He can even control a video tape recorder.
- The CEI-310 camera head, with its sealed prism optical assembly, is rugged and weathertight. It can take rough handling and withstand the rigors of the elements.
- The CEI-310, in its portable configurations, has one of the finest 3-inch viewfinders ever developed. It is fully adjustable in all directions. It can be changed in seconds from an ocular to a direct viewing setup, depending on the situation. Video level indicator is included, of course.
- The CEI-310 can be operated from a variety of power sources, from DC to 250VAC-a battery belt, a battery pack that attaches to the electronics unit, direct connection to any 12V DC source, or an AC power pack.
- The CEI-310 gives you a choice of 2/3-inch Saticon or Plumbicon rear-loading pickup tubes. Quick disconnect lens mount. A four position filter wheel with filters. Bias light. High gain, low noise preamplifiers. Self-gating low power sweep circuits. Precision yokes. Comprehensive radio frequency and magnetic shielding.
- · But convenience and versatility are just one part of the story of this remarkable new camera. Equally important is that the CEI-310 gives you uncompromised full broadcast quality video performance, with outstanding S/N ratio, sensitivity, and resolution. And full production system control features.

The compact electronics unit has everything that sophisticated electronics can provide for signal processing, including an ultra stable I and Q encoder with color bar generator.



#### Configurations



Prices and specifications subject to change without notice

or studio may be remoted up to 2500 feet beyond the

ectronics Unit with a Sys-erns Integration Unit and a

Extended operation

for any configuration

#### Bar Graph 101



Accepts 10 signal inputs and converts these into a vertical "Bar" pattern as seen on the screen of a standard TV monitor. Rack mount,  $3\frac{1}{2}$ " h.

\$1250.

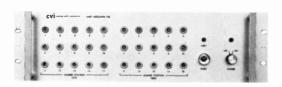


#### Bar Graph 120

Accepts 30 negative going input signals and produces a horizontal bar display with better than 1% accuracy. Has individual channel markers, zero suppression, decade expansion, and other features. Requires external sync. Rack mount, 7" h.

\$4200.

#### Limit Indicator 122



Produces 15 separate "high" and 15 separate "low" vertical markers with automatic alarm when video falls outside of predetermined limits. Requires external sync. Rack mount, 51/4" h.

\$3500.

#### Video Compressor 260B



Accepts standard composite video signals and performs sampling, digitizing, buffering, and slow scan TV conversion operations. Provides output for direct connection of slow scan signals to voice grade communications circuits. Rack mount, 5½" h. Also includes remote control unit.

\$3000.

#### Video Compressor 262

Similar to the 260B but uses sampling only (8kHz) or sampling plus buffering (1kHz) to

perform slow scan conversion. Compact table-top configuration.

\$1250. 262A

8kHz bandwidth

**1500**.

262B

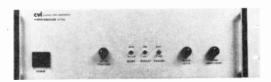
1kHz bandwidth

CVI

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Circle (31) on Reader Service Card

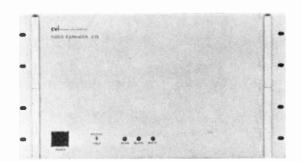
#### Video Digitizer



Converts standard television signals into digital data for computer processing and control. Can also redisplay data on a standard television monitor for photographic production of hard copy by time exposure. Easily interfaced with modern minicomputers. Rack mount, 51/4" h.

\$4000.

#### Video Expander 275



A solid state video memory capable of storing one frame of video information. Data may be fed into the 275 at a slow rate, stored, and displayed to present a continuously refreshed image on a standard television monitor screen. The image buildup process may be continuously observed, and there is no fadeout or image degradation with time in the resulting display. The 275 may be used as a computer display device or as a slow scan video communications receiver. For communications applications it is a companion unit for CVI Models 260B or 262 Video Compressors. Available in 256x256 or 256x512 element resolution, 6-bit grayscale. Rack mount, 10½" h.

<b>\$7000.</b>	275A	1kHz	256x256
7000.	275A-8	8kHz	256x256
9000.	275B	1kHz	256x512
9000.	275B-8	8kHz	256x512
1000.	Computer I/O Option		
2000.	Frame Grab Option		

#### Video Transceiver

Combines the functions of digital frame grabbing and slow scan transmission and reception in a single package. Contains 256x512x6 bit solid state video memory using 4K RAMs. Features remote control of functions and dual rate/resolution operation. Rack mount, 101/2 x10x15".

\$12,500.

#### Video Analyzer



Displays "vertically line-selected" TV waveforms directly on the screen of a normal TV monitor. 1/1 waveform/picture ratio simplifies identification of individual picture elements. Display also includes an electronic reference grating and H and V markers. Requires external sync. Rack mount, 31/2" h.

\$875.



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#### Sync Stripper 302-2

A utility unit producing sync, horizontal drive, vertical drive, and blanking signals derived from a standard composite video source. Allows interconnection and synchronization of video devices to camera or tape recorded signals. Size 9½ x6¾ x1¾″.

\$250.

#### Raster Generator 302-5



Generates very low speed rasters, up to one half hour in duration. Intended for use in recording sampled video information or other low frequency signals in conjunction with a conventional X-Y plotter. Produces pseudo topographical type displays with information vertically deflecting raster lines. Rack mount, 3½" h.

\$950.

#### Motion Detector 304



Samples four independent points in a TV scene and produces an alarm when a change in brightness occurs at any of the sampling points. Operates with standard, composite, video signals. Rack mount, 3½" h.

\$1000.

#### Video Micrometer 305



Designed for dimensional analysis of objects seen by TV camera. Incorporates image enhancement circuitry and a unique video waveform display superimposed on monitor screen for more objective determination of soft or fuzzy edges. Accepts standard video signals. Table top mounting; 514" h.

**\$3150.** 

#### Video Integrator 310



Produces a D.C. voltage directly proportional to the integral of a video signal falling within a selectable "window" area. Requires external drives. Rack mount,  $3\frac{1}{2}$ " h.

\$1500.



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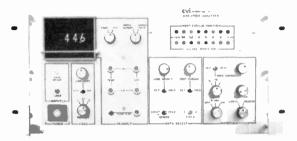
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TWX: 910-940-3248 • COLO VIDEO BDR

#### Video Analyzer 321



Laboratory version of the 301. Incorporates additional circuitry to allow chart recording of line selected video waveforms X-Y coordinate indication, noise analysis, computer data input, and other features. Rack mount, 3½" h.

\$2500.

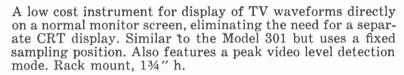


#### Video Analyzer 340

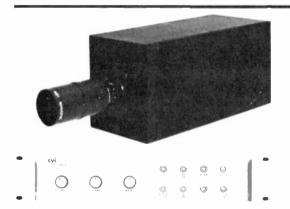
A sophisticated instrument intended to derive objective data from video signals. Functions include digitization of a selected TV line and processing of derived data. Several patterns are superimposed over input video for simplification of analysis. Rack mount, 8¾" h.

\$14,500.

#### Video Analyzer 350



\$400.



#### Data Camera 502

A TV camera intended particularly for research or industrial inspection uses. Accepts nearly any 1 inch tube and has various features such as externally controllable sweeps, beam blanking, dynamic gain control, plug-in low pass filters, and very wide range of operating rates. Options include video sampler and digital control of various functions. Camera is three chassis configuration: head, control unit, power supply. Requires external drives, blanking, or deflection voltages.

\$4000.

#### Sync Generator 601-B



A unit intended for laboratory use when either standard or non-standard TV scan rates are required. Uses micrologic binary counters with adjustable feedback paths. Drive and blanking pulses are variable width, but sync is not EIA format. Incorporates dot/bar generator for test purposes. Rack mount, 3½" h.

**\$1025.** 

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U.S.A.

#### TWX: 910-940-3248 • COLO VIDEO BDR Data Insertion Generator **603**



Combines the functions of a 2 channel video mixer, special effects generator, and video pointer. A moveable oblong is positionable to any point in TV raster and is variable in size over a wide range. The oblong acts as the internal "key" in special effects mode, and also generates a white "box" outline or solid square for marking purposes. Requires external sync. Rack mount,  $3\frac{1}{2}$ " h.

\$1250.

#### Video Processor 604



Modifies the grayscale of a video input signal by selecting and amplifying a variable width "slice." Also incorporates variable brightness control, sync adding, and external marker adding functions. Requires external sync. Rack mount, 3½" h.

\$950.

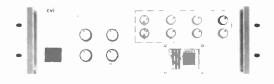
#### Video Quantizer 606



Allows the processing of a video input signal into 16 separate amplitude levels. Operates with tape, camera, or disc inputs and allows radical grayscale alterations or the generation of complex synthetic color signals. Rack mount, 5¼" h.

\$3500.

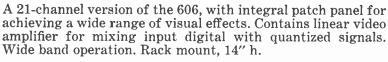
#### Video Quantizer 606A



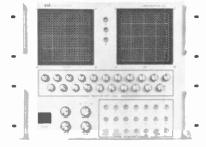
An eight-channel version of the 606, containing a built-in patch panel for the color coding and mixing functions. Produces R-G-B outputs and sync. Rack mount, 5¼" h.

\$2500.

#### Video Quantizer 606C



\$5000.





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#### **Shading Generator** 608



Generates H and V sawtooth and parabolic waveforms of variable amplitude and polarity to provide compensation of brightness errors in video input signals. May also be used to drive external dynamic correction circuitry. Requires external sync. Rack mount, 31/2" h.

\$950.

#### Video Pointer 610E



Generates five different oblong and/or cross patterns which are positionable to any location on the TV screen. Oblongs can be changed in size over a range of 10 to 1. Unit may be used for marking purposes or for positional measurements. Rack mount, 3½" h.

**\$1950.** 

#### Diameter Analyzer 611



Contains gating, slicing, and counting circuits to provide automatic measurement of the maximum vertical dimension of a target with moderate to high contrast. Both digital and analog output signals are available. Rack mount, 31/2" h.

**\$1950.** 

#### Video Generator 615



Generates grayscale, grating, dot, window, multiburst, and flat field signals. Multiburst is variable in position for monitor resolution checks, and multiburst frequencies to 20 MHz may be ordered. 615 requires external drives, blanking, and sync. 615A has internal sync generator and supplies video, sync, blanking, and drives. Rack mount, 51/4" h.

\$2000. 615 615A **2250.** 

#### X-Y Indicator 620

Generates white cross hairs superimposed over a video input signal. Allows rapid alignment of subject material with a predetermined location when used in conjunction with a standard TV camera and monitor. Accepts composite video on a terminated input and provides composite video out to a standard TV monitor. Size 11x8x 1.65". Mounting: Free standing or rack mount.

\$400.



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X-Y Indicator 621



Accepts either composite or non-composite video signals and superimposes either a small white dot or set of cross hairs on the video image. Marker may be manually positioned to any location on the raster and two directly proportional DC output signals are generated for analysis of spatial location of subjects. Also contains built-in grating generator for evaluation of input signal quality. Rack mount, 3½" h.

\$1500.

#### X-Y Digitizer 622



Provides 8 bit digital X-Y coordinates of a small white dot that may be manually located anywhere on a standard TV image. Also incorporates automatic tracking of high contrast targets, and stable grating test signal. Operates from composite video. Rack mount, 5¼" h.

\$4500.

#### Sync Delay 624



Accepts standard format vertical and horizontal drives and generates drives, blanking, and industrial sync signals which may be delayed by selectable amounts, both vertically and horizontally, from the original drive signals. Rack mount, 3½" h.

\$1250.

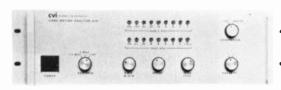
#### Video Detector 630



Provides gating functions combined with high and low video detection circuitry to provide automatic warning when video levels exceed preset limits. May also be operated in a differential mode to provide high sensitivity to small changes in contrast, such as might be produced by spots or hairline cracks. Operates from composite video signals. Standard rack mount,  $3\frac{1}{2}$ " h.

\$1500.

#### Video Motion Analyzer 633



- Accepts composite video signals and measures lateral motion of a high contrast video target in a selectable portion of the TV signal. Operates in two modes: one-line gate superim-
- posed on target image, or variable gate to blank out all but target profile. Rack mount, 51/4" h.

\$4000.



VIDEO INSTRUMENTS FOR DATA ACQUISITION — PROCESSING — DISPLAY — TRANSMISSION Prices and Specifications Subject to Change Without Notice.

#### A few words about Colorado Video, Incorporated.

CVI specializes in the design and manufacture of instruments utilizing video technology. Particular areas of interest include research laboratory instrumentation, industrial inspection and control, computer input/output of television signals, video metrology, image alteration and synthesis, electronic art, scan conversion, and communications involving the transmission of TV pictures over audio grade circuits.



Colorado Video, Incorporated — 3245 Prairie Avenue, Boulder, Colorado USA

CVI instruments are used throughout the world and are available for operation from 50 to 400 Hertz power sources and at various scanning rates. For technical assistance, please contact any of the following:

CVI - Box 928 - Boulder, CO 80306 U.S.A. (303) 444-3972 --- TWX 910-940-3248 COLO VIDEO BDR

#### Overseas Representatives

Australian Video Engineering 4 Euston Street Rydalmere, NSW, Australia 2116 (638-6400)

Ciclovision S.R.L. Marcelo T. de Alvear 849° "A" Buenos Aires, Argentina (32-2939)

Hae Nin Commerce Co., Inc. Central P.O. Box 1201 Seoul, Korea (22-2128)

Integrerad Electronik AB Box 43 S-182 51 Djursholm, Sweden  $(08/753 \ 0330)$ 

#### U.S. Representatives

Perception Systems 13844 Peyton Drive Dallas, Texas 75240 (214) 233-5497

CVI North East Sales Office - Chelmsford, MA (617) 256-3381

CVI New York Sales Office - New York, NY (212) 246-2490

Jorgen Anderson Ingeniorfirma A.S. 1, Produktionsvej DK-2600 Glostrup Copenhagen, Denmark (02/91.88.88)

L.A.R.T., S.p.A. Via Sapri, 20 20156 Milan, Italy (30-69-06)

Protech, Inc. 2-3 Chuo, 4-Chome, Nakanoku Tokyo, Japan 164 (383-1039)

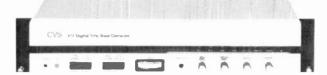
Sintra 294 Rue de President Salvador Allende 92700 Colombes, France (781-81-51)

Perspective Measurements 7370 Convoy Court San Diego, California 92111 (714) 278-8931



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# Better video-digitallyfor any TV standard



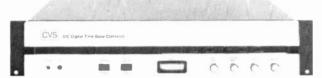
#### CVS-517 Digital Time Base Corrector

Broadcast quality (SECAM optional), L. Lock and V. Lock. SECAM option also provides PAL/SECAM pi-directional standards conversion. Features: 2h + window, Gen Lock, DOC, Vel Comp. Proc Amp. Options include: SECAM, Image Enhancer/Noise Reducer, 16h window.



#### CVS-515 Digital Time Base Corrector

Broadcast quality, has NTSC to PAL-M standards conversion. Features: 2h + window, Gen Lock, DOC, Vel Comp, and Proc Amp. Image Enhancer/Noise Reducer and 16h window optional.



#### CVS-510 Digital Time Base Corrector

Ideal for CCTV and CATV; monochrome or heterodyne color. Features include: 1h + window, DOC, Proc Amp, Color Interlace.



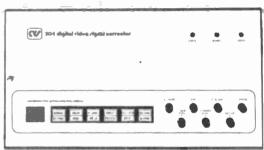
#### CVS-516 Digital Time Base Corrector

Broadcast quality, specifically designed for heterodyne VTRs. Features: 2h+ window, Gen Lock, DOC, Vel Comp. Proc Amp. Options: Image Enhancer/Noise Reducer, 16h window.



#### CVS-520 Digital Time Base Corrector

Broadcast quality for every VTR: segmented or nonsegmented. Only TBC with 9 bit 4x subcarrier digital processing. Can update mono quad to color; has DOC, line-by-line Vel Comp and digital outputs.



#### CVS-504B Digital Time Base Corrector

Broadcast quality, monochrome, direct and heterodyne color, (L. Lock and V. Lock). Includes: 3h window, Gen Lock, Proc Amp. Options: Vel Comp, Heterodyne Phase Corrector.



#### CVS 310 Image Enhancer/Noise Reducer

Reduces luminance & chroma noise 6 dB; enhances horiz. & vert.; minimizes fine grain noise. moiré & streaking; reduces chroma-to-luminance crosstalk by 20 dB; corrects chroma/luma delay errors.

#### **EPIC**™Computer Aided Editor

A complete, software-based system for on or off-line use with multiple VTRs—from quad and 1" to 34" cassette types. With EPIC, functions that, before, required separate, costly hardware—like time code generation—are now in software. As a result, total system cost is reduced while versatility and convenience are increased.

#### Want to know more about TBCs?

Ask for our free bocklet, the "What, Why and When of Time Base Correction.



#### Consolidated Video Systems, inc.

U.S. Headquarters 1255 E. Arques Avenue

Sunnyvale, California 94086 London, W1V2HR England Phone: (408) 737-2100 Telex: 35-2028

#### **European Office** 293 Regent Street Phone: 636 3850 Telex: 268316

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CVS is making digital technology work for video users worldwide. To keep up to date on our new product developments call or write.



#### Cases Incorporated, California

1745 West 134th Street Gardena, California 90249 Telephone (213) 770-4444

#### Portable Rack Mountable Equipment Cases

Organization For Your Rack Mount Equipment — Field Or Studio

- Attractive for studio use and rugged enough for field operations
- Scuff & scratch resistant
- All hardware is recessed on cases with four or more rack spaces
- Front & rear lids are removable for complete access to your equipment
- Pack channel is drilled and tapped for 10/32 screw Depth including the (2) 2 1/4" removable lids is 22" I.D.

Both Lids Attached Ready For Transport Or Storage

Heavy Duty Steel Corners

21/2" Heavy Duty Casters For Field Or Studio

**Durable Aluminum** Angle Trim

Strap Recessed Latches For Accurate Unbroken



- Height available from 2 to 44 spaces (3.5" to 77")
- Depth is optional, can be ordered deeper or narrower
- Rack channel on rear optional 2½" or 3½" casters optional
- Logo or stenciling optional
- Available in blue black orange
- Certified A.T.A construction optional

Both Lids Removed Ready For Operating

Spring Loaded Recessed Handles With Thick Padded Rubber Grip For Comfortable Carrying

Sturdy 1/8" Gauge Rack Channel Pre-drilled And Tapped

Deep Tongue & Groove Closure Insures Water And Dust Resistance



#### Vid-Pro Travel Cases

Carrying Cases For Video Recorders

#### **Standard Duty Case**

Attractive Carrying Case For Traveling Around Town Or To Your Friends.

Hand Holes For Easy Placement Of Your Equipment. Our Hand Holes Also Serve To Hold Two Tapes Each Side.

Dense Foam Padding For Added Protection

Chrome Corners For Extra Protection

Positive Two Chrome Locks For Security

Reinforced Handle For Comfortable Carrying



Heavy Gauge Vinyl Covering Over Solid 4" Plywood

Decorative Side Stitching Top & Bottom

#### Make Sure Your Equipment Arrives In Working Order

#### **Heavy Duty Case**

Continuous Hinge

Hand Holes For Easy Placement And Extra Tapes

Extra Dense Foam **Padding** 

Recessed Latches

Recessed Spring Loaded Handle

Heavy ABS Plastic Laminated to 1/4" Solid Plywood

Heavy Duty Steel Corners

Durable Aluminum Angle

Deep Tongue And Groove Valance



Total Protection For Your Valuable Equipment. Airline Proof Heavy Duty Travel Cases - Perfect For Traveling Around The Country Or Overseas

#### Travel Cases Available For:

- Sony Betamax
- Sony Betamax II

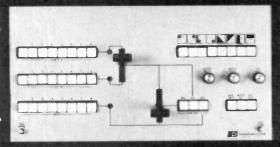
Panasonic Omnivision

- Sanyo Betacord Magnavox
- RCA Selectavision
- JVC Vîdstar
- Zenith
- · Inquiries for equipment not listed welcome • We manufacture cases for most audio
  - visual and camera equipment
- Travel with confidence...use Vid-Pro

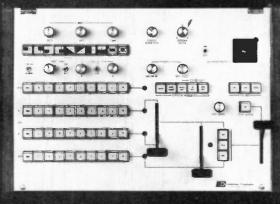
Tape carrying cases for Beta and VHS videocassette formats. Available in 12 or 24 tape. Constructed like standard duty case above.

Specifications Subject to Change Without Notice.

# small... sophisticated ticated CSUPET



VS-10



VS-14



AFM-10

# CDL's Video Switchers & Audio Mixer Switcher team up for flexibility, compact size & price!

#### small...

The VS-10... an 8-input, 3-bus, compact, self contained, vertical interval, solid state switcher. Impressive special effects, Mix Amplifier, Wipe/Key Amplifier, output selector and broad operational capabilities provide exceptional production flexibility. Includes automatic Preview; can wipe and dissolve to keys; has true On-Air Tally system. Chroma Keying also available.

#### sophisticated

The VS-14... a 10-input 4 bus switcher with a combined Mix Amp, Wipe/Key/Mask Key Amp and a Downstream Keyer that allows execution of a complex effects sequence... such as ... dissolve from one source to a masked chroma key ... then dissolve a color matted title over a chroma key, and finally dissolve

out of the chroma key to a different source while retaining the title. Standard features also include Soft Wipes, Soft Keys, Color Titles, Split Screens and Spotlight. Downstream Keyer can insert or dissolve titles.

#### Gsuper

AFM-10...its "teammate" power and flexibility allows it to automatically operate as an Audio Follow or an Audio Mix/Follow Switcher with the VS-10 cr VS-14...plus it has a "hands-off" automatic gain riding Compressor/Limiter.

In the Follow Mode, the AFM-10 becomes an automatic remote controlled switcher.

In the Mix/Follow Mode, the AFM-10 beautifully performs a "voice over", manually or automatically.

As a Mixer, the AFM-10 hancles many jobs with its 7 inputs with individual channel gain pots. independent Master and Auxiliary Line level outputs, and Comp/Lim that can be switched IN or OUT.

Actually, Super is what you'll say when you real ze how much you can do for the price . . . and remember, that includes CDL Quality and Reliability

So send for brochures today or for immediate response, call or write.

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Circle (41) on Reader Service Card

B-41

# CHYRON' CASSETTE CLEANER & EVALUATOR

The CHYRON Cassette Cleaner and Evaluator, Model U-1, provides rapid cleaning and evaluating of 3/4-inch Type A Format Video Magnetic Tape in both standard and small size videocassettes. The system operates with all standard tape, including the new thick oxide tape.

Outstanding operating features make the Model U-1 the leader in professional videocassette tape maintenance.

#### COMPLETELY SELF-CONTAINED.

All of the U-1's capabilities are built into a single stand-alone unit. There is no need to tie up or tie into expensive auxiliary equipment.

#### DOESN'T ALTER THE RECORDED SIGNAL.

The circuitry is designed to safeguard the pre-recorded signal — and, in fact, may improve the signal quality on playback.

#### SELECTABLE ERASE.

The erase function can be activated — at the operator's discretion — by two electrically interlocked front panel switches. When the ERASE button and START button are pressed simultaneously, the erase oscillator is energized and the full-track erase head moves into the tape path. In order to prevent accidental erasure of cassettes, the erase function is deenergized at the end of the cleaning cycle or when the STOP button is pressed.

#### **SELECTABLE OPERATING MODES.**

A front panel switch can select one of three operating modes: STOP ON MAJOR ERROR, DON'T STOP, or STOP ON ALL ERRORS. Thresholds of damage recognition are manually adjustable to meet specific user requirements. The *entire* playing surface of the tape can be cleaned and evaluated. However, when time is a prime consideration, selection of a STOP ON ERROR mode allows the operator to physically examine the tape and/or reject it without completing the cycle.

#### HIGH SPEED, HANDS-OFF OPERATION.

Inserting the cassette in the U-1 produces an automatic rewind to the beginning. Pressing the START button causes the tape to be withdrawn from the cassette and formed into a loop. The tape is automatically placed into contact with front and back surface cleaning stations and with a honing edge which removes embedded particles from the oxide surface.

The tape shuttles from supply spool to takeup spool, and rewinds with constant torque to assure proper tape tension for optimum performance during VTR recording and playback. The tape is cleaned - doubly cleaned during the forward and reverse passes. Evaluation takes place during the forward pass only. Average tape speed is 60 inches per second. A 30-minute cassette is thoroughly cleaned, evaluated, and rewound in less than 3 minutes. The system is completely automatic - and so simple to use that little or no operator training is required.

#### **DUAL OPTICAL EVALUATION.**

The slit evaluator operates as a shadow-graph to detect edge damage, edge creases, changes in tape width, and uncoated tape. The reflective evaluator examines the oxide surface for head scoring, creases, and minor abrasions which could adversely affect signal quality during recording and playback.

#### FEED-BACK TO OPERATOR.

Eight indicator lights on the front panel provide easy monitoring of tape and system status. Two separate 3-digit LED counter displays provide the actual tape length in playing time, and tally each detection of major and minor tape damage.

#### REPLACEABLE PARTS AND SUPPLIES.

Spools of specially treated polyester material — advancing at the rate of one inch per minute — are sufficient to clean 320 thirty-minute cassettes. Replacement is quick, easy — and inexpensive. The precision-ground honing edge can be rotated periodically to provide thousands of hours of use — and is easily replaced when necessary.

#### SPECIFICATIONS

- INPUT POWER: 105-125 VAC, 60 Hz, 100 watts nominal
- EXTERNAL ALARM OUTPUT: Dry relay contacts, one Form C (SPDT) to operate remote "Stop On Error" indicator (lamp, bell, etc.). Contact ratings 48 VDC @ 1A.

#### • FRONT PANEL CONTROLS:

POWER ON OFF (push push).

START (momentary push).

STOP (momentary push).

ERASE (momentary push, electrically interlocked with START pushbutton).

RETRACT (momentary push).

STOP ON MAJOR ERROR ALL NONE (three-position selector switch).
EJECT (lever).

SET LENGTH (thumb-wheel switch).

#### • FRONT PANEL 3-DIGIT LED INDICATORS: TAPE LENGTH — displays the actual tape playing

time in minutes and tenths to 99.9 minutes. DAMAGE COUNT — displays the accumulated count of major and minor tape damage as determined by Minor Error Sensitivity Setting.

- MESSAGE READOUT LAMPS: Wait, Tape Drive, Forward, Reverse, Damage, Remove Cassette, Change Tissue, Rewind.
- SELECTABLE ERASE: Frequency 800 kHz.
- DEPTH OF ERASURE (at tape speed of 60 ips): nominally 50 dB.
- TISSUE SPOOL CAPACITY: Each pair of spools contains 80 feet of specially treated polyester material.
- TISSUE SPOOL ROTATION: 1 4 rpm.

#### • INTERNAL CONTROLS:

Major Error Sensitivity Setting — adjustable from 1 to 10.

Minor Error Sensitivity Setting — adjustable from 1 to 10

Erase Inhibit Jog Forward

Jog Forward Jog Reverse.

#### • DIMENSIONS:

Height — 10° Width — 17

Depth — 18-1 2

Weight — 55 lbs.

#### • FINISH:

Front and Rear Panels — Fed. Std. 595A #20400 (light tan lusterless vinyl).

Cabinet — Fed. Std. 595A #30108 (dark brown textured vinyl).

Chassis and Internal Assemblies — satin black anodize.

Rugged, all-metal construction.

- POWER CONNECTOR: Hubbell, 3-wire twistlock #7484. Mating power cord supplied.
   EXTERNAL ALARM CONNECTOR: 5-pin Am-
- EXTERNAL ALARM CONNECTOR: 5-pin Amphenol #126-218-1000 socket. Mating plug #126-217 supplied.

Maintenance and Operating Manuals provided. Specifications subject to change without notice.



# CORPORATION VIDEO PRODUCTS DIVISION

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Columbia Special Products brings you a unique production tool drawn from the world-wide audio archives of CBS: THE CBS SOUND LIBRARY.

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crowds including a comprehensive baseball stadium sequence . . . Outdoor crowds, such as street riots, street fighting, rallies, sirens, applauses; etc . . . Fire engines, traffic, construction, car wash and gas station sounds . . . Sports sequences including scuba diving; boxing; motorboating; and children at play . . . On-location nature and rainforest sequences; including weather and beach effects . . . Various bird sounds; sea lions; and horse and wagon effects . . . On-location sounds from prisons and courts of law; stock exchange interiors; department stores and supermarkets . . . Factory effects; school interiors and fireworks effects . . . Orchestra tuning up; party crowds; teargas grenades; street vendors . . . and morel

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The new CBS SOUND LIBRARY - consisting of sixteen 12" pure vinyl LP records plus a complete catalog and exhaustive leasy-to-use index - can be yours right now for just \$150. Quite a bargain when you consider the outstanding new dimension and quality you'll be adding to your production capabilities.

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Telephone	
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□ Check enclosed	□ Bill us

Eighteen years proven performance...unmatched worldwide. Power you can rely on. With all you put on the line every time you pick up a camera, can you afford anything less?

Individual cell modules — custom-matched nickel-cadmium cells in high-impact protective containers.

Prime material — Most durable material known for imperviousness to extremes of temperature, humidity and abrasion.

Patented design— J. S. Pat. No. 3,274, 476 and German Pat. No. D. B.P. 1,264,001 awarded to Cine 60 president. Paul Wildum.

Form-fitting compartments—cells cannot shift or move regardless of Powerbelt position; minimizes undesirable flexing of belt wiring.

Vacuum-formed seamless compartments—deep-molded, with rounded corners and uniform wall thickness to reduce stress on material.

Heavy-duty zipper— Assures easy access to wiring and cell modules for on-the-spot internal inspection

charging.

Built-in solid-state charger with indicator light and AC

cable-provides overnight

**Powerpacks**—all Powerbelt models also available in compact battery packs.

Automatic circuit breaker helps protect camera, lights, etc., as well as batteries in case of external shorts Resets automatically.

Special fast-charge in FC models—provides full charge in one hour with optional Model 9400 Fast Charger.

Heavy-duty wiring—with AMP friction-lock connectors. For extra protection against loose connections due to shock and vibration. AMP connectors are additionally soldered to cell abs for increased security and reduced internal resistance.

Optional coiled power cord shown.

Riveting and doublestitching—provides heavy-duty reinforcement.



160 types Powerbelts and Powerpaks, 4 to 14 Ambere-hour capacity for Sony, JVC, Panasonic, Thomson, Akal, Javelin, Magnavox, Ampex, NEC, Philips, Fernseh, CEI, Asaca, Micro-Wave, Hitachi, RCA, Ikegami, Sharp, Cinema Products, Sanyo, Toshiba, Mitchell, Bolza, Arri, Beaulieu, Eclair, Photoson cs and other battery-operated equipment. See your local dealer or contact us for information and prices

Cine 60 Inc. 630 9th Ave. N.Y. N.Y. 10036, 212-586-8782. West Coast 5430 Senset Bvd. Hollywood, Cal. 90928, 213-261-3048.

# CINE 60 Sun-Gun Kits



The 12V. Sun-Gun Kit consists of: The Cine 60 Sun-Gun Head (with integral Swing-Away Filter Holder, removable handle, integral battery cable), Cat. No. 6201A; Tungsten-Halogen Lamp, 11.5V. 100 Watt, Cat. No. 6211; Swing-Away Dichroic Filter, Cat. No. 6202; Battery Cable Adapter, Cat. No. SG6512; 12V. SG Powerbelt or Powerpak, Standard or Fast Charge; Overnite Charger; Carrying Case Cat. No. 6207. Pictured: 12 V. 8AH Fast Charge Powerbelt Sun-Gun Kit with 1 Hour Fast Charger.

Cat. No. SGK-8327PS

SGK-6307PS	12 VOLT 4AH STANDARD POWERBELT SUN-GUN KIT. 25 minute life. Wt. 15 lbs	681.00
SGK-7007PS	12 VOLT 7AH STANDARD POWERBELT SUN-GUN KIT. 40 minute life. Wt. 17 lbs	811.00
SGK-6327PS	12 VOLT 8AH STANDARD POWERBELT SUN-GUN KIT. 50 minute life. Wt. 20 lbs	822.00
SGK-8307PS	12 VOLT 4AH FAST CHARGE POWERBELT SUN-GUN KIT. 25 minute life. With 9400 Fast Charger. Wt. 18 lbs	
SGK-8327PS	12 VOLT 8AH FAST CHARGE POWERBELT SUN-GUN KIT. 50 minute life. With 9400 Fast Charger. Wt. 23 lbs	
SGK-9107PS	12 VOLT 4AH STANDARD POWERPAK SUN-GUN KIT. 25 minute life. Wt. 14 lbs	
SGK-9107FC	12 VOLT 4AH FAST CHARGE POWERPAK SUN-GUN KIT. 25 minute life. With 9400 Fast Charger. Wt. 17 lbs	
SGK-9707PS	12 VOLT 7AH STANDARD POWERPAK SUN-GUN KIT. 40 minute life. Wt. 16 lbs	
SGK-9127PS	12 VOLT 8AH STANDARD POWERPAK SUN-GUN KIT. 50 minute life. Wt. 19 lbs	871.00
SGK-9127FC	12 VOLT 8AH FAST CHARGE POWERPAK SUN-GUN KIT. 50 minute life. With 9400 Fast Charger. Wt. 22 lbs	
SGK-9727PS	12 VOLT 14AH STANDARD POWERPAK SUN-GUN KIT.	1077.00

80 minute life. Wt. 23 lbs . . . . . . . .



The 30V Sun-Gun Kit consists of: The Cine 60 Sun-Gun Head, Cat. No. 6201A; Tungsten-Halogen Lamp, 30V. 250 Watts. Cat. No. 6209; Swing-Away Dichroic Filter, Cat. No. 6202; 30V. SG Powerbelt or Powerpak, Standard or Fast Charge, Overnite Charger; Carrying Case, Cat. No. 6207. Pictured: 30V. 4AH Fast Charge Powerpak Sun-Gun Kit with 1 Hour Fast Charger.

Cat. No. SGK-9104FC

SGK-6304PS	30V4AH STANDARD POWERBELT SUN-GUN KIT. 25 minute life. Wt. 21 lbs	785.00
SGK-8304PS	30V4AH FAST CHARGE POWERBELT SUN-GUN KIT. 25 minute life. With 9400 Fast Charger. Wt. 24 lbs	1086.00
SGK-9104PS	30V4AH STANDARD POWERPAK SUN-GUN KIT. 25 minute life. Wt. 21 lbs	821.00
SGK-9104FC	30V4AH FAST CHARGE POWERPAK SUN-GUN KIT. 25 minute life. With 9400 Fast Charger. Wt. 24 lbs	1116.00
SGK-9704PS	30V7AH STANDARD POWERPAK SUN-GUN KIT. 40 minute life. Wt. 23 lbs	1024.00
SGK-9704FC	30V7AH 2 HR. FAST CHARGE POWERPAK SUN-GUN KIT. 40 minute life. With 9400 Fast Charger. Wt. 26 lbs	



## CINE 60 Sun-Gun Light

Cine 60's Sun-Gun is a unique battery powered light used by TV camera men and documentary film makers all over the world as a "fill" light outdoors, a "key" or "fill" light indoors. For 30 Volt 150, 250, 350 watt and 12 Volt 100 watt tungsten-halogen lamps. Features: Soft, Wide Angle Focusing Light ideal as a camera mounted light in head-on situations. At 10 ft. Flood Position throws a 14 ft. wide beam flat from edge to edge, free of hot spots, filament patterns, or halos. Lets camera man achieve better picture quality, balancing "fill" light to ambient light, and eliminating harsh facial shadows. A heat-insulated knob on back is used to focus, sliding in and out and locking at any point from maximum to minimum beam width. Built-In Swing-Away Dichroic Filter, 3400°K indoor color temperature or 5500°K color temperature with the turn of a knob

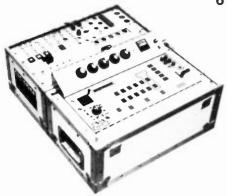
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**12V DC** 117V AC 1 3/4" SYNC GENERATOR SYSTEM

6006





Fully Portable Switching System. Versatile switcher with mix into effects and effects into mix. Built in sync generator with full pulse distribution system, intercom, colorizer, color bar generator and audio mixer.

Complete Sync Generator System Five subcarrier, vertical drive, sync or Horizontal drive outputs. (Four subcarrier and four horz. adjustable).

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6016

#### **INTERCOM & TALLY SUPPLY**



Five Station Intercom System For carbon microphone, 600 ohm head sets. Tally supply: 24V, 500mA. DC.



6016A

Sony Compatible

In-line amplifier. No modification to camera. Processor for sync and burst. Automatic gain control, max. 12db (Two lens stops)

#### **8 INPUT SWITCHER**

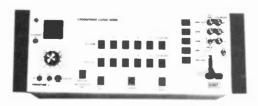
6114



8 input switcher with mix effects and effects into mix, wipe key, mix key, 24 hour event timer, blink effects, pattern modulator, soft wipe, spot-lite and colorizer.

#### **6 INPUT SWITCHER**

6107



Features double re-entry (Mix into effects and effects into mix). Full preview, with only two buses. Built in intercom, tally supply. Auto preview, toggle, 12 pattern effects, colorizer.

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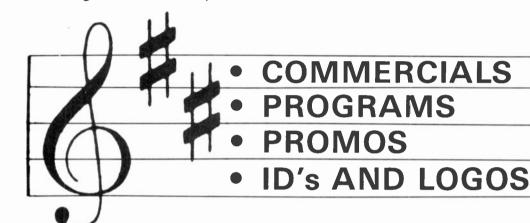
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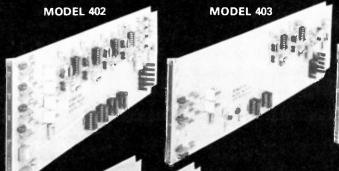
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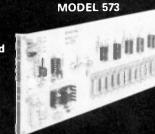
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**AUDIO/VIDEO ROUTING** SWITCHERS, REMOTE CONTROLLED, LOOP THRU INPUTS



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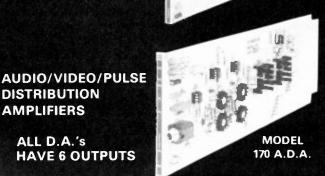
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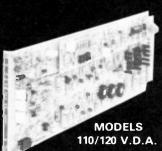
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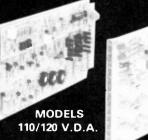
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> Freq. Range 20 to 100 CPS (Factory Set) Level -25 to -35 dBm (Adjustable) Alarm, LED & Relay



MODEL 471 **DETECTOR** 

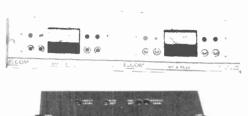
**MODEL 7001** 

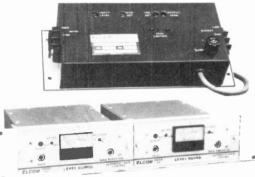


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- ☐ Split Spectrum Optical Control
- ☐ Keyed Integrator Low Distortion Limiting
- ☐ Peak Ceiling Control Circuit
- ☐ AM and FM Response Shaping

#### Wideband Composite Limiter Model WBL

\$495

- ☐ Stops all stereo filter and pre-emphasis wave-form over-shoot
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- Phase coherent wide band for composite stereo
- ☐ WBL-M for mono to stop pre-emphasis overshoot

#### Level Guard Mod. AGC

\$395

- □ AGC for AM-FM-TV-recording
- ☐ Optical gain servo for inaudible control
- Optional control by modulation flasher
- ☐ Meets FCC ATS rules

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**Standard Frequency Monitor** 

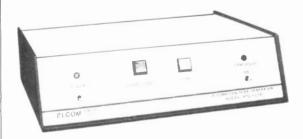
Model 300

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- ☐ FCC Approved method, station frequency measurements, 10Hz
- ☐ Eliminates measurements by outside agency
- □ 8 digit readings referenced to WWV
- ☐ 5 and 10 MHz crystal control WWV receiver

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• 25 Hz TONE GENERATOR AND TRANSPORT CONTROL •



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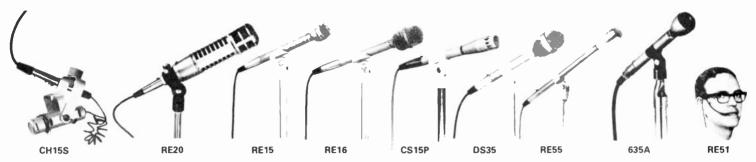
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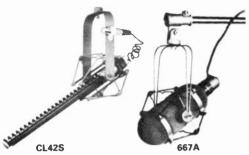
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## Electro-Voice microphones

600 Cecil Street • Buchanan, MI 49107 • (616) 695-6831







#### professional models

model:	CL42S	667A	CH15S	RE20	RE15
type:	type: Cardiline condenser		single-d hyper- cardioid condenser	Cont. Variable-D® cardioid dynamic	Cont. Variable-D® super-cardioid dynamic
response:	90-12k Hz	40-10k Hz	55-13.5k Hz	45-18k Hz	80-15k Hz
impedance:	10-z	50/150/ 250 ohms			lo-z
output:	—33 dB	—51 dB	-40 dB	—57 dB	—56 dB
finish:	fawn beige	gray	fawn beige	fawn beige	fawn beige
applications:	long range pick-up; TV & movie booms, ENG	boom/ fishpole	TV, movie boom/ fishpole	highest quality wide-range recording/p.a.	hand, stand, or boom/ broadcast/ recording/p.a.
comments:	phantom or A-B powerable	6 response variations selectable	phantom or A-B powerable	bass tiltdown switch	bass tiltdown switch
similar models:	DL42—dynamic				RE10—less exacting applications

CL42S . \$637.00 DL42 . . \$400.00

667A ..\$346.00 CH15S \$491.00

RE20 ..\$349.00

RE15 ..\$202.00 RE10 ..\$127.50

#### professional lavalier

RE16	CS15P	DS35	RE55	635A	RE51	CO90	649B
Cont. Variable-D* super-cardioid dynamic	single-d cardioid electret condenser	single-d cardioid dynamic	omni- directional dynamic	omni- directional dynamic	personal headset dynamic	omni- directional condenser	lavalier dynamic
80-15k Hz	40-18k Hz	60-17k Hz	40-20k Hz	80-13k Hz	80-10k Hz	40-15k Hz	70-10k Hz
lo-z	lo-z	lo-z	1o-z	lo-z	lo-Z	lo-z	lo-z
—56 dB	—45 dB	60 dB	—57 dB	—55 dB	—56 dB	—57 dB	—61 dB
fawn beige	fawn beige	fawn beige	fawn beige	fawn beige	black	fawn beige	fawn beige
close-up handheld vocal	highest quality p.a./ recording	prof. enter- tainer broad- cast/p.a./ recording	highest quality p.a./recording	hand or stand vocal/instru- mental broad- cast/record- ing	sports/news remotes/ lecturing	TV news, interview	concealed walkaround p.a./broadcast
bass tiltdown switch/super pop filter	remotely powerable/ removeable pop filter	emphases bass close-up super pop filter	smoothest widest range dynamic	built-in pop filter	hands-free use/clips on eyeglasses	tie clasp mounting	small and lightweight
RE11—less exacting applications	BS9—Opt. plug-in battery supply		<b>DO54</b> — 50-18k Hz —55 dB	RE50— noiseless construction	967M—communications model 967ME—with earphone	CO85— "tie-tac"	RE85— noiseless construction

CS15P . \$237.00 BS9 . . . \$ 50.75 RE16 ..\$210.00 RE11 ..\$141.00

RE55 ..\$232.00 DO54 ..\$112.50

635A . . \$ 69.75

RE51 ..\$153.00

CO90 . . \$112.50 CO85 . . \$164.00

649B ..\$102.00

Prices and Specifications Subject to Change Without Notice.



#### Bectro-Voice Accessories

600 Cecil Street • Buchanan, MI 49107 • (616) 695-6831



BS9

502CP



#### **Electrical Accessories**

AC24 Phantom power supply AC24M provides remote power for two microphones from standard 117 VAC power Expandable in multiples of four to accept up to 10 microphones by using AC24S Expander

BS9 Remote Battery power supply To power any E-V professional condenser microphone Inserts in mic-line between mic-and mixer For balanced or unbalanced lo-z (150 ohms) inputs. Uses two standard 9v batteries. \$50.75

CA10 For any E-V professional condenser system head Reduces output level by approximately 10 dB. For use where extremely high sound pressure levels may cause distortion in the microphone electronics \$26.40

CO9R Repair kit for CO90 mike \$19.10

380 Attenuator for use in mike line Reduces signal 10 dB, does not affect response Prevents overloading of electronics with extremely high-level sound input. Mates with A3-type professional connectors (For other value attenuators, send for E-V Design your own attenuator plans ) \$20.60

381 Switch connector and cable SPST switch built into mike connector Converts mikes with no switch into switch type. Fits mikes with A3-type professional connector 15 cable replaces cable supplied with mike \$24.00

502C Transformer for matching low impedance microphones to high impedance amp inputs. Input is A3F connector, MC1M. output connects directly to amp. Matching A3M cable connector furnished \$20.60

502CP Same as 502C but with 14 phone plug output \$20.60

513A Low-frequency cutoff filter for use with Lo-Z mikes. Elim nates unwanted noise and reverberation components below 100 Hz Professional A3-type connectors \$62.50



Specially formulated Acoustifoam' cellular material is transparent to normal sounds but stops sudden air blasts as caused by wind, movement of the mike, and voice

P and T pops Unaffected by temperature extremes water resistant, protects against mechanical shock and pickup of dust. magnetic particles

314 For RE10 and RE15 mikes Zippered for easy installation. Rear portion can be used on RE11 and RE16 for wind protection. For additional protection use 307 shock mount and 368 windscreen \$12.00

314E For 635A Can be used for pop protection only on front of RE10, and RE15 \$6.40

315A for CS15P mike \$6,40 343 For CL42 and DL42 mikes \$25.60

351 For pop filter on DS35 RE11 & RE16 \$6.40

351 for pop filter on DS35, RE15 RE11.671 & 672 \$6.40

355A For DO54 RE55, mikes \$6.40

368 For 667A Also fits over 34 dia mikes in 307 shock mount and over RE20 in 309 shock mount for added wind protection \$94.00

















340

385 For CO90 CO90E and CO85 mikes

520 4 6m (15) 2-cond shielded gray vinyl jacketed with Switchcraft A3F connector at one end and 'a phone plug at the other end

521 76m (25) 2-cond shielded brown rubber jacketed with Switchcraft A3F connector at one end and A3M at the other end \$23,40

#### **Shock Mounts**

304 Shock mount for SE15 Short electronics with CO15 CS15E or CH15E heads of the E-V condenser mic system. Will also work with microphones with 34 or 1 inch barrels. Attaches directly to boom head. fishpole or floor stand Includes 58 -27 stand adapter \$28.80

307 Shock mount adapts any microphone with 34 diamater cylindrical shank for boom or stand use Accommodates 314 and or 368 windscreens \$33.40

309 Shock mount for RE20 mike Accommodates 368 windscreen \$44.00

#### **Desk Stands**

411 Floor-mount mike mouse for medium and long-distance pickup on stage, desk top. wall, ceiling, etc. Recommended for use with RE10, RE15 mikes. Uses reflected sound wave for increased gain before feedback \$12.80

400 Desk stand in non-reflecting gray with foam rubber base pads, for most microphones whether clamp mounted or fitted with switch stud \$14.40

422 Low profile desk stand with rubber shock mount, accepts E-V stand clamps into which mike is placed \$15.90

423A Desk stand with 518 diameter base and 5 riser 58-27 mounting thread Rests on rubber feet Gray \$11.70

428: Desk stand 518" diameter base with grip-to-talk switch in riser Lever type DPDT switch controls mike and relay Momentary contact or locks in 'talk position Grav 7 high \$31.90

#### Stand Clamps and Mounts

301 Stand clamp for 1 to 118 diameter microphones Allows snap-out use Black \$5.60

301A Same as 301 except gray \$5.60

310 Stand clamp for 34 microphones Allows slip-out use Black \$5.60

310A Same as 310 except gray \$5.60

312 Stand clamp for 34' microphones Allows snap-out use Black \$5.60

312A Same as 312 except gray \$5.60

340: Security Clamp For 34" diameter cylindrical shank mikes. Allen set screws lock mike and connector in place Standard 58 -27 thread mounting \$11.90

342 Security stud-mount adapter Converts studiess mikes with 34 cylindrical barrel and A3-type connector to stud type with on off switch. Allen set screw holds mike in position

#### Carrying Case

456 Tough molded carrying case with foam plastic universal insert, holds virtually any E-V microphone and cable Keeps mike clean, free from damage \$12.50



343

Prices and specifications subject to change without notice

314F

#### **ELECTROHOME**

## **Color Monitor 2000 Series**

Electrohome's new 2000 Series modular range of color monitors have been developed to meet a widely recognized need. They have been developed to satisfy the requirements of many specialized users, both in and outside the broadcast industry for a high grade utility color monitor at a price substantially less than that of existing broadcast-type units.

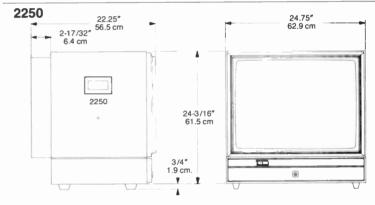


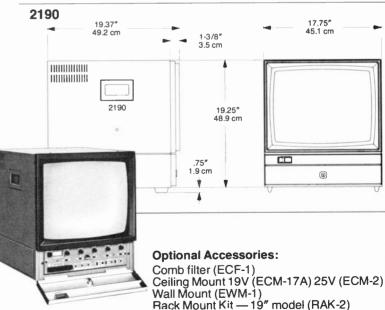
2250



# Product Features

- RGB/NTSC/PAL/SECAM convertibility through optional plug-in circuit boards.
- Signal processing circuitry located on front accessible plug-in circuit boards.
- DC coupled operating controls permitting final user to remote any or all primary functions.
- Excellent tracking of all three channels throughout the operating range.
- Active convergence circuitry provides full raster convergence.
- Excellent black level stability through high level back porch clamp.
- A multiple clamping arrangement provides hum rejection in series mode.
- The power supply design allows asynchronous operation.
- Maintenance of full resolution at brightness levels by the use of the Negative Guardband picture tube.
- Optional luminance comb filter provides full luminance response avoiding the bandwidth limitations associated with conventional passive subcarrier traps. As a second function, this comb filter reduces luminance cross color interference in the chroma display.
- Each model offers reduced scan.
- Options permit Ceiling/Wall/Pedestal mounting. Rack mount (19V) only.





**ELECTROHOME** 

Commercial Marketing Electronics Division Electrohome Limited, 809 Wellington Street North Kitchener, Ontario N2G 4J6 Canada Phone: 519/744-7111, Telex: 069-55449

#### **ELECTROHOME**

Electrohome's Solid State video monitors are designed and built to international standards as established by the communications and surveillance industries. These specially designed monitors are used in a

variety of applications including digital and VTR display, studio, medical and industrial monitoring.

All cabinets are constructed of heavy gauge metal components. Case (table) models

are finished in beige with a blue base or an optional Walnut paint finish with complementary black. Rack units are finished in beige with grey side painting. Add "X" to suffix of model code for 220/240 Volt versions.

- Internal/External Sync Capability
- A/B Video Input Selection
- VTR Time Constant Switching
- Pilot Lamp/Tally Light
- 75Ω Termination Switch (A & B)
- UL/CSA Approved

- Featuring
- Switchable Power Supply 110/220V Hi Lo|Line 90-132V
- 15 MHz Bandwidth to optimize resolution
- Wide Dynamic Range
- Excellent Black Level Clamping and Hum Suppression with Back Porch Clamp
- EHT Regulation
- Up Front Primary & Most Secondary Controls
- AC Cord Winder
- Universal AC Interlock
- Attractive Styling
- Optional Walnut Finish (N.A. Versions)

EVM-910R 9" 38 sq. in. (245.2 cm²) Rack Mounted Video Monitor



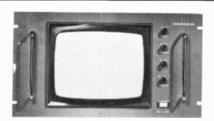
EVM-910R2 Twin 9" 38 sq. in (245.2 cm²) Rack Mounted Video Monitor





EVM-910 9" 38 sq. in. (245.2 cm²) Video Monitor

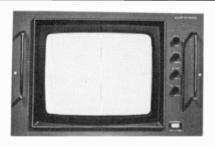
EVM-1110R 11" 61 sq. in. (393.5 cm²) Rack Mounted Video Monitor





EVM-1110 11" 61 sq. in. (393.5 cm<sup>2</sup>) Video Monitor

EVM-1410R 14" 82 sq. in. (529 cm²) Rack Mounted Video Monitor





EVM-1410 14" 82 sq. in. (529 cm²) Video Monitor

EVM-1710R 17" 149 sq. in. (961.3 cm²) Rack Mounted Video Monitor





EVM-1710 17" 149 sq. in. (961.3 cm²) Video Monitor

### **ELECTROHOME**

Commercial Marketing Electronics Division Electrohome Limited, 809 Wellington Street North Kitchener, Ontario N2G 4J6 Canada Phone: 519/744-7111, Telex: 069-5449

#### from the SCRimmer Company Electronics Diversified, Inc.

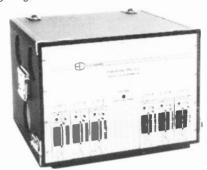
- Portable Lighting Control Systems
- Permanent Lighting Control Systems
- Memory Lighting Control Systems



The Trouping Control Consoles (TCC) are completely portable control panels that permit an operator to vary the light output of a theatre lighting control system. TCCs can control two (2) scenes of six to thirty-six dimmers, in increments of six. Two-scene controllers have a split fader that smoothly transfers control from one scene to the other. Additional features include 2 time faders to be used in conjunction with the split fader and independent master with a time fader.

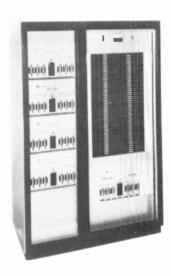
X and Y Masters
 Completely portable
 Any controller can be used with any size power unit
 U.L. Listed.

- · Architectural Lighting Control Systems
- . Disco Lighting Control Systms
- Lighting Distribution Panels



The Trouping Power Packs (TPP) are all-metal power units packaged in wooden, steel reinforced cases with front and rear covers. All units are forced-air cooled. Cool air passes through plug-in dimmer heat sinks, and exhausts high on each side expelling heat generated in the plug-in SCRs and chokes. The plug-in dimmers available may be used in any combination of 2.4Kw, 3.6Kw, 4.8Kw, 6.0Kw, 7.2Kw or 12Kw modules.

• 97% Efficiency • Various output panels available • Square Law dimming curve • No interaction • Modular plug-ins, for easy service.



The Dimmer Bank (DB) is constructed of code gauge cold roll steel and aluminum. With trouping cases removed, the power units are mounted in a standard 19" electronic equipment enclosure as a permanent installation. All units are air cooled. Each rack section is designed to house from one up to five power units. The plug-in units can be removed from the rack for maintenance without the use of any tools. The modules can be removed under power without damage to the units. These modules are available in any combination of 2.4Kw, 3.6Kw, 4.8Kw, 6 Kw. 7.2Kw and 12Kw plug-ins.



The OMNI/3000 was developed to provide all of the advantages of a memory system with the familiarity of a manual console. It's minicomputer design allows for more useful functions and operator interaction than most elaborate memory systems.

• Any and all channels may be overriden by the Channel Manual Selectors or the All On Manual button • Memory and Manual Masters allow the operator immediate access to all operations • Channel capacity is available up to 120 channels • Individual channels may be modified within a cue, alleviating the necessity of resetting and re-recording that cue.

This system is designed for technical simplicity and maximum versatility, the operator is always in complete control of the system.

The Desk Control Console (DCC) is of a permanent type control console with which an operator can vary the output of a theatre lighting system. DCCs are available in two scene or multi scene models consisting of any number of control channels, in increments of six. DCCs have split dipless crossfader controls that allow smooth transitions between scenes and pile-on capabilities.

• "A" and "B" Subscenes • U.L. Listed • Grand Master • Independent Master w/Grand Master assignment.





#### Electronics Diversified Inc.

LIGHTING CONTROL SPECIALISTS

1675 N. W. 216TH HILLSBORO, OREGON 97123 TELEPHONE (503) 645-5533 Write or Call for a free catalog on the many options and features we offer. Representative inquiries invited. Dealers located throughout the U.S.

Prices and specifications subject to change without notice

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- MAGAZINE INSERTS
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DIGITAL CLOCK ES 112/124 (\$145)

Options:

ES 112 (12 hr.) and ES 124 (24 hr.) are solid state, six digit clocks. Three simple controls make setting to the precise second easy. Fast Advance, Slow Advance, Hold. Can drive Jumbo Slaves

Dimensions: 212" High x 8" Wide x 5-5/8" Deep Etched Aluminum 117V AC 50/60 Hz 10W max Case: Electrical: BCDJKLPQRSW

Do you need a contact closure one or more times during the Many ESE clocks can be equipped to generate a time pulse Contact factory for pricing



#### DIGITAL CLOCK THERMOMETER ES 142/144 (\$250)

ES 142 (12 hr ) and ES 144 (24 hr ) are MOS, solid state ES 142 (12 hr.) and ES 144 (24 hr.) are MOS, solid state digital clock/thermometers. Displays 6 digits of time thours, minutes, seconds) and 3 digits of temperature (-50°F to +150°F or -45°C to +66°C) in planar, gas discharge displays. 55° high. Temperature sensor on 25 ft. cable included, attaches to rear-mounted connector.

ES 240 Digital thermometer is available as separate unit.

calibrated for \*F or \*C
Dimensions: 21°; High x 10" Wide x 6 Deep
Electrical: 12W max 117V AC 60 Hz
Options: B C D J K P R S W



SIX DIGIT-CLOCK TIMER ES 500 (\$166)

ES 500 is a 12 hour clock or timer with 5 front-mounted controls. Start Stop, Reset, Fast Advance, Slow Advance Will run continuously to 12 59 59. Advances to 1 00 00 and continuous as clock unless stopped or advanced. After use as a timer time of day must be re-established. Can drive

Dimensions: 21. High x 8 Wide x 5-5/8 Deep

Etched Aluminum Case 117V AC 60 Hz 12W max B C D J K P Q F S W Options:



CONSOLE MOUNT CLOCKS AND TIMERS, 70 SERIES

All units have access to control inputs on rear mounted connector

ES 172 Six Digit, 12 Hour Clock (\$139.00)): Three setting controls—Fast Advance. Slow Advance, and Hold Four line multi-nlexed BCO\*s present on the rear connector. Options are C. D. J. M.

ES 174 Six Digit, 24 Hour Clock (\$139.00) Otherwise identical to the

ES 370 Four-Digit. One Hundred Minute Up/Down Timer (\$178.00)

Six controls—Count. Up. Count. Cown. Stop. Minutes. Advance Seconds Advance, Reset. Options are B. C. D. J. M and V. ES 371 Up/Down Timer (\$278.00). Similar to the ES 370 except with Leverwheel Preset capability for faster setting of the desired time. Option D is an ingegral, separately mounted part of this unit.

ES 570 Four Digit, Sixty or 100 Minute Timer (\$139.00) Select 60 or 100 minute mode on rear connector. Start, Stop and Reset controls.

Runs continuously unless stopped. Reset will return all displays to zero. Unit will run if reset while running or will stay at zero if reset when stopped. Options are B. C. D. J. M and V.

when stopped Options are B. C. D. J. M and V. ES 572 Six Digit. 12 Hour Clock or Timer (\$166.00). Five controls—Start. Stop. Reset. Fast Advance. Slow Advance Will run continuously to 12.59.59. Advances to 1.00.00 and continues as clock unless stopped or advanced. After use as a timer, time of day must be re-established using Fast Advance. Slow Advance and Stop Controls. Options are C. D. J. M. and V.

ES 574 (\$166.00) A 24 hour version of ES 572

Dimensions: 2 16 High x 4 5' Wide x 4 13' Deep Electrical: 117V AC, 60 Hz



JUMBO CLOCKS AND TIMERS, 80 SERIES

Displays are 1 planar das discharde

ES 182 Six Digit, 12 Hour Clock (\$240.00) Three rear-mounted setting controls—Fast Advance. Slow Advance and Hold Options are B. C. D. J. P. Q. R. S. and W. When option Q. panel mount, is specified digits will be separated by colons.

ES 184 Six Digit, 24 Hour Clock (\$240.00) Otherwise identical to the

ES 380 Four Digit, 100 Minute Up/Down Timer (\$278.00) Displays minutes and seconds, with rear-mounted connector to allow remote writing of six momentary SPST controls—Count Up, Count Down, Stop, Minutes Advance, Seconds Advance and Reser Other features similar to ES 300 Options are B. C. D. J. N. P. Q. S. T. W. Y. and

ES 381 Up/Down Timer (\$367.00) Similar to ES 380, except that tes 361 Up/ Down Timer (\$307.00) Similar to ES 360. except ride leverwheel preset is used instead of pushbutton preset Option D is supplied as part of this unit Options are B. C. J. N. P. Q. S. T. W ES 580 Four Digit, 60 Minute Timer (\$201.00) Displays minutes and seconds Rear connector allows remote wiring of three momentary SPST controls—Start. Stop and Reset Runs continuously unless stopped Reset returns all displays to zero, and timer will continue to run from zero if reset while running. Options are B. C. D. J. P. Q.

S. 1, and W ES 582 Six Digit, 12 Hour Clock or Timer (\$278.00) Five control inputs (SPST momentary) brought to rear connector—Start. Stop. Reset, Fast Advance and Stow Advance. After use as a timer, time of day must be re-established using Fast Advance. Slow Advance and Stop controls. Options are B. C. D. J. P. Q. S. and W.

80 Series slaves are also compatible with other ESE clocks and timers. ES 112/124, 300, 301, 302, 400, 510, and 500.

Dimensions: 4 45" High x 10.38" Wide x 6 58' Deep

117V AC 60 Hz Electrical:



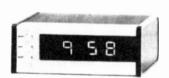
#### ES 512/524 FOUR DIGIT CLOCK TIMER WITH MEMORY (\$208)

Combination four digit 12 or 24 hour clock and 60 minute timer with memory, allowing the user to set the clock to the correct time of day switch to timer mode then switch back to time of day by pushing one button time of day will be correctly displayed in hours and minutes

Electrical: 117V AC 60 Hz, 8 watts Max Mechanical: 8" Wide x 2-3/4" High x 5-5/8" Deep

Etched Aluminum
Four digits of 55° Planar Gas Discharge Display
B. C. D. J. P. Q. R. & W Case Display

Options:



THREE DIGIT 10 MINUTE TIMER ES 400 (\$109)

The ES 400 has three controls-Start Stop Reset. Auns continuously unless stopped. Reset returns display to all zeros. Can be reset while running or stopped. If reset while running timer will continue to run. Can drive Jumbo. Slaves

Dimensions: 2': High x 6 Wide x 5-5 8' Deep Case: Etched Aluminum

Electrical: 117V AC 60 Hz 8W max B D J K P Q R S T W Options:



FOUR DIGIT 60 MINUTE TIMER ES 510 (\$139)

ES 510 is a four digit sixty minute timer (59 59) with Start. Stop and Reset controls (Single pole, momentary push-button) Runs continuously unless stopped Reset returns display to all zeros. Can reset while running or stopped Can drive Jumbo Slaves

Dimensions: 21. High x 6 Wide x 5-5/8 Deep Etched Aluminum 117V AC 60 Hz 10W max Case:

Flectrical: BDJKPORSTW



ES 300 (\$187)



301 (\$206)







100 MINUTE UP/DOWN TIMERS

ES 300 is a four digit, one hundred minute timer (99-59) with six controls. Count Up. Count Down Stop, Minutes Advance. Seconds Advance. Reset. Controls are single pole. momentary push-button switches When Stop control is pressed the four digit display is held. Counting direction iup or down) can be changed or time can be reset for zero without stopping the count lit will continue to register elapsed time beyond the zero setting unless stopped. The ES 300 can drive Jumbo Slaves

 Dimensions:
 2\*.
 High x 8
 Wide x 5-5
 8
 Deep

 Electrical:
 117V AC 60 Hz 10W max

 Options:
 B D J K P Q R S W Y Z

The ES-302 is similar to the ES 300, except that planar gas discharge displays are used in the ES 301-302. Display height is 55

All the ES 300 features are included in the ES 301 Additionally with the ES 302 the user can preset times much faster than with the ES 300 or ES 301 because lever-wheel type switches are used for the preset feature The ES 301-302 can drive Jumbo Slaves

Dimensions: ES 301 2'. High x 8 Wide x 6 Deep ES 302 2'. High x 10 Wide x 6 Deep Electrical. 117V AC 60 Mz 7 W max

301 – B D J K N P Q R S T W Y Z 302 – B D J K N P R S T W Y Z



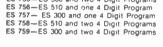
#### PROGRAMMER/ **COMPARATORS 750 SERIES**

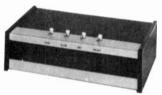
For flexibility and economy with up to ten events ESE has designed the 750 Series of Programmer/Comparators. Rugged thumb-wheel programmers coupled with an ESE clock or timer to provide single pole form A contact closure (1 Amp contact rating) for the length of time program matches display. All this on a 3½" high 19" relay rack mounting panel. Power required: 117V AC 60 Hz; 220V AC 50 Hz may be specified.

If required control function involves a count other than timing, these products can be adapted to your needs

#### wheel Comperator Systems

ES 750-ES 112 and one 6 Digit Program
ES 751-ES 124 and one 6 Digit Program
ES 752-ES 500 and one 6 Digit Program
ES 753-ES 112 and two 4 Digit Program
ES 754-ES 124 and two 4 Digit Programs
ES 755-ES 500 and two 4 Digit Programs

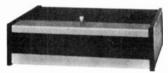




#### ES 1296 (\$156)

For Off-Air taping, or operating tape recorders when nobody is there, ESE has created ES 1296. Presets up to 96 hrs. ahead. ES 1296 is a six digit, twelve hour clock with LED displays and a programmable, 300 watt, 117V AC outlet on the rear. Once the rear outlet is activated, it will remain on for 66 minutes, unless manually terminated, or an optional Record Duration switch is set to a different time interval. This Record Duration option allows the user to select one of four time intervals for recording. These four time intervals are either 16, 33, 66 and 138 minutes, or 33, 66, 138 and 250 minutes. Price \$25,00.

An additional option is Sequential Turn-on, for those machines that require Power, Play, Record in sequence, for proper operation. This option costs \$25.00.



#### ES-251 (\$260)

ES 251 SMPTE Time Code Reader ES 251 is a six digit SMPTE Time Code Reader displaying Hours, Minutes and Seconds. Receives the standard SMPTE Time Code through rear mounted BNC connector, converts it into six digits of clock time. Source of the code is normally a SMPTE time code generator but the unit will read the time code directly from a tape machine running at playback speed. This unit produces an extremely accurate time of day display when driven from a time code generator which is locked to a color sub-carrier frequency. The momentary hold switch allows holding of time on display. Releasing hold switch updates display to correct time.

The input code is AC coupled to two stages of amplification and level shifting to obtain a ground reference. The input circuit requires between 1 and 20 volts peak to peak of input signal and presents an input impedance of 50 Kohm. ES 251 is a CMOS design which

operates from a single power supply.

Dimensions: Aluminum Case 2¾" High x 8"
Wide x 5-5/8" Deep.

Electrical: 117V AC 50/60 Hz 6W Max. Options: BJPQW

ES 252 SMPTE Time Code Reader: Exactly like ES 251, but displays Minutes, Seconds

## **Perfect Timing**



#### MASTER CLOCKS

ES 160 (6775.00): Mounted in a 51/4" relay rack panel and chassis, displays six digits of time information on large, easy to read .3" LED displays, in 12 or 24 hour format, as specified. ES 160 has its own internal timebase, with three second per month accuracy. Its standard output is serial BCD, CMOS compatible, and can drive 20 ES 161, 166, 168 or 171 Remote Displays without buffering. All inputs and outputs are through rear-mounted connectors.

Connectors.

Dimensions: 5¼" High x 19" Wide x 15" Deep Electrical: 117V AC 50/60 Hz.

Doptions: B (CMOS Compatible), J, One PPS Output, Relay Closure on hour and half hour, Battery/Charger (ES 163) Impulse Driver (ES 162), External Timebase-1, 5 or 10 MHz.

Battery/Charger (ES 163) Impulse Driver (ES 162), External Timebase-1, 5 or 10 MHz. ES 180/1 (9355.00): One second per month version of ES 160 ES 190 (9355.00): The ultimate in accuracy! A digital clock, similar to ES 180, with special circuits for receiving and decoding a 1000 Hz tone at the start of each minute. The decoder output resets the seconds' counters in the clock each minute except the first minute of every hour, when a 1500 Hz tone occurs. These tones are transmitted by Radio Station WWV, with an oscillator accuracy of ±1 part in 10<sup>11</sup> ES 190 has an antenna and internal WWV receiver with audio-output. Its crystal timebase is accurate to ±1.7 seconds per day, used when WWV is not received. A battery and charger (ES 163) is available to protect against power interruptions. Displays are .3" red LED's. Serial output drives ES 161, 166, 166 or 171 Slaves. 168 or 171 Slaves.

Dimensions: 5¼" High x 19" Wide x 15" Deep Electrical: 117V AC 50/60 Hz

Options: B (CMOS compatible), J. One PPS Output, Relay Closure on hour and ½ hour, Battery/Charger (ES 163)

Battery/Charger (ES 163) ES192/194 (286.00): The most economical Masters, ES 192 (12 Hr) and ES 194 (24 Hr) are constructed using ES 112 or ES 124 digital clocks and adding the ES 167 Serial Time Code Generator to provide the output needed to drive Remote Serial Displays ES 161, ES 166, ES 168 and ES 171, 60 Hz timebase is derived from the power line. Displays are .6" incandescent type.
Dimensions: 2½" High x 8" Wide x 5-5/8" Deep.
Electrical: 117V AC 60 Hz

Electrical: 117V AC 60 Hz
Options: 8 EOJL POR, Time Pulse Outputs, Battery and Charger, Impulse Driver. Unit
mounted on a 3½" High panel when certain options are specified.
ES 196 (6975.00): Time and Temperature Master—Basically the same as ES 192, with gas
discharge displays, panel mounting and separate serial BCD outputs for time and
temperature. Displays either 12 or 24 hours and "F or "C, as specified.
Dimensions: 3½" High x 19" Wide x 8" Deep
Electrical: 117V AC 60 Hz

Options: BCDJR, Time Pulse Outputs, Battery/Charger

#### **ACCESSORIES**

ES 161 Remote Digital Display (\$145.00): Designed to function with any ESE Master Clock, Es foi Remote vigital display (\$193.00). Designed to function with any 55" Gas Discharge decodes serial time data and displays six digits of clock time on large .55" Gas Discharge Displays, in either 12 or 24 hour format as specified.

Dimensions: 8" Wide x 2½" High x 6" Deep.

nensions: 8" Wide x 21/2" h trical: 117V AC 50/60 Hz. Electrical:

Options: JPOW

ES 162 Impulse Driver (\$177.00): Plugs into the ES 160 chassis, can drive 20 Impulse Clocks. Designed so that, if power fails, impulse always comes on with the same polarity when power is restored. Drives minute or second clocks as specified.

when power is restored. Drives minute or second clocks as specified. ES 163 Battery and Charger (\$145.00): Plugs into the ES 180 or ES 190 chassis. Fast charge, 12 hours continuous use. When operating on battery, displays are automatically blanked and may be viewed by actuating Display button on the front panel. ES 164 Remote Digital Impulse Display (\$177.00): Similar to the ES 161 except that the ES 164 derives its count command from the ES 162 Impulse Driver, or any Impulse clock drive circuits already installed. Choice of 12 or 24 hour display and available either as desk top unit or panel mounted.

Dimensions: 8" Wide x 2½" High x 6" Deep. Electrical: 117V AC 50/60 Hz.

Options: BJPQW.

Options: BJPQW.
ES 166 Jumbo 1" Clock Display (9224.00): Features six digits of one inch high planar gas discharge displays in 12 or 24 hour format as specified. Receives serial time code input from any ESE Master Clock or serial time code generator.

Dimensions: 10½" Wide x 4½" High x 6½" Deep.

Electrical: 117V AC 50/60 Hz.

Options: JPOW. If 0 is ordered digits are separated by colons.

ES 167 Serial Time Code Generator (\$130.00): Offers a low cost answer to a master timing system. An Jintegral part of ES 160, 190, 192/194 and 196 Master Clocks, this unit can be added to many other ESE products, including ES 112, 124, 182, 184, 500, 582, 750, 751, 752, 753, 754, 755, and all 780 Series Time Programmers. The ES 167 fits inside the case so 752, 753, 754, 755, and all 780 Series Time Programmers. The ES 167 rits inside the case so that no extra space is needed. Drives 20 ES 161, 166, 188 or 171 Remote Displays. ES 167 provides CMOS compatible serial BCD output and operates from the logic supply voltage. ES 168 Remote Electromagnetic Display (\$404.00): 4" HEIGHT! Used wherever large size at low cost is essential. Receives the serial time code from any ESE Master Clock (sipplays the time on four bright, yellow-green digits in 12 or 24 hour format as specified. Designed to mount on wall or ceiling. When time changes, audible "click" is heard Dimensions: 6" High x 16½" Wide x 6" Deep. Electrical: 117V AC 50/60 Hz.

Options: JW

ES 169 Temperature Slave (\$130.00): Receives serial BCD temperature code from ES 196, displays it on .55" Gas Discharge Displays.

Dimensions: 8" Wide x 2½" High x 6" Deep.

Electrical: 117V AC 50/60 Hz.

Options: JPQW.

ES 171 Console Mount Display (\$139.00): Newest of the 70 series console mount clocks and timers, ES 171 receives the serial time code generated by any ESE Master Clock, or any ESE product containing the ES 167 serial time code generator, and displays it on bright red .3" LED's.

Dimensions: 21/4" High x 41/2" Wide x 4" Deep Case: High Impact Black Plastic.

Electrical: 117V AC 50/60 Hz

Options: JW



#### RAM TIME PROGRAMMERS 780 SERIES

The ES 780 Series Programmers provide 32 events (expandable to 96) in 51/4 inches of rack space. Ten minutes is all that is required to install, set the clock and program 32 events. Bright .3" LED displays and all controls are on the front panel, outputs and battery test are on the rear ES 167 Serial Time Code Outputs can be specified as an option. Line frequency time base with backup crystal time base, 72 hour battery/battery charger are standard. External time base can be used. 60 Hz is preferred, others may require additional internal curcuitry

Eight Digits of Programming Capability: ES 780—10 Days, 10 Outputs, H Minutes, Seconds

Minutes, Seconds
ES 781—100 Days, Hours, Minutes, Seconds
ES 782—16 Outputs, Hours, Minutes, Seconds
Six Digits of Programming Capability:
ES 783—Hours, Minutes, Seconds
ES 784—100 Days, Hours, Minutes
ES 785—100 Days, Minutes, Seconds
ES 786—16 Outputs, Hours, Minutes
ES 787—16 Outputs, Minutes, Seconds

Four Digits of Programming Capability: ES 788—Hours, Minutes ES 789—Minutes, Seconds

ES 782, 786, and 787 have 16 isolated outputs. Any of the 32 events can be programmed to activate any of the 16 outputs. ES 780 has 10 outputs. The other units have

a single output. ES 784, 786, and 788 have a one minute contact closure. The others have a one second contact closure

REAL TIME: An eight digit display when day selection is required as on the ES 781, 784, 785, seven digits for ES 780, and six digits for the others.

NEXT EVENT: A two digit display of next

event number. NEXT EVENT TIME: An eight digit display when ES 780, 781, or 782 is specified, a six digit display when ES 783, 784, 785, 786, or 787 is specified, and a four digit display when ES 788 or 789 is specified.

Dimensions: 51/4" high x 19" wide x 10"

Weight: Approx. 20 lbs. varying with model

Front Panel: Brushed, etched, anodized

#### **OPTIONS**

Please Note: Some combinations of options are not compatible. Consult factory if in doubt

**B BCD Output** 

C Crystal Timebase: A ± .002% crystal is employed in an oscillator for those applications requiring independence from the power line frequency. Trimmer included for greater accuracy

D Remote Connector, 6' Cable and Control Switch Set: This option consists of a rearmounted connector wired for all control functions, a mating connector, wired to six feet of cable, the other end of which is connected to control switches which are mounted on a 1/8" anodized satin finish aluminum plate suitable for mounting on

.55" Planar Gas Discharge Display M Front-mounted pushbutton controls: available on 70 Series except for ES 371.

N Available on ES 301, 302, 380, 381. Provides a change in count direction from down to up at zero when the unit has been counting down from a preset time P 19" Front Panel, 31/2" high.

Q 9" Front Panel, 31/2" high

R Remote Connector

S Slave/Remote Display: User must specify option B (BCD Output) on master ordering a slave.

T Tenths of Seconds

DC Operation (Includes crystal timebase) W Three Wire Cord Y Relay Closure at Zero: Available on ES 300,

Z Relay Contact Closure and Stop at Zero: Available on ES 300, 301, 302, 380 and 381

302, 380 and 381 only.



142 Sierra Street El Segundo, CA 90245 (213) 322-2136



# Frezzi Rezi Rezi Rezi High-Capacity Battery Packs

Portable power for all video cameras, video recorders, and hand-held "Frezzi Lights."



Frezzolini E.N.G. support equipment.

Made in U.S.A.

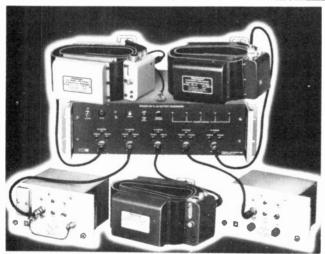
Frezzolini Electronics Inc.
7 Valley St. Hawthorne, N.J. 07506 USA



# Frezzi Belt's

#### Video Power Selector Guide

YOUR VIDEO EQUIPMENT	FREZZI BELT MODEL NUMBER	BELT WEIGHT IN POUNDS	APPROXIMATE CAPACITY (IN MINUTES)	INTERNAL TRICKLE CHARGER	OPTIONAL EXTERNAL FAST CHARGER	SEQUENCER CHARGER CAPABILITY*	BELT LIST PRICE IN U.S. DOLLARS	EXTERNAL CHARGER LIST PRICE IN U.S. DOLLARS
RCA TK-76	F-12-P6	8.5	120	YES	BC-76	YES	\$440.00	\$395.00
IKEGAMI HL-77/37	F-12-77	8.5	120	YES	BC-77	YES	\$440.00	\$395.00
THOMSON MICRO-CAM	F-12-EXF (XLR-5-31)	8.5	120	YES	BC-77	YES	\$440.00	\$395.00
HITACHI FP-3030	F-12-EXF	8.5	180	YES	BC-77	YES	\$440.00	\$395.00
SONY VO-3800	F-12-EXF	8.5	180	YES	BC-77	YES	\$440.00	\$395.00
SONY BVU-100	F-12-EXF	8.5	180	YES	BC-77	YES	\$440.00	\$395.00
SONY DXC-1600	F-12-EXF	8.5	120	YES	BC-77	YES	\$440.00	\$395.00
AKAI VTS 150/150B	F-12-EXF	8.5	100	YES	BC·77	YES	\$440.00	\$395.00
AKAI CCS250P	F-12-EXF	8.5	180	YES	BC-77	YES	\$440.00	\$395.00
JVC CR4400U	F-12-EXF	8.5	180	YES	BC-77	YES	\$440.00	\$395.00
JVC GC4800U	F-12-EXF	8.5	180	YES	BC-77	YES	\$440.00	\$395.00
SUN GUN (250W)	F-30	10	30	YES	NONE	NO	\$485.00	_
SUN GUN (250W)	F-30-EXF	10	30	YES	BC-30 BC-30C	YES	\$535.00	\$395.00 \$495.00
ANY 30VDC CINÉ OR VIDEO SYSTEM	F-30-EXF	10		YES	BC-30 BC-30C	YES	\$535.00	\$395.00 \$495.00
RCA TK-76 <u>AND</u> 100W SUN GUN, FREZZI FLH-100**	F-14-10P6 DUAL VOLTAGE	13	60 40	YES	NONE	NO	\$625.00	_
IKEGAMI HL-77 AND 100W SUN GUN, FREZZI FLH-100**	F-12-1277 DUAL VOLTAGE	13	60 40	YES	NONE	NO	\$625.00	_
RCA TK-76*** IKEGAMI HL-77/79***	D12-76-T D12-77/79-T	6	90 90	YES YES	NONE NONE	NO NO	\$395.00 \$395.00	_



<sup>\*</sup>FREZZI SEQUENCER CHARGER re-charges any intermixed or same group of 5 (or less) Frezzi Belts or Frezzi Battery Packs, unattended (hands-off), in sequence, and maintains them in maximum readiness for use.

List (USA) \$1995.00

List (USA) \$98.00

NOTE: All optional external Frezzi Fast Chargers are line-isolated, power transformer models. All Frezzi Fast Chargers can fully recharge our Belts and Battery Packs in one hour or less.

(C) designation after charger for use with overseas power line inputs.

For information call (N.J. 201) 427-1160 [N.Y.C.212] 594-2294



7 Valley St. Hawthorne, N. J. 07506 USA

Frezzolini E.N.G. support equipment. Made in U.S.A.

FREZZI SEQUENCER CHARGER Prices and specifications subject to change without notice

<sup>\*\*</sup>FREZZI Model FLH - 100 (11.5VDC at 100W) Lighthead.

<sup>\*\*\*</sup>Built-in line isolated charger .

# FUJINON 1979

F/1.7 17x9 zoom with built-in 2X extender







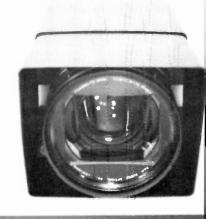
10X close-focusing wide angle zoom



F/1.4 6mm ultra wide angle



14x16.5 high resolution zoom F/2.1 at all focal lengths



16X lightweight 4-range wide angle zoom



Beam Splitting **Optical Systems** 



30X twin range field zoom

# In studio, field, ENG/EFP lenses and optical systems, FUJINON is light years ahead.

Model No.	Format	Focal Length	1	Mod.	Diagonal	Field Angle Horizontal	Vertical	Back Focal Length	Iris	Zoom	Focus	Remarks
				Hand	lheld EN	G/EFP Fo	r Prism T	ype Can	nera			
A10X10.5	2/3"	10.5-105	1.4	1.5	57° 38′-6° 18′	47° 30′-5° 04′	36° 32′-3° 47′	60.12	DC Servo	Flexible Cable	Flexible Cable	Adaptable For 2X Extender
A12X10	2/3"	10-120	1.9	0.8	57° 37′-5° 15′	47° 30′-4° 12′	36° 32′-3° 09′	58.08	DC Servo	Servo or Manual	Manual	
A12X9	2/3"	9-108	1.7	0.8	62° 52′-5° 50′	52° 06′-4° 40′	40° 16′-3° 30′	30.63	DC Servo	Servo or Manual	Manual	
A14X10	2/3"	10-140	1.9	8.0	57° 37′-4° 30′	47° 30′-3° 36′	36° 32′-2° 42′	38.99	DC Servo	Servo or Manual	Manual	Built-in 2X Extender
A14X11	2/3"	11-154	2.1	0.8	53° 08′-4° 05′	43° 36′-3° 16′	33° 24′-2° 27′	60.36	DC Servo	Servo or Manual	Manual	Built-in 2X Extender
A17X9	2/3"	9-153	1.7	0.9	62° 51′-4° 07′	52° 06′-3° 17′	40 16'-2 28'	55.99	DC Servo	Servo or Manual	Manuai	Built-in 2X Extender
A22X12.5	2/3"	12.5-275	1.6	2.5	47° 9'-2° 19'	38° 30′-1° 52′	29° 21′-1° 24′		DC Servo	Manual	Manual	Built-in 2X Extender
AF6	2/3"	6	1.4	0.2	83° 54′	70° 36′	56° 00′		DC Servo		Manual	
K12X14	1"	14-164	1.9	0.95	59° 30′-5° 27′	49° 8′-4° 22′	37° 50′-3° 16′	59.47	DC Servo	Servo	Manual	
				Hand	held ENC	G/EFP Fo	r Relay Ty	pe Cam	era			
N10X10	2/3"	10-100	1.9	1.0	57° 37′-6° 18′	47° 30′-5° 02′	36° 32′-3° 47′	29.02	DC Servo	Manual	Manuat	
N12X9	2√3″	9-108	1.7	0.8	62° 52′-5° 50′	52° 06′-4° 40′	40° 16′-3° 36′	29.30	DC Servo	Servo or Manual		
V14X10	2/3"	10-140	1.9	0.8	57° 37′-4° 30′	47° 30′-3° 36′	36° 32′-2° 42′	32.49	DC Servo	Servo or Manual		

#### Manual and Servo Systems For ENG/EFP LENSES

MANUAL: Mounting Clamp (MCA)
Manual Zoom Module (ZMM)
Flexible Cable (CFC)
Zoom Handle (CZH)
Manual Focus Demand (FMM)
Focus Grip (CFH)

SERVO: Servo Zoom Module (ZSM)
Servo Focus Module (FSM)
Lens Grip (SRD)
Grip Attachment (CTHA)
Extension Cable or (ECC)
Servo Focus Demand (FMM)
DC Power Source (DPS)

Studio/Field Television Lenses												
R10X11	1"	11-110	2.1	0.35	72° 00′-8° 18′	60° 12′-6° 36′	47° 06′-5° 00′	60.52	Servo	Flexible Cable	Flexible Cable	Adaptable For X1.5, 2, 2.5 Extender
R14X12.5	1"	12.5-175	1.6	0 75	65° 14′-5° 14′	54° 13′-4° 11′	42° 01′-3° 09′	60.61	Servo	Manual or Servo	Manual or Servo	
R16X13	1"	13-210	1.6	0.75	63° 13′-4° 22′	52° 25′-3° 29	40° 32′-2° 37′	61.70	Servo	Manual or Servo	Manual or Servo	Built-in X1.5, 2, 2.5 Extenders
R30X16	1"	16-500	18	2.5	53° 08′-*° 50′	43° 36′-1° 28′	33° 24′-1° 06′	70.03	Servo	Manual or Servo	Manual or Servo	Built-in 2X Extender
P10X15	11/4"	15-150	2.8	0.35	71° 00′-8° 00′	59° 20′-6° 30	46° 20′-4° 54′	63.74	Servo	Flexible Cable	Flexible Cable	Built-in 2X Extender
P14X16.5	11/4"	16.5-230	2.1	0.75	65° 56′-5° 20′	54° 50′-4° 16′	42° 31'-3° 12'	66.36	Servo	Manual or Servo	Manual or Servo	
P16X17	11/4"	17-270	2.1	0.75	64° 22′-4° 32′	53° 27′-3° 38′	41° 23′-21° 23′	81.72	Servo	Manual or Servo	Manual or Servo	Built-in X1.5, 2, 2.5 Extenders
P30X20	11/4"	20-620	2.2	2.5	56° 17'-1° 59'	46° 20′-1° 35″	35° 36′-1° 11′	91.39	Servo	Manual or Servo	Manual or Servo	Built-in 2X Extender



Fujinon Optical Inc. • 672 White Plains Road • Scarsdale, New York 10583 • (914) 472-9800 • Telex: 131642

West Coast Distributor: F.P. Optical Inc. • 3333 Bowers Avenue • Suite 130 • Santa Clara, California 95051 • (408) 727-2757 • Telex: 171200

## **Garner Industries High Speed Tape Erasers**

# Garner's New VIDEO'RASER

Erases video cassettes in less than 5 seconds



Imagine getting video tape erasure depth that exceeds professional standards in less than 5 seconds! Garner's compact Video'Raser Unit lets you completely automate your video tape erasing jobs. It's a simple one-step, in-and-out operation that gives you perfect tape erasures in one pass. Four high flux coils eliminate slow, time-consuming operations. Simply insert video cassette, cartridge or reel in the Video'Raser opening and erased tape is automatically ejected at end of machine.

#### Video'Raser Specifications Model 270

Operating Cycle: Less than 5 seconds.

Reel Sizes: Holds up to 81/2" reels and cassettes.

**Overall Dimensions:** 

Length: 281/2" Width: 16" Height: 9"

Weight: 95 lbs.

Method of Operation: Tapes are passed on continuous belt between four high flux coils and ejected at end of machine.

Power: 120 VAC, 60 Hz @ 15 Amps., or 240 VAC, 50 Hz @ 15 Amps. Specify when ordering.

Thermal Protection: Overheating is prevented by automatic cutoff switch, which reactivates eraser

after cool-down period.



We've designed our audio erasing units to automate your tape erasing operations and to eliminate residual noise problems... and our customers tell us we've got a winner! Just hit the power button and drop any reel or cassette up to 10½" on endless belt. In four seconds it delivers a clean, "no-whump" erasure that will meet the most stringent recording standards. You'll save valuable man-hours and do a better job.

#### Garner's Audio Erasing Units

Turn a boring job into a breeze

#### **Audio and Video Specifications**

Overall Dimensions:	MODE	L 70 MODEL 105
Length	27"	271/2"
Width	10"	131/4"
Height	5"	5"
Belt Width*	71/2"	11"
Power:	117 VAC, 4 amps	117 VAC, 6 amps

Method of Operation: Tapes are passed on continuous belt over high flux coils and deposited at end of

Thermal Protection: Overheating is prevented by automatic cut-off switch, which reactivates eraser after cool-down period.

\*Conveyor belt width can be ordered up to 16 inches. Specify width.

**30-Day Trial Guarantee** The Garner VIDEO'RASER and Audio Erasing Units may be returned at any time during the first 30 days after receipt for a complete refund. Advance notification is all that is required. Additional warranty information available from manufacturer on request.

For more information, write or call:

#### **GARNER INDUSTRIES**

4200 North 48th Street, Lincoln, Nebraska 68504, Phone 402-464-5911





#### **Gruber Products Company**

5254 JACKMAN RD. TOLEDO, OHIO 43613 (419) 476-7200

- · Smooth pivot collapsible fold
- Positive locking platforms
- Large 12" ball bearing wheels
- Solid 4" swivel caster wheels with lock
- · Heavy duty construction
- Anti-corrosive zinc plating
- · Formica covered platforms

#### **MECHANICAL SPECIFICATIONS**

Equipment platform 14" > 29"

Wheel base 16"

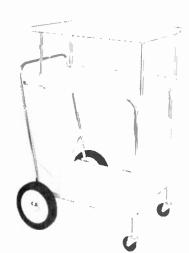
Camera platform pre-drilled to accept Quick-Set 7900 elevator column 53,4" < 14"

Shipping weight 50 lbs

- · Sound-absorbing platforms
- Generous 16" wheel base
- · Human engineered for perfect balance
- Camera platform pre-drilled for elevator column
- Equipment platform pre-drilled for easy adjustment

ENG-1	\$200.00
PACKAGE 1	
ENG-1	\$200.00
7900 Samson Elevator Column	130.00
7201-3 Samson Friction Head	95.00
	\$425.00
PACKAGE 2	
ENG-1	\$200.00
7900 Samson Elevator Column	130.00
7230 Samson Cam Link Head	285.00
	\$615.00





WHEELIT MODEL 432"

#### WHEELIT INDOOR VIDEO CASSETTE ROLLING TABLE, MODELS

3727, 4327: Designed specially for indoor transportation and operation of video cassette equipment, these two Wheelit Rolling Tables accommodate all video cassette player recorders. The heavy duty tubular steel frame safely supports up to 140 pounds of equipment and the formica covered particle board platforms resist sound vibration. Large 10 inch wheels and 3 inch locking casters afford maneuverability around tight corners and narrow passageways. The tilt back handle design permits balanced transportation up and down stairways. Normally the video player/recorder is positioned on the second platform. For transportation the monitor is positioned on the lower platform and for viewing the monitor is stationed on the top platform. Selection between Model 3727 and 4327 should be made with regards to monitor transportation height and monitor viewing level. 3oth Wheelit Models accommodate the full line of accessories

#### **MODEL 3727**

Upper Platform Middle Platform Lower Platform Load Capacity Wheel Base Wheels Casters Shipping Weight

#### MODEL 4327

Upper Platform Middle Plattorm Lower Platform Load Capacity Wheel Base Wheels Shipping Weight

#### \$97.00

19½" × 27½" × 37½" high 19½" × 27½" × 26" high 18" × 24" × 8" high 140 lbs 21"  $10^{\rm n}$ 

39 lbs

#### \$98.00

19½" × 27½" × 43½" high 19½" × 27½" × 32" high 18" x 24" x 8" high 140 lbs 10" 3' w/swivel & lock 60 lbs

Remember, ENG not only stands for ELECTRONIC NEWS GATHERING but also means EVERYONE NEEDS GRUBER.

#### WHEELIT INDOOR/OUTDOOR SLIM LINE FOLDING VIDEO

CASSETTE TABLE, MODEL 4118: Designed for indoor outdoor transportation, the new Wheelit Slim Line is unlike all other folding carts. All of the Slim Line tolds not just the platforms, but the entire unit pivots to collapse to an incredibly thin 12 inchprofile. In the trunk of your automobile or stored in a closet there is room to spare. When transporting or displaying equipment, you can trust the Wheelit Slim Line. Platforms lock intothe upright position with positive assurance. The generous 16 inch wheelbase assures perfect balance and stability. And when you operate equipment from the new Wheelit Slim Line there is hardly a hint of vibration noise because of the unique part cle board platform composition. Accessories available include the electric cord reel and equipment tie down straps. For additional Wheelit Slim Line Video Cassette Tables see back of page



**MODEL 4118** 

MODEL 4118 \$150.00 Platforms Top Platform to floor Bottom Platform to floor 30% Load Capacity 120 lbs Wheels Casters 4 in wisassel & lock Wheel base 16 12 × 25" × 41" Shipping Weight

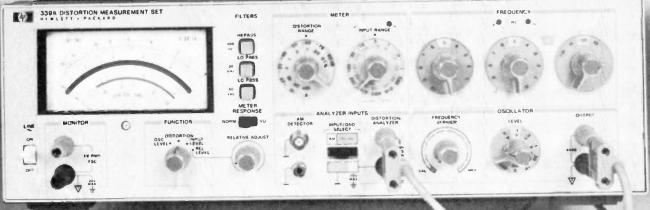


WHETEIT MODEL 4118

Prices and Specifications Subject to Change Without Notice.

# SPEED transceiver, audio or broadcast testing...





## With HP's new 339A Distortion Measurement Set.

Automatic frequency nulling and auto set level features of the 339A speed your total harmonic distortion measurements (THD). And true-rms detection means accurate measurements as low as 0.0018% (-95 dB) from 10 Hz to 110 kHz. Just select the frequency of the built-in oscillator and the 339A's "turn signal" indicators show you how to make the proper range settings. Whether you're testing transceivers, sophisticated audio equipment or broadcast performance, here's how the 339A, priced at \$1900\*, can help you make quick and accurate measurements.

Transceiver testing. Automatic setting of the 100% reference level over a 10 dB input range means fewer critical adjustments. And true-rms detection lets you accurately determine thermal noise and harmonic components in making SINAD measurements.

Audio testing. In addition to the time-saving convenience of auto set level and auto null, you have the benefits of a built-in tracking oscillator for testing high-quality audio equipment.

**Broadcast compliance testing.** An AM detector, 30 kHz low-pass filter, switchable VU meter ballistics, and

a +2 to -12 dBM (600 $\Omega$ ) meter scale reduce your set-up time when checking your equipment for compliance with operating regulations.

For a separate low-distortion oscillator, investigate HP's new 239A, priced at \$575.\* Like the built-in oscillator



of the 339A, it provides less than -95 dB THD over the audio range. For details contact your local HP field engineer.

\* Domestic U.S.A. prive only



1507 Page Mill Road, Palo Ato, California 94304

For assistance call: Washington (301: 948-6370, Chicago (312) 255-9800 Atlanta (404) 955-1500, Los Angeles (213) 877-1282



#### Hitachi Denshi America, Ltd.

Headquarters and East Coast Office West Coast Office Midwest Office Southwest Office Southwest Office Central Western Office \$5 25 Brooklyn-Queens Expressively, Woodside, NY 11377, U.S.A.
Phone: (212) 888 1283, TWX 710-582-2485, Teles: 24200 HDAL UI
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1051 Andover Ferk, West Tuxwile, Wash. 9818t, U.S.A. — Phove: (205) 2951690, TWX 911-444 2155

# SK-96 Studio/Field Hand-Held Convertible Color TV Camera

Television production techniques are constantly diversifying. The SK-96 is designed to meet all requirements for TV camera versatility.

In addition to being a convertible studio/field and hand-held camera, the SK-96 also has a complete Camera Control Unit (CCU). With the SK-96, you can produce programs anytime, anywhere with assurance of superior picture quality.



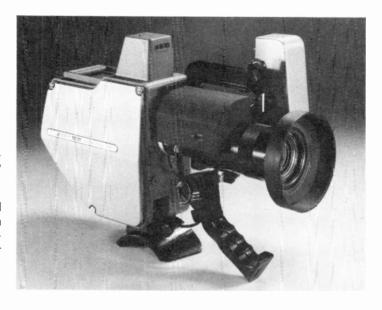
#### **Excellent Picture Quality**

- Three %-inch SATICON\* tubes (H8397A) and an extrasmall, highly efficient beam-splitting prism provide 500line horizontal resolution and a signal-to-noise ratio of more than 51dB.
- Built-in 2H contour corrector with comb filter guarantees sharp, crisp pictures.
- Built-in linear matrix masking amplifier gives high-fidelity color rendition.
- Standard I & Q encoder with switchable color bar generator produces full bandwidth signals.

#### Convertible Camera

- The SK-96 is readily convertible from a studio camera to a hand-held camera and vice versa. To make the conversion, simply take the camera head out of the studio housing and set it in the hand-held housing. Then you have a perfectly functioning hand-held camera. The camera head and housing are designed for quick and easy conversion.
- Studio/Field Use Equipped with everything necessary for standard studio use. x10 standard zoom lenses and x22 field zoom lenses are also available.
- Hand-held Use Thanks to careful human engineering, the camera maintains proper balance on the operator's shoulder, assuring excellent operability. Built-in microphone amplifier accepts input levels of —50 to —10dB. A trigger button is provided on the camera grip for remote control (start/stop) of a portble VTR. An LED tally near the viewfinder screen lights up when the VTR is in the recording mode.

\* Trademark



#### **Built-in ABO [Automatic Beam Optimizer]**

 An ABO circuit, newly developed by Hitachi, eliminates the comet-tail phenomenon which occurs due to lack of a beam current when shooting highly illuminated objects. Hitachi's exclusive ABO circuit controls the beam current automatically.

#### Remote Operation by DCU [Digital Command Unit]

 The SK-96 can be remotely controlled by a DCU at the base station. Signals can be transmitted through a coaxial or triaxial cable of up to 3,000 feet.

#### And Many More Features

- Automatic white balance, built-in color and N/D filters, and automatic iris control by video level detection simplify camera operation even under varying light conditions, both indoors and outdoors.
- The lens iris can be adjusted in the manual mode by observing the black and white stripes superimposed on the viewfinder screen which indicate over-level.
- High gain switch offers +6dB or +12dB operation for extremely low light conditions.
- Built-in sync generator with Genlock circuit can be locked to an external black burst or NTSC color composite signal.
- Low power consumption, great stability and great reliability are obtained by extensive use of ICs and LSIs.
   Bundled wiring is eliminated by the introduction of mother boards.
- The camera body is sturdily constructed.
- The 7-inch studio viewfinder has a tilting mechanism.
- The 1.5-inch hand-held viewfinder is equipped with a magnifying eyepiece and can be positioned for the individual cameraman's comfort by a fully adjustable mechanism for panning and tilting.

Prices and specifications subject to change without notice



#### Hitachi Denshi America. Ltd.

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#### **SK-90**

## Self-contained Portable Color TV Camera

The SK-90 is a lightweight color TV camera that produces unusually sharp and crisp pictures. It enhances the visual appeal of commercials and adds a new dimension of reality to dramas, news and sports. The SK-90 may look like an ordinary camera on the outside, but inside its sturdy case there are two pace-making developments in TV technology — SATICON\* tubes and an Automatic Beam Optimizer (ABO). These innovations create a difference in picture quality which is dramatic enough to attract new viewers and sponsors to your station.

The SK-90 is designed to give TV cameramen all the freedom and mobility they need to go out on location and shoot action features, without worrying about complex equipment, tripping over bulky cords, or staggering under heavy loads.

Weighing only 18 pounds, the camera sits balanced on the operator's shoulder. It requires no backpack, delivers a usable picture in 5 seconds and runs for over an hour on a rechargeable battery belt. Built to withstand temperatures from below zero to above 100°F, the SK-90 will work wherever you have the imagination and the physical courage to take it. And it is packed with automatic features so you don't have to be a technical wizard to use it with professional results.

\*Trade Mark

#### FEATURES

#### **Excellent Picture Quality**

- Three ¾-inch SATICON tubes (H8397A) and an extra-small, highly-efficient beam-splitting prism (F1.4) provide 500-line horizontal resolution and a more than 51dB signal-to-noise ratio.
- The ABO (Automatic Beam Optimizer) circuit, newly developed by Hitachi, prevents occurrence of the comet-tail phenomenon due to lack of a beam current when shooting highly illuminated objects. Hitachi's exclusive ABO circuit solves the problem of lack of beam by controlling it automatically.
- Built-in 2H contour enhancer with comb filter guarantees sharp, crisp pictures.
- Built-in linear matrix masking amplifier for high-fidelity color rendition.
- Standard I & Q encoder with switchable color bar generator produces full bandwidth signals

#### **Automatic and Easy Operation**

- Automatic white balance, built-in color and N/D filters, and automatic iris control by video level detection simplify camera operation even under varying lighting conditions, both indoors and outdoors.
- In the manual iris mode the lens iris can be adjusted by observing picture waveforms superimposed on the viewfinder screen.
- Servo zoom lenses with automatic iris are provided. Conversion kit is available for studio use.
- Convenient quick-start circuit permits almost instantaneous operation (about 5 seconds) after switching-on.
- High gain switch offers both +6 dB and +12dB operation for extremely low light conditions.
- Built-in sync generator can be locked to external black burst signals or NTSC color composite signals with built-in Genlock circuit.



 The camera maintains proper balance on the operator's shoulder, assuring less operator fatigue, and allowing greater concentration on production.

#### Adjustable Viewfinder

- 1.5-inch viewfinder with magnifying eyepiece assures precise framing and focusing.
- 1.5-inch electronic viewfinder may be positioned for individual cameraman's comfort with fully adjustable mechanism for panning and tilting.
- LED (light-emitting diode) tally indicates "VTR Record" or "Battery Low Voltage." Switchable superimposed waveform shows picture level.

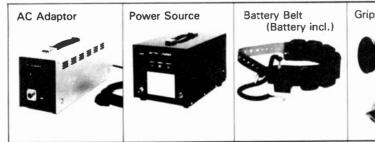
#### DCU (Digital Command Unit) and ROU (Remote Operation Unit)

- The camera with optional Multi-Adaptor can be remotely controlled from a DCU (option) at the base station. Signals can be transmitted via RG-11A/U coaxial cable or triaxial cable up to 3,300 feet.
- The ROU (with multi-conductor cable) is also available as an option. The cable can be extended up to 1,000 feet.

#### And More Features

- Low power consumption (only 35W) even when fully equipped.
- Continuous operation in excess of one hour may be achieved by using a battery belt. Flashing of LED Tally alerts the cameraman to low battery voltage.
- Built-in microphone amplifier accepts input level of -50 to -10dB.
- A trigger button is provided on the camera grip for remote control of a portable VTR.

OPTIONAL ACCESSORIES





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#### **FEATURES:**

#### **AUTOMATIC AND EASY OPERATION:**

Automatic white balance, built-in color and N/D filters, and automatic iris by video level detection simplify camera operation even under varying lighting conditions, both indoors and outdoors.

The lens iris can be adjusted in the manual iris mode by observing picture waveforms superimposed on the viewfinder screen. Standard 16mm lenses ("C" mount or Arriflex mount, can be

easily accommodated.

Built-in microphone amplifier accepts input level of -50 to 0 dB. An earphone jack is also provided for monitoring.

A trigger button is provided on the camera grip for remote control of a portable VTR. An LED (light-emitting diode) tally over the viewfinder screen illuminates when recording is in progress. Continuous two-hour operation may be achieved by using a battery belt. Flashing of LED Tally alerts the cameraman of low

battery voltage.

An attached adjustable shoulder mount assures better camera counter balance; by removing it the camera may be mounted on a standard tripod.

EXCELLENT PICTURE QUALITY:
Three ⅓ inch SATICON Tubes (H8397) provide 500-line horizontal resolution and 50 dB signal-to-noise ratio.
Built-in bias light and +6 dB high gain switch ensure excellent pic-

tures under low light conditions.

Built-in horizontal and vertical image enhancer guarantees sharp and crisp pictures.

Built-in I & Q encoder with switchable color bar generator pro-

duces a full bandwidth signal.

#### ADJUSTABLE VIEWFINDER:

1.5 inch electronic viewfinder may be positioned for individual cameraman's comfort. Full ± 90° tilting is possible for difficult camera angle shots.

Diopter correction lenses are provided for nearsighted or farsighted cameramen.

LED tally indicates "VTR Record" or "Battery Low Voltage." Switchable superimposed waveform shows "Picture Level."

USEFUL OPTIONAL ACCESSORIES:

"AC Adaptor" or "Car Battery Adaptor" supplies DC power for longer operation.

"Gen-lock unit" permits camera gen-lock with only external blackburst signal.

"Studio Adaptor" houses 5-inch viewfinder, gen-lock unit, AC power adaptor and remote connector, rendering studio type camera operation possible.

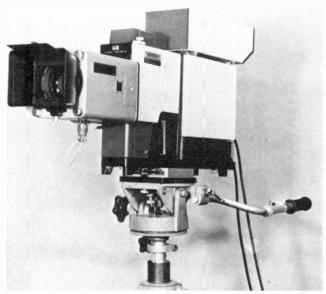
#### SK-80 **PORTABLE COLOR CAMERA**



SK-80 is a fully self-contained portable color TV camera which has broadcast quality. Although the camera utilizes a 3-tube system, compactness, lightweight and stable registration are attained by using Hitachi 3 inch SATICON tubes and a paralleled dichroic mirror

The SK-80 handles like a 16mm cine camera, yet offers on-air immediacy and versatility not only for ENG (electronic news gathering), but also for documentary production, sports coverage, and production of local programs and commercials.

#### **SK-70** THE THIRD GENERATION COLOR TELEVISION CAMERA



Featuring Hitachi's newly developed 3/3 inch SATICON tube and new modular construction concept of this camera, the SK-70 offers highly satisfactory broadcast quality an unusual versatility for all-around application - at low cost.

If one considers the studio camera as the first generation and the portable camera as the second generation, then one must surely consider the SK-70 "The Third Generation Camera" for the television industry. Versatility should be the key word.

#### **FEATURES:**

Three ¾inch SATICON tubes with excellent picture quality.

Versatile operation . . . Hand-held camera with back pack, self-contained camera for remote and small studio applications, and standard studio camera with full remote control . . . any of the above configurations can be achieved simply by changing the combination of modules, adaptors, and accessories, and time involved is just minutes.

Small-size, light-weight, simplified operation, and improved performance.

High sensitivity and excellent signal-to noise ratio

Highly efficient beam-splitting prism with built-in bias light.

Light-weight zoom lens for hand-held operation and high-quality zoom lens for studio use.

Built-in linear matrix masking amplifier, and horizontal and vertical contour corrector.

Digital command remote control.

Low power consumption.

Prices and Specifications Subject to Change Without Notice.



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#### **FP-1020 PORTABLE COLOR TELEVISION CAMERA**



Hitachi FP-1020 is the three-tube, self-contained, portable color camera for everyone. Everyone, because the built-in auto color control circuit with digital memory makes the set-up of auto white and black blaance quite easy, with one touch in seconds. The memory can be kept on until power-off so as to be very stable, just to mention for example.

The development of the FP-1020 is an epoch-making outgrowth of the popular Hitachi FPC-1000 series cameras which have been widely used in every phase of industry because of their reliability and excellent performance.

The portable FP-1020 is proud of its compact light weight construction which provides easy handling and low power consumption of only 22 watts.

The Hitachi FP-1020 is a product of the combination of new technology and the vintage of well established experience for years.

- Built-in digital memory type color balance circuit
  White balance and black balance are controlled by an 8-bit digital memory which guarantees one touch set-up and stable picture.

  Saticon\* with bias light
- Hitachi Saticon\*, featuring a uniform sensitivity in the entire visible light range, provides a sharp color picture. The built-in bias light reduces after-image.
- Three-way power supply An AC pack, batery pack and external DC (12V) can be used. Four (4)-position Filter disc for color temperature and ND.
- High gain switch (+6 dB).
- Low power consumption only about 22 Watts.

  More than 2 hours of continuous operation by a power-belt (option).
- Built-in color bar generator.
  Built-in vertical enhancer is also available as an option.
- No mechanical mis-registration by a single-block mounting of lens,
- optical system and tubes. 1.5" detachable Viewfinder with built-in video level checker.
- Battery warning indicator and tally lamp in the Viewfinder. Plug-in type printed circuit boards for easy maintenance.

#### **FP-1011B** COLOR TELEVISION CAMERA

The FP-1011B is one of the FP-1010 series color television cameras whose excellent quality and performance have earned them a high reputation. The FP-1011B consists of a camera head and a camera control unit with a remote control panel which enables major camera operations from it. Since the remote control panel can be separated from the camera control unit up to 100m, the remote control panel can be located quite far from the camera control unit. Similar to the FP-1010, the FP-1011B can be used as a "self-contained camera" with the optional self-contained kit (only for NTSC color system). The FP-1011B is provided with three SATICON\* tubes; however, the Plumbicon\*\* or Vidicon tube version cameras are also available. The 7" viewfinder is tiltable and detachable. Performance of the new FP-1011B is enhanced by the listed features which provide ease of operation, stability, and minimal set-up time. These features make the FP-1011B ideal for use is educational broadcasting, CATV origination, software production and hospitals as well as in professional broadcasting.

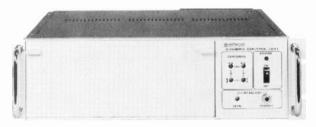
#### **FEATURES:**

- Pickup Tubes SATICON\*
- The RP-1011B Remote Control Panel Controls Many Functions.
- 3-way Synchronization System
- Self-contained Format Possible [Only for NTSC color system]
- **Automatic Iris Control Circuit**
- Built-in Digital-memory-type, White Balance Circuit
- **Combined Color Temperature Compensation**
- Built-in H-detail Circuit and Vertical Image Enhancer
- + 6dB Switch [High Gain]
- Tiltable 7" Viewfinder
- Built-in Encoder
- Built-in Color Bar Generator
- **Color Painting Function**
- Built-in Cable Compensator
- Built-in Masking Amplifier [Option]
- Built-in Test Signals
- Built-in Auto-wobbling Circuit [Focus Lock]





**REMOTE CONTROL PANEL RP-1011B** 



**CAMERA CONTROL UNIT CU-1011B** 

\* Trademark

\*\* Trademark of N.V. Philips

Prices and specifications subject to change without notice



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### HR-100 Portable One Inch "C" Format Recorder

The HR-100 Portable One Inch Recorder Features:

- SMPTE type "C" format
- "Uniblock" construction makes sturdy yet small and lightweight unit.
- Built-in auto assemble edit
- Built-in SMPTE time code generator
- 90 minute operation on built-in 12V battery.



### HR-200 Studio Model One Inch "C" Format Recorder

The HR-200 Studio Model One Inch Recorder Features:

- SMPTE type "C" format.
- Non-contact air drum for reduced tape and head wear.
- Movable exitguide to facilitate threading.
- Air entrance guide reduces tape wear and improves interchange.
- Fast acceleration DC motors reduce FF/REW time to 80 seconds.
- Advanced circuit design renders superior performance: 48 + BSW, DFF Gain 3%, Diff. Phase 3 degrees.



B-69

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## CM-182 (NTSC) CM-1822 (R,G,B) Color Video Monitor — 18 Inch

Hitachi 18-inch color video monitors CM-182 (for NTSC) and CM-1822 (for R,G,B), employing an in-line-type picture tube, provide sharp pictures with excellent color fidelity.

Model CM-182 (for NTSC) is ideally suited for broadcast and medical TV applications which demand accurate colorimetry.

Model CM-1822 (for R,G,B) is designed specifically for use in industrial or medical TV systems where individual color levels and better detail are desirable.

The CM-182 and the CM-1822 ensure a stable color presentation and excellent performance at a reasonable cost.

#### **FEATURES:**

- Hitachi's innovative in-line-type color picture tube ensures reproduction of an extremely bright picture with vivid color.
- By incorporating integrated circuits, color synchronizing and color decoding circuits can reproduce and maintain delicate color hues.
- Aperture correction circuit offers sharp pictures without ringing.



CM-182

	SPECIFICATIONS		
	CM-182	CM-1822	
Color System	NTSC	RGB	
Color decoding	3 axes decoding in narrow band		
	1.0 Vp-p (VBS) $75\Omega$ or high,	0.7 Vp-p (V) or 1.0 Vp-p (VS) G ch only	
Video input	BNC connector	$75\Omega$ or high, BNC connector	
Comp. Samuel		4.0 Vp-p negative polarity $75\Omega$ or high,	
Sync input		BNC connector	
	Horizontal: more than 370 lines at center		
Resolution	(at monochrome signal)		
	Vertical: more than 350 line	es at center	
Signal-to-noise ratio	More than 46dB		
Deflection linearity	Less than 2% (within the central zone of diameter equal to picture height)		
CRT	18-in. In-line-type 90° Deflection 470EFB22 or equivalent		
Ambient temperature	0°C to 40°C (32°F to 104°F)		
Power requirement	U & C type 117V	AC ±10% 60Hz	
Power consumption	Approx	. 80W	
Dimensions (W x H x D)	464 x 440 x 459mm (18-1/4	4 × 17-5/16 × 18-1/16 in)	
Weight	Approx. 30	kg (66 lb)	



### VM-129 12-Inch Video Monitor



The Hitachi VM-129 Video Monitor is an ICincorporated and transistorized, high resolution universaltype 12" monitor de-

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signed to receive video signals of such equipment as the Hitachi TV Camera and VTR without deteriorating their picture quality. The VM-129 is provided with such superb functions as high deflection linearity, wide synchronous holding range and DC restoration facility.

### **FEATURES**

- Preeminent reliability
   All-IC and silicon transistorized circuit ensures high reliability.
- High resolution
   Enhanced frequency and focus characteristics offer horizontal resolution 700 lines at center.
- Excellent deflection linearity
   Linearity correcting coil of the horizontal deflection circuit and highly standardized

deflection yoke provide remarkably low distortion factor of less than 1% at center.

- Stable picture
   Stabilized power circuit keeps picture
- Multiple monitoring
   Bridge connection of the video monitors enables multiple monitoring through one video signal, which offers high image
- High-fidelity picture reproduction
   Built-in DC restorer (switchable) ensures highly faithful image.
- Wide holding range of synchronization
   Wide holding range of synchronization
   stabilizes input signal against jittering
   video signal such as the VTR reproduction picture.
- Capable of revising to an external sync mode video monitor.

### VM-173 17-Inch Video Monitor



The Hitachi VM-173 is a solid state 17-inch black and white video monitor to display video signals from Hitachi CCTV cameras, VTRs and other signal sources.

#### **FEATURES**

- Reliability
   Solid state circuitry using an IC
  - Solid state circuitry using an IC and silicon transistors ensures high reliability.
- 700 lines horizontal resolution
   Horizontal resolution in excess of 700 lines is achieved at picture center.
- Excellent linearity
  Deflection linearity is less than 2%.

Stable picture

stable.

Even played back pictures of VTR can be displayed without jittering.

- Looping video input
   Video input can be looped through with built-in termination switch.
- DC restoration switch
- External sync operation (available as option for U and C types)

### VM-906 9-Inch Video Monitor



The Hitachi VM-906 is a solid state 9-inch black and white video monitor to display video signals from Hitachi CCTV cameras, VTRs and other signal sources.

#### **FEATURES**

- Reliability
  - Solid state circuitry using an IC and silicon transistors ensures high reliability.
- 700 lines horizontal resolution
   Horizontal resolution in excess of 700
   lines is achieved at picture center.
- Excellent linearity
  Deflection linearity is less than 1%.

Stable picture

Even played back pictures of VTR can be displayed without jittering.

Looping video input

Video input can be looped through with built-in termination switch.

- DC restoration switch
- External sync operation (available as option for U and C types)
- Compact construction

Two monitors are mountable side by side in a standard 19-inch rack.

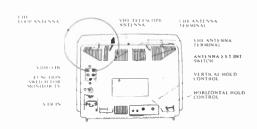
### P/05M 12-Inch Receiver Monitor



12" Receiver Monitor with EIAJ VTR connector and video input (BNC).

#### **FEATURES**

- Solid state chassis
- Low power consumption
- · Instant picture and sound
- Memory fine tuning (VHF)
- Solid state 70 position UHF tuner
- UL approved
- FCC certified





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### V-059B MINI-PORTABLE OSCILLOSCOPE



Model V-059B combines a TV waveform monitor and a single trace 7 MHz portable oscilloscope in a small, lightweight body (6.4 lbs.). Features include keyed DC restorer; TV Sync-separator with automatic LINE/FIELD rate triggering selection by Time/div control; and AC, DC or rechargeable battery powering capability. It is ideal for

video equipment servicing applications and for monitoring TV waveforms in electronic field production. The V-059B has a 10 mv/div deflection factor at 2 MHz bandwidth. A 3-1/2 inch 8 x 10 div rectangular internal graticule CRT assures accurate and easy measurements. The V-059B has a battery protection circuit.

#### **FEATURES**

- · Small size and lightweight: 6.4 lbs.
- · AC, DC or battery powered
- Sharp trace CRT with parallax-free internal graticule
- Keyed DC Restorer for TV waveform monitoring application
- TV Sync separator automatic LINE/FIELD rate triggering selection by time/div control switch
- Selectable input impedance, 1M ohm/75 ohm
- Low line/battery voltage warning indication and battery protection
- All-solid-state reliability and easy maintenance
- 15-position carrying handle optimizes viewing angle
- 2V/2H sweep rate selectable
- External Horizontal sweep mode provided
- External -40, 0, 100 IRE Unit graticule on light filter
- Charging indication by brightness of LED

#### COMPOSITION

V 1 V	11 00111014		
1.	V-059B oscilloscope1		Needle tip attachment .1
2.	AD-058B battery pack .1		Alligator attachment 1
3.	External graticule		Ground lead1
	(attached to	5.	Protective cover 1
	oscilloscope) 1	6.	Viewing hood 1
4.	AT-10P1.5 probe 1	7.	Screw driver for
	Probe housing1		adjustment1
	Pincher tip 1	8.	Operation manual 1

Ambient Temperature

Amplitude Calibrato

**Power Requirements** 

Operating:

Storage:

Height

Width

Depth

Net Weight

Charging Time

**ENVIRONMENTAL CAPABILITIES** 

OTHER CHARACTERISTICS

Positive-going rectangular pulse

Depth (with handle extended)

the aforementioned oscilloscope.

Operates on an AD-058B Battery Pack.

0°C to +40°C

-20°C to +70°C

Sweep gate output, 1 V  $\pm 2\%$  (+15°C to +35°C)

117V  $\pm$ 10%, 50 Hz to 400 Hz. Approx. 18W at 117V, 60 Hz.

External DC source of 11.5V to 14V, requires approx. 0.8A.

Model AD-058B provides up to three hours of operation for

model V-059B. The pack may be attached to the bottom of

#### **SPECIFICATIONS**

#### VERTICAL DEFLECTION

Bandwidth and Risetime: 0°C to +40°C DC to at least 7 MHz, 50 ns or less

DC to at least 2 MHz, 175 ns or less using x 5 gain

AC, DC, or 75 ohm selectable. Using a high impedance 10x probe, the 75 ohm position will be an apparent ground. For AC coupling, the low frequency  $-3 \, \mathrm{dB}$  point is 10 Hz or less; 1 Hz or less with a 10x probe.

#### Deflection Factor

50 mV/div to 2 V/div in six calibrated steps (1-2-5 sequence), 10 mV/div and 20 mV/div using x5 gain, accurate within 3% from +20°C to +30°C and 5% from 0°C to +40°C. Continuously variable between steps and to at least 5 V/div

#### Input R and C

AC and DC: 1 M ohm ±2%, approx. 40pF

75 ohm: 75 ohm ±2%

### DC Restorer

Slow-acting, sync-tip DC restoration. Sync-tip level shift due to changes in APL from 10 to 90% will not exceed 3 IRE units. May be rendered ineffective when desired by a frontpanel switch.

#### Maximum Input Voltage

AC, DC and Ground: 100V (DC + peak AC), 100 Vp-p AC at

1 kHz or less

75 ohm 5V rms max

300V (DC + peack AC), 300 Vp-p AC at 1 kHz or less with a 10x probe

#### HORIZONTAL DEFLECTION

#### Time Base

10 µs/div to 20 ms/div in 6 calibrated steps (1-5-20 sequence) x10 MAG extends fastest sweep rate to 1 µs/div

Continuously variable between steps and to at least 0.1 s/div Time base may be selected: 2V/10 div or 2H/10 div when horizontal display switch is in the 2V-2H position.

#### Time Base Accuracy

	+20°C to +30°C	0°C to +40°C
x1	3%	5%
x10	5%	7%

#### **External Horizontal Input**

DC to at least 10 kHz. Approx. 2 V/div and 0.2 V/div with a x10 MAG.

approx. 20 K ohm Input R:

Maximum Input Voltage: 100V (DC + peak AC), 100 Vp-p AC at 1 kHz or less

#### TRIGGERING

#### Trigger Modes

(sweep free-runs in the absence of a trigger and Automatic: for signals below 100 Hz)

(sweep runs when triggered)

### Coupling

AC

### TV Sync Separator

An internal TV Sync Separator circuit permits stable internal Line or Field-rate triggering from displayed composite video or

### Trigger Source

Internal, External, and Line

### Level and Slope

For Internal Trigger; permits triggering at any point on the positive or negative slope of the displayed waveform.

For External Trigger, permits triggering on any level between -2V to +2V

#### Trigger Sensitivity

	Internal	External
50 Hz to 1 MHz	1 div deflection	400 mV
At 7 MHz	2 div deflection	800 mV

TV sync pulse amplitude requirements - 1 div deflection for internal and 400 mV for external in TV (-) slope selection.

### External Trigger Input

Approx. 1 M ohm; Approx. 40 pF 100V (DC + peak AC), 100 Vp-p AC at 1 kHz or less

8 x 10 div display area, each div is 6.35 mm.

Rectangular tube, P31 Phosphor 1.5 kV accelerating potential

#### Graticule

Internal, nonparallax, nonilluminated External - 40, 0, 100 IRE Unit graticule on light filter

#### SPECIFICATIONS **Output Power**

	External	
1	400 mV	
า	800 mV	

Charging Source V-059B oscilloscope with power cord connected to AC line; scope operation is stopped in the charging

**AD-058B BATTERY PACK** 

15 hours, charging current is automatically set to trickle level at full

12V, 2.7 Ah from full charge

(sealed lead-acid gel)

85mm

198mm

292mm

360mm

3.35"

7.8"

11.5"

18.17"

charge. Operating 0°C to +40°C Ambient Temperature

Charging 0°C to +40°C 0°C to +40°C Storage Height 42mm 1.65" Dimensions Width 162mm Depth 262mm 10.3"

Net Weight 1.7 kg 3.74 lbs.

# Innovative Electronics for Recording and Broadcasting from Inovonics Inc.

Model 201—Average and Peak Responding Limiter \$480

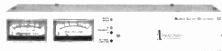


The ideal general-purpose radio production and recording studio compressor/limiter. Independent, yet simultaneous control over program average and peak values. Low distortion, very smooth sounding.

### Model 215—AM Broadcast Peak Processor \$360

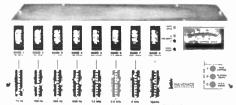
Phase-following integrated limiter/clipper for AM transmitter over-modulation protection. Follows other processors or STL/Telco facilities. Provides inaudible phase optimization, adjustable clipping depth and variable asymmetry.

Model 221—"Audio Level Optimizer II" \$760



A broadband broadcast audio processor for either AM or FM. Gated A.G.C. is followed by a smooth r.m.s. compressor and a peak limiter switchable to phase-following, asymmetrical limiting for AM or independent 75 or 25µs FM limiting.

Model 231—"MAP II" Multiband Audio Processor \$1670



The last word in AM broadcast audio processing for a consistently loud, surprisingly clean sound. The MAP II features gated A.G.C., 8 bands of independently variable compression and a phase-following, asymmetrical Integrated Peak Controller for optimum AM carrier modulation. An integral Pink Noise source aids setup, and the Peak Controller can be remoted for split studio/transmitter operation.

Model 241—DYNEX Noise Suppression \$280



A novel and useful device for reduction of background noise in tape and disc playback systems, TV film chains, Telco program lines. Reduces hiss, rumble, hum, room noise, etc., with little effect on legitimate program material.

Model 375—Tape Recording Electronics \$690



A self-contained record/reproduce electronics assembly for updating older professional recorders or for new installations. Pincompatible with Ampex 300, 350/351/354 and all AG-series machines; adaptable to Scully and many other recorders. Interfaces with original or replacement heads. Three-speed equalization, "linearized" record amplifier, phase-correcting reproduce cicuitry.

Model 376—Dual Channel Reproduce Amplifier \$550



Two channel (stereo) playback-only version of Model 375. Suited to automation systems, editing machines, etc.

400 Series—TENTROL Tape Tensioning Kit \$300



For Ampex, Scully, Otari and several other studio recorders and tape duplicator transports. Provides constant holdback tension regardless of supply reel diameter. Improves high frequency response and 2-track phase performance, extends head life.

Model 500—Acoustic Analyzer \$2750



A fully portable unit for real time, one-third octave audio spectrum display and reverberation analysis. Peak and averaged measurements, two memories, RT60 and Decay Plot capabilities, built-in Pink Noise generator. I/O logic interfaces with digital peripherals.

Full details and specifications available in our full-line catalog; call or write for your copy and a listing of our dealers nationwide.

### **Inovonics Inc.**

503-B Vandell Way Campbell, CA 95008 Telephone (408) 374-8300



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\$40.00

## JVC PROFESSIONAL VIDEO DIVISION

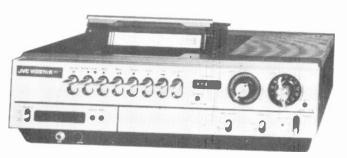
US JVC Corp.

58-75 Queens Midtown Expwy., Maspeth, NY 11378 (212) 476-8300 3012 Malmo Dr., Arlington Heights, IL 60005 (312) 593-8997 1011 West Artesia Blvd., Compton, CA 90220 (213) 537-8230 3400 S. Loop East, Houston, TX 77021 (713) 741-3741

## JVC VIDST R VHS TM.



VIDSTAR HR-3600



VIDSTAR HR-3300

### New Vidstar 1/2-Inch VCR

## The 2 Hour, ½" Videocassette Recorder/Player System

Featuring the popular VHS format developed by JVC. This system can record up to 2 hours of programming on reusable videocassettes. Record one program while watching another or use the built-in timer to record programs while you are not there.

Transfer your 8mm movies or slides to videocassettes with the optional Tele-cine Converter.

Make your own videocassettes using one of JVC's optional color cameras.

JVC's new Model HR-3600 Vidstar is the first ½-inch videocassette recorder to feature slow motion, stop-action and double-speed, in addition to normal viewing. The unit is equipped with two remote control attachments for operating stop-action, double-speed, normal speed and pause functions without touching the machine's front panel.

JVC's Model HR-3300 — a Video Cassette Recorder with styling, ease of operation and quality. Designed from the very start to give 2-hour playing time, and features such as Search and Pause controls, Switchable Channel 3-4 RF Modulator, Timer Select switch, Digital Clock, Audio Dub, Automatic Fine Tuning, and much more.

#### VIDSTAR VHS™ RECORDER/PLAYER SYSTEM

MIDCEAR VILCIM

Model

nn-3300	Player including built-in 24-hour LED Clock/Timer,
	built-in Switchable RF Modulator channel 3-4, VHF/
	UHF Tuner, and one T-30 (30 min.) tape
HR-3600	VIDSTAR VHS™ ½" Color Video Cassette Recorder/ Player including built-in 24-hour LED Clock/Timer, built-in 24-hour LED Clock/Timer, built-in Switchable RF Modulator channel 3-4 and VHF/UHF Tuner, Remote Pause and Still Frame. Slow Motion, and Double Speed Play, 2 Remote Controls, and one T-30 (30 min.) tape.

Description

#### VIDSTAR VHS™ VIDEOCASSETTE TAPES

T-30	1/2 ′′	Videocassette	Tape	(30 min.)
T-60	1/2 "	Videocassette	Tape	(60 min.)
T-120	1/2"	Videocassette	Tape	(120 min.

#### VIDSTAR VHS™ COLOR/BW CAMERA SYSTEMS AND ACCESSORIES

G-31US Single Tube Striped Filter, 1" Vidicon Pick-up Tube, Optical View Finder, 25mm Fixed Lens, AC Adapter, Outdoor Filter and 20ft. Multipin Cable.

### VIDSTAR VHS™ VIDEO CABLES

Coaxial cable (16 Ft.)

Coaxial cable (32 Ft.)

VC-102U

VC-103U

Coaxial cable (66 Ft.)
Single Tube Striped Filter, 1" Vidicon Pick-up tube 1½" Electronic View Finder, 6 x 1 Auto iris Zoom Lens, AC Adapter, Outdoor Filter, and 20 ft. Multipin Cable.
Battery Kit for G-31US/G-71US Cameras, Consisting of Rechargeable Battery B-502, Charger BH-112, and Battery Case.
Rechargeable Battery for G-31US/G-71US Battery Charger for G-31US/G-71US
33ft. Camera Extension Cable for G-31US/G-71US
Camera Cable for Model HR-4100 and G-31US/G-71US
6 x 1 Auto Iris Zoom Lens (17-102mm) for G-31US
1 ½" Electronic View Finder for G-31US
3'' Vidicon B/W Camera with 16mm, F1.4 lens
Camera extension cable (33 ft.)
Manual Zoom lens (12.5-75mm) for GS-1500
Telecine Attachment
Omni-directional microphone
Audio/Video cable (9 ft.)



## **HP-4000AU**VHS Color Videocassette Player

The HP-4000AU color video player accepts standard VHS videocassettes for playback in classrooms, training centers and locker rooms. The HP-4000AU is suitable for home use as well.

Normal, stop-motion and slow-motion speed controls are offered on the HP-4000AU player via an optional Remote Controller (JVC RM-44). The player also has a Search mechanism to permit quick and easy location of desired selections on a pre-recorded VHS videocassette. The HP-4000AU accepts VHS videocassettes up to the T-120 for up to 120 minutes (2 hours) of audio/video playback in color with high quality sound.

#### **Easy Connection**

Simply connect the cables (provided) to the Antenna terminals on any ordinary TV receiver, or to an optional 8-pin connector to monitor TV.

#### Simple Operation

Just push the PLAY lever after loading a pre-recorded VHS video-cassette. Nothing could be simpler.

#### Up to Two Hours of Continuous Play

This player is designed to accept standard long-playing VHS video-cassettes up to the T-120 for up to 120 minutes (2 hours) of video playback. Pre-recorded videocassettes in color or black and white always yield clean and clear pictures thanks to the drop-out compensator circuit in the JVC HP-4000AU.

#### Search Facility

Set the digital counter to "000" at any point during play. Then play or fast-forward the videocassette to its end. Next, set the mode to REWIND and the tape will return to the point previously marked, and stop. You may then replay the section of the tape you desire.

### Normal, Stop-Motion and Slow-Motion Play

Speed control versatility is a highlight in the JVC HP-4000AU. It's easy to "freeze" the video motion at any time for a close inspection of the pictured subject. It's equally easy to set the mode for SLOW-MOTION to observe the action as you like it. Neither of these operations can cause damage to the tape or the player thanks to special JVC safeguards.

### **Remote Control Unit (optional)**

The JVC RM-44 is available at option for use with the HP-4000AU to provide remote control of the Normal/Stop-Motion/Slow-Motion Playback functions.

#### AC/DC Power Supply

Indoors, use the AC power pack (provided) to power the HP-4000AU from ordinary household AC. User may also employ a DC power pack (JVC PBP-1, available at option) containing batteries for indoor or in-the-field use. A power adaptor (JVC AA-p41AU, also optional) is used to recharge the battery pack.

### High-Quality Pictures/Sound

JVC is a leader in audio/video technology as is amply demonstrated in our wide high fidelity, home entertainment and video product lineups. The HP-4000AU, using the popular VHS videocassettes for crystal-clear video playback, likewise offers low-noise, low-distortion sound thanks to the total policy of JVC.



Dimensions: 33.8(W) x 13.7(H) x 36.1(D) cm

(13-3/8 x 5-7/16 x 14-3/16 inches)

Weight: 7.0kg (15.4 lbs.)

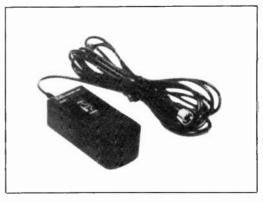
8.1kg (17.8 lbs.) including AC power pack

Accessories Provided:

AC power pack, Earphone, RF converter,

Antenna cable

### REMOTE CONTROL UNIT JVC RM-44 (optional)



## JVC VIDSTAR VHS

### VHS recorder HR-4100AU



### HR-4100AU Portable VHS Recorder

VHS quality and operability are met with full conformity in this unit: no additional equipment is necessary to obtain quality color video tapings in combination with the GC-3350U color video camera. Stable pictures are always the rule, even during on-the-go taping thanks to such special portability designing as high-precision capstan servo and quick-response drum servo systems. The built-in RF converter makes it connectable to most any TV receiver for playback.

- One (1) hour of continuous recording on a single battery pack.
- Battery power/moisture condensation warning.
- Pause mode controlled directly or with an optional RM-42 remote control switch.
- Audio dubbing for later sound recording.
- Search mechanism for locating any tape section.
- Automatic switching between camera and line inputs.
- Video and audio source connection flexibility for direct recording from a TV monitor and/or audio equipment.
- Tape-end auto-stop mechanism.
- Drop-out compensator for clean pictures.

### AA-P41AU AC Power Adapter

This is an essential member of this portable system, though you don't have to carry it with you. Employ it to power the system with household AC power or to recharge the battery pack for outdoor

- · Recharges two battery packs simultaneously; one in the recorder and a separate spare one.
- Informs you of the charging conditions with a switchable meter.

**GA-120U** Telecine converter set **CB-35U** Carrying case for HR-4100AU







Pause mode remote control switch

> VC-3U Car battery cord

VC-226

Monitor cable (3 m/9.5 ft)

VC-221 Camera extension cable (10 m/32 ft)



### 7860UM Color TV Monitor/Receiver

A 19" (measured diagonally) color monitor, with 100% solid-state chassis construction. Features 8-pin VTR connector that handles both video and audio input and output signals, letting you record off-the-air signals or play back video tapes (with optional equipment). Many connectors: video input for monitoring camera signals) bridged video output for multi-monitor system; audio output permitting hookups with separate audio systems; two earphone jacks. In-line black stripe picture tube. Scene control. Three-position aperture compensator control (APACON). One-touch Picture Tune Control simplifies color, tint, brightness and contrast adjustments. Manual adjustment is also possible. Automatic Fine Tune Control (AFC).

VC-202 Monitor Cable (9.75 ft.)

Description

Model

### Optional Accessories for 34-Inch VCR's

KR-503BU KR-504BU KR-505BU KR-506BU	Channel 3 color RF converter Channel 4 color RF converter Channel 5 color RF converter Channel 6 color RF converter				
KR-234U KR-256U	Switchable channel 3 and 4 color RF converter Switchable channel 5 and 6 color RF converter  CP-5200U CR-6300U CR-6060U CR-4400U				
RM-50U	Remote control for CP-5000U/CP-5200U/CR-6300U				
RM-51U	Remote control with 18 Ft. cable				
RM-60U	Remote control for CR-6060U				
RM-41	Remote Actuating Switch for CR-4400U				
AAP-44U	AC power adapter for CR-4400U				
AAP-44LU	AC power adapter for CR-4400LU				
PBP-1	Battery pack for CR-4400U				
VC-208	Monitor cable for CP-5000U (9 Ft.)				
VC-216	Dubbing Cable (9.75 ft.) 10 pin (male)/ 8 pin (male)				
VC-220U	Monitor cable for CR-6100U/CR-6300U (9 Ft.)				
VC-224U	Connecting cable for CR-4400U to monitor				
SW-200UF	Switchbox and antenna cable for CR-6060U				
CN-309	Audio cable (6 Ft.)				
RC-101	Cable with RF connectors and matching transformer				
MCB-20	Special carrying case for any JVC VCR				
CB-56U	Metal case for CR-4400U				
CB-34U	Carrying case for CR-4400∪				

## JVC VIDEOCASSETTE PLAYERS

### Model CP-5000U Videocassette Player



Dimensions: 20¾ ''(W) x 7-11/16''(H) x 17¾ ''(D)

(526mm x 195mm x 450mm)

Weight: 58 lbs. (26 kg)

This color videocassette player uses automatic phase control as automatic color control to insure crisp bright pictures.

All circuits are solid state providing reliable long-term operatio The player is completely solenoid operated which prevents switjamming and makes operation a breeze.

The optional remote control unit permits PLAY, STOP, FAS FORWARD and REWIND operation from as far away as 18 fee Simplified, positive loading mechanism vertually eliminates t possibility of tape jamming during loading or unloading. Aut matic fail-safe circuit turns power off if tape should spill. Plug RF converter permits playback through almost any standa monochrome or color receiver.

Auto-repeat provides the capability of viewing a progra repeatedly with no operator present. Counter-repeat allows selected program segment to be automatically played. (From t beginning of tape to the selected point.)

Two audio tracks provide stereo sound or automatic cueing ' system operation. Tracking, skew and color lock control guarantee interchange with any correctly set-up U-standa VCR.

The videocassette may be removed and reinserted at any place the program without rewinding tape. APC (Automatic Pha Control) and ACC (Automatic Color Control) circuits insure cr pictures and bright colors. A built-in drop out compensator he clean up the picture, even if the videocassette is old and abuse Multiple distribution is available via RF or Video with the aid accessory distribution amplifiers.

### Model CP-5200U Videocassette Player



**CP-5200U** 

#### MODEL CP-5200U VIDEOCASSETTE PLAYER

The CP-5200U is based on the CP-5000U with all its feature additionally it provides still-frame capability. A simple lever gi an excellent noise-free still-frame stop-action picture for detail analysis of any event.

An RF plug-in converter, KR-256U, switchable to channel 5 channel 6, is a standard accessory for the CP-5200U only.

Dimensions: 20%"(W) x 7-11/16"(H) x 17%"(D)

(526mm x 195mm x 450mm)

Weight: 58 lbs. (26 kg)



### VIDEOCASSETTE RECORDER/PLAYERS

### Model CR-6060U Videocassette Recorder

The CR-6060U is the first fully remote controllable color videocassette recorder available at a reasonable price.

#### Features include:

- · AGC (Automatic Gain Control) with ACC (Automatic Color Control) circuits for sharp pictures with stable images and wellbalanced colors.
- Full solid state construction for consistent, reliable performance.
- Built-in control for Fast Forward, Play, Stop, Rewind, Full Record, Audio Dub Channel-1, Pause/Still and Frame Advance. (Remote Control accessory available.)
- · Automatic or manual control of audio recording levels. Separate level meters for audio channels-1 and -2.
- · Pause control to stop taping in the record mode. A tape and time-saving feature.
- Still Frame Playback with the frame advance (FRAME ADV) button - the operator can advance tape position to desired frame location.
- Stereophonic audio track two audio channels for simultaneous recording or playback of two sound sources or audio cue tones.
- · Auto search facility for automatically locating desired section of tape in rewind or fast forward mode.
- Auto re-play facility for repeating playback automatically.



- · Patented dubbing mode (switch) for bypassing built-in APC circuit; permits processing of signal by receiving VCR, VTR, time base corrector, etc.
- Timer start capability for automatic recording off-the-air material, with a monitor/receiver or an outboard tuner-timer.

Dimensions: 20¾"(W) x 7-11/16" (H) x 17¾"(D)

(526mm x 195mm x 450mm) Weight: 58 lbs. (26 kg.)

### Model CR-6300U Videocassette Recorder

### MODEL CR-6300U VIDEOCASSETTE RECORDER

The CR-6300U is based on the CR-6100U with all its features; additionally it provides still-frame capability in playback and pause capability in recording. A single Still/Pause lever gives you still pictures in playback and lets you stop the tape temporarily during recording.

An RF plug-in converter, KR-256U, switchable to channel 5 or channel 6, is a standard accessory for the CR-6300U only.

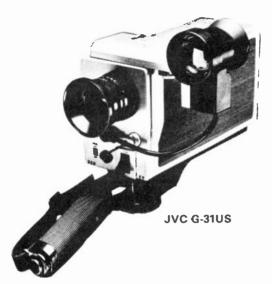
Dimensions: 24-1/16"(W) x 7-11/16"(H) x 17% "(D)

(610mm x 195mm x 450mm) Weight: 64 lbs. (29 kg)

Cabinet: Simulated teak grain

CR-6300U

## JVC G-31 Color Video Camera





JVC G-31US/G-71US Two versions of the same camera; the change is in viewfinder and lens. Uses one 1" uni-electrode striped filter vidicon with built-in color circuitry and phase frequency separation (PFS) that adjusts to changing light levels. Has condenser microphone built into hand grip and can use power from rechargeable batteries, "D" cell batteries, the VCR, or AC via an adaptor. The G-31US has a 25mm, f/1.8, "C" mount lens and an optical viewfinder; the G-71US has a 6:1, f/2.0 zoom lens with automatic iris and a 1.5" electronic viewfinder. Both types of viewfinder have LED indicators for overexposure, underexposure, and VCR on/off with flash to indicate the final 10 minutes of battery power. Camera also has automatic gain control and comes with a multi-pin cable, the AC adaptor, and an outdoor filter. Outputs: Video-1V p-p, 75 ohms; Audio - -20 dB low-Z. S/N: Better than 40 dB, luminance. Hor. resolution: More than 230 lines, center. Added gain: Automatic control to + /-6 dB. Sensitivity: 100 Lux (9 footcandles) minimum at f/1.8, 3,200°K indoors, 6,500°K outdoors with filter. Cable/connector: 12-pin, multi-conductor. Power: 12V DC; 9W (G-31US) or 12W (G-71US). Dimensions: 225mm(I) x 200mm(H) x 93mm(W). Weight: G-31US-4 lbs.; G-71US-6.1 lbs., 8.1 lbs. including battery.

Options: HR-4100 camera cable, extension cable (for operation up to 86' from VCR), battery kit with battery, charger, case.

The single-tube camera employs a conventional black-and-white TV vidicon with a special striped filter which reproduces a true color picture by using unique circuitry. Through this approach, JVC has achieved high productivity and low cost in a high performance color video camera.

Video playback capability is built into the electronic viewfinder on the G-71 camera. Used with any of JVC's Vidstar decks, this allows recorded material to be played back immediately through the viewfinder's 1.5-inch black and white TV screen.

Designed to be held while resting against the shoulder, for more stable shooting, the portable camera weighs 4 pounds with optical viewfinder and fixed lens (G-31), and 6.1 pounds with electronic viewfinder and zoom lens (G-71). Power usage is 9 watts in normal operation, 12 watts with electronic viewfinder.

Included in the system is a universal-type camera cable, for connection to any 1/2-inch videocassette recorder. By adding cable extensions, the camera can be operated on AC up to 86 feet away from the recorder.

When the Automatic Gain Control (AGC) is used the camera sensitivity adjusts to help correct underlit or overlit scenes by +/-6dB (6dB equals one F stop).

An outdoor filter accessory acts as a color temperature adjustment for natural daylight shooting. (A sun-gun clip is also provided.) The result is sharp, Vidstar-quality color.

A significant price breakthrough in video color cameras has been achieved by JVC, which recently introduced a low price portable color video camera.

The unit is the third Vidstar Color Camera in JVC's expanded line of ½-inch videocassette equipment.

The camera operates from either batteries or AC power and is available in two versions.

In its basic version, Model G-31 comes with fixed 25mm "C" mount lens (F1.8) and optical viewfinder with three LED indicators. The Model G-71 version is equipped with auto iris 6:1 zoom lens (F2.0) and 1.5-inch electronic viewfinder with three LED indicators.

All color control circuitry for the self-contained "G" cameras is built-in, eliminating the need for a separate Color Control Unit (CCU). Built into the hand grip is a condenser microphone.

Both models have as standard accessories an outdoor filter, AC adaptor, hand grip with built-in microphone and a multi-pin cable for use with any 1/2-inch VCR.

The unprecedented low price of the JVC "G" Series cameras is in part the result of a unique circuitry system developed by JVC engineers.

Called Phase Frequency Separation (PFS), this technological advance provides a high-quality color picture in varying light levels. If lighting conditions are either too bright or too dim, the PFS System automatically adjusts for the proper amount of illumination.



### CY-8800U Lightweight ENG Color Camera

This self-contained three-tube color camera is designed for professional quality, remote production. It is compact, rugged, and lightweight, ideally suited for ENG and EFP as well as studio applications.

The CY-8800U's sensitivity and signal-to-noise ratio are high; however, power consumption is very low, via an optional AC adaptor, or with an external +12V DC source.

The 1.5 inch (38 mm) viewfinder adjusts easily for maximum operator convenience. Also the handgrip contains both a VCR trigger switch and an open/close switch for the optional auto-iris 10 to 1 zoom lens. The controls and indicators are conveniently located on both sides of the camera.

#### **Features**

- Built-in color bar generator
   Built-in auto white balance
- Built-in waveform sampler Battery warning circuit
- Auto-iris circuit
   Sensitivity doubling (+6 dB or +12 dB)
- · Built-in horizontal and vertical contour correction
- Built-in filters: turret-type ND filter
   Electronic and manual color temperature correction
- Fast warm-up time, full specification: 5 minutes



Model	Description
CY-8800US	with Saticon** tubes
CY-8800US10	with Saticon** tubes, F1.9 10mm - 100mm zoom lens, shipping case and KA880 hand grip
CY-8800US12	with Saticon** tubes, F1.7 9mm - 108mm auto iris zoom lens, and shipping case
CY-8800UP	with Plumbicon* tubes
CY-8800UP10	with Plumbicon* tubes, F1.9 10mm - 100mm zoom lens, shipping case and KA880 hand grip
CY-8800UP12	with Plumbicon* tubes, F1.7 9mm - 108mm auto iris zoom lens, and shipping case

OPTIONAL ACCESSORIES FOR CY-8800U		
Model	Description	
HZ-8100U	F1.9 10mm - 100mm auto iris zoom lens	
N12 x 9R	F1.7 9mm - 108mm auto iris zoom lens	
VF-8801U	3" electronic viewfinder	
RS-8800U	Remote and synchronizing unit with (VC-550 cable and 66 ft.)	
GN-8800U	Portable Gen lock unit with (VC-586 5 ft. cable)	
VC-550	66 ft. remote cable	
VC-551	163 ft. remote cable	
VC-552	333 ft. remote cable	
VC-553	495 ft. remote cable	
VC-582	33 ft. 10 pin - 10 pin extension cable	
VC-583	33 ft. 4 pin - 10 pin AC power supply cable	
KA-880	Hand grip with VCR start/stop button, return video button, iris open/close button	
CDK-1	Cable drives for 12 x 1 zoom (servo zoom & manual focus)	
CDK-2	Cable drives for 12 x 1 zoom (servo zoom & servo focus)	

## JVC



#### NU-1800U Color Video Camera

The NU-1800U, consisting of the CH-1800U camera head, VF-1800U viewfinder and HZ-1800U zoom lens, is a three-tube, professional quality "self-contained" TV camera, with built-in CCU. Compact and lightweight, it combines studio quality with operation simple enough for non-technical personnel. Dimensions: 7-3/16"(W) x 12-7/16"(H) x 24-7/16"(D) (182 mm x 315 mm x 620 mm). Weight: 28.7 lbs. (13kg). DESCRIPTION: CH-1800U Camera Head - NTSC-type color signals directly from the camera head. Video adjustment indicator (VAI) in the viewfinder for adjusting color balance. Three-tube system with dichronic mirror color-separation. Internal color bar generator for checking encoder performance. Color temperature compensation for different lighting conditions by a switch located on the camera control panel. The iris functions in the automatic or manual mode. Controls on the rear panel for adjustment of camera registration. +/ dB gain switch for doubling sensitivity for low light conditions. Built-in ND filters closed, 3%, 25% transmission, and open—can be selected by the rotary dial. All C-mount zoom lens, in both 1'' and 2/3'' formats, may be used. All circuits are constructed in plug-in module form for convenient servicing. VH-1800U Viewfinder - Video signal indicator (VSI) for at-a-glance checking of the light level and iris control. Video adjustment indicator (VAI) for black level and white balance. Video signal select switches for independently checking of R, G, B, -G and color encoded output. AUX video monitor switch for viewing the video signal fed back from a multi-camera system. HZ-1800U Zoom Lens - 6X (12.5 to 75 mm) f/1.8 zoom lens with C-mount. Automatic and manual iris control.









#### RS-1800U Remote & Synchronizing Unit

All electronic controls on the NU-1800U Color Camera head (with built-in CCU) are duplicated on this unit, permitting remote control operation of the camera. The RS-1800U also serves as a gen-lock couper when two or more cameras are incorporated in a system. The unit accepts SYNC, BL, BFP and SC signals for external synchronization of the cameras, and is equipped with built-in cable length compensator, sub-carrier phase shifter, tally and intercom facilities. Only 1%" (44 mm) high, the unit can be mounted on EIA standard 19" racks with adapters.

### SG-1820U Color Sync Signal Generator (Gen-Lock type)

The SG-1820U incorporates a 14.3 MHz crystal oscillator, sub-carrier phase shifter and H-phase shifter. In the internal sysnc mode the SG-1820U produces all required pulses. In the external sysnc mode it locks the pulses to the NTSC-type composite video signal, SYNC + SC, or SYNC supplied from another optional unit. This permits mixing camera signals with VCR, VTR or off-the-air signals.

#### SG-1800U Color Sync Signal Generator

The SG-1800U sync signal generator produces SC, HD, VD, BL, SYNC and BFP pulses for use in the color video system. The sub-carrier of the unit is frequency-interleaved. Sync pulses provide EIA-type 2:1 interlacing. (RS-170)

#### **CB-1800U Color Camera Shipping Case**

A specially-designed metal case, which protects the NU-1800U system during transport. Dimensions: 10-3/8"(W) x 18%"(H) x 27%"(D) (263 mm x 475 mm x 704 mm) Weight: 19.2 lbs. (8.7 kg)



### VC-521U Camera Cable

34-pin (female) - 34-pin (male) for connecting the NU-1800U to the RS-1800U. Several cables can be interconnected with each other.

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   1/2 to 1/3 the size of other processors with equivalent output.
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Please send information on Jamieson	n Processors and a list of some users.
Name	Title
Firm	Phone
Address	City
State Zip	JAMIESON FILM COMPANY 6901 Forest Park Rd. Dallas, TX 75235

## kliegl

### **Key and Back Lights**

### ALL UNITS PROVIDED WITH 36 INCH LEADS, C-CLAMP, SAFETY CABLE AND CONNECTOR



3604TV



3606TV



3610TV

CATALOG NUMBER	DESCRIPTION	PRICE
3604TV 23604TV 13604TV	4 ½ ′′ 750W quartz Fresnel, slide focus 4 way Barndoor Color Frame	\$120.00 38.00 5.00
	QUARTZ LAMPS FOR3604TV: BSP 500W 3200°K 100 hrs. BWM 750W 3200°K 200 hrs.	33.75 49.50
3606TV 23606TV 13606TV	6-3/8" 750W Quartz Fresnel 4 way Barndoor Color Frame	130.00 40.00 6.00
	QUARTZ LAMPS FOR 3606TV: EHC 500W 3200°K 500 hrs. EHF 750W 3200°K 300 hrs.	34.00 38.00
3608TV 23608TV 13608TV	8" 1000W Quartz Fresnel 4 way Barndoor Color Frame	200.00 50.00 7.00
	QUARTZ LAMPS FOR 3608TV: CYV 1000W 3200°K 200 hrs. CXZ 1500W 3200°K 325 hrs. CYX 2000W 3200°K 250 hrs.	58.00 83.25 74.00
3610TV 23610TV 13610TV	10'' 2000W Quartz Fresnel 4 way Barndoor Color Frame	300.00 86.00 9.00
	QUARTZ LAMP FOR 3610TV: CYX 2000W 3200°K 250 hrs.	74.00
3612TV 23612TV 13612TV	12'' 5000W Quartz Fresnel 4 way Barndoor Color Frame	310.00 100.00 15.00
	QUARTZ LAMP FOR 3612TV: DPY 5000W 3200°K 500 hrs.	293.50
3616TV 23616TV 13616TV	16'' 10000W Quartz Fresnel 4 way Barndoor Color Frame	P.O.A. P.O.A. P.O.A.
	QUARTZ LAMP FOR 3616TV: DTY 10000W 3200°K 300 hrs.	564.00
NOTES: Oval Beam	® 8" Fresnels available on Special Order	

NOTES: Oval Beam® 8" Fresnels available on Special Order

Pole-operated Fresnels available on Special Order

P.O.A. - Price On Application

### ADD SUFFIX TO CATALOG NUMBER TO SPECIFY PROPER CONNECTOR

- -- UG Parallel blade U-ground, U.L. listed
- -955G 3 pole pin connector, U.L. listed
- -TLG 3 pole twistlock, U.L. listed

Prices and specifications subject to change without notice



Kliegl Bros. 32-32 48th Ave. Long Island City New York 11101 212/786-7474 Telex: 960158

Circle (84) on Reader Service Card



### **Base and Fill Lights**

### ALL UNITS PROVIDED WITH 36 INCH LEADS, C-CLAMP, SAFETY CABLE AND CONNECTOR



**CATALOG** 



3451TV



1155TV



6914TV

NUMBER	DESCRIPTION	PRICE
3450TV 13450TV	12'' 500/750W Quartz Scoop Color Frame	\$100.00 25.00
	QUARTZ LAMPS FOR 3450TV: FDN 500W 3200°K 400 hrs. frosted EMD 750W 3200°K 400 hrs. frosted	20.00 27.75
3451TV 3452TV 13451TV	16" 1000W Quartz Scoop 16" 1000W Focusing Quartz Scoop Color Frame	110.00 145.00 20.00
	QUARTZ LAMPS FOR 3451TV/3452TV: FDN 500W 3200°K 400 hrs. frosted EMD 750W 3200°K 400 hrs. frosted FHM 1000W 3200°K 300 hrs. frosted	20.00 27.75 25.50
1155TV 11155TV	18" 2000W Quartz Scoop Color Frame	120.00 30.00
	QUARTZ LAMPS FOR 1155TV: DSE 1000W 3200°K 500 hrs. DSF 1500W 3200°K 500 hrs. BWL 2000W 3200°K 750 hrs.	36.00 36.00 104.00
6912TV 16912TV	2000W Soft Light Color Frame	475.00 35.00
	QUARTZ LAMPS FOR 6912TV: FHM 1000W 3200°K 300 hrs. frosted	25.50
6914TV 16912TV	4000W Soft Light Color Frame	475.00 35.00
	QUARTZ LAMPS FOR 6914TV: FFW 2000W 3200°K 125 hrs.	52.50
DIFFUSION MATERIAL	s	
CATALOG		

DIT OUTON MATERIALS		
CATALOG NUMBER	DESCRIPTION	PRICE
TSP-2TV	Tough Spun. Replaces spun glass. Roll 48'' x 25 feet.	\$ 60.00
TSK-2TV	Tough Silk. Same diffusion qualities as real silk. Roll 48" x 25 feet.	60.00
835TV	Spun glass. Roll 36" x 12 feet.	20.00
NOTE: Softlights require 2 lamps each.		

### ADD SUFFIX TO CATALOG NUMBER TO SPECIFY PROPER CONNECTOR

- -UG Parallel blade U-ground, U.L. listed
- -955G 3 pole pin connector, U.L. listed-TLG 3 pole twistlock, U.L. listed

Prices and specifications subject to change without notice



Long Island City New York 11101 212 786-7474 Telex: 960158

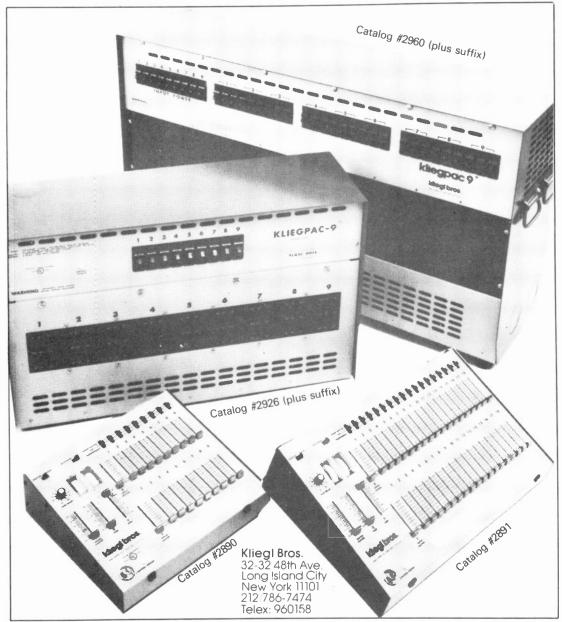




### Standard Systems (Include Dimmer Bank, Control Console and Control Cable)

System #	Description	Dimmer Bank #	Control Console #	Price \$
4000/TLG	$9-2.4\ { m KW}$ Dimmers. Twistlock Receptacles	2926/TLG	2890	3,600.00
4000/9555G	9 $-$ 2.4 KW Dimmers. Pin Connector Receptacles	2926/955G	2890	3,600.00
4000/UG	9 - 2.4 KW Dimmers. U Ground Receptacles	2926/UG	2890	3,600.00
4000/S	9 - 2.4 KW Dimmers. Terminal Strip Output	2926/S	2890	3,400.00
5000/955G	9 - 6.0 KW Dimmers. Pin Connector Receptacles	2960/955G	2890	7,400.00
5000/S	9 - 6.0 KW Dimmers. Terminal Strip Output	2960/S	2890	6,400.00

NOTE: A #2892 Control Cable is furnished with each system.



Prices and Specifications Subject to Change Without Notice.



### **Studio Lighting Packages**

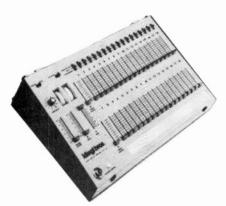
### SIX STUDIO LIGHTING PACKAGES

These packages have been designed and engineered by Kliegl to cover a broad spectrum of studio lighting applications as they apply to most commercial, educational, and industrial users. Each package has been carefully laid out to ensure that the compliment of lighting fixtures, distribution equipment and the lighting control system will prove adequate in the area for which it is designed.



LIGHTING FIXTURES

DISTRIBUTION EQUIPMENT



LIGHTING CONTROL SYSTEM



32-32 48th Ave. Long Island City New York 11101 212/786-7474 Telex: 960158 LIGHTING FIXTURES — A varying compliment of Key, Back, Base, Fill and Set lights, including their accessories, are provided in every package. Pattern Projectors and special Cyc lighting instruments are included in certain packages. All fixtures are provided with 36" leads, C-clamp, safety cable and connector.

**DISTRIBUTION EQUIPMENT** — Wireway connector strips and wall outlet boxes are provided in various quantities for each package (except the STUDIO/FIELD Package, which uses a portable plugging box), in order to ensure proper power distribution throughout the specified studio. Cyc drop boxes are also used in the two larger packages for powering the cyc lighting units.

**LIGHTING CONTROL SYSTEM** — A solid state, low voltage control dimming system has been designed for each of the studio packages. Each system consists of an SCR Dimmer Bank, a Safpatch Panel, a portable 2 Scene Control Console and Plugging Box. The STUDIO/FIELD Package has the **option** of using a KLIEGPAC 9 portable dimming system in place of the portable Plugging Box normally provided.

In addition to the above, each of the studio packages contain a studio layout, the power requirements of the package, a system riser (flow) diagram and pricing information for budgeting purposes. The packages are listed as follows:

CATALOG	PACKAGE	PRICE	
NUMBER	DESCRIPTION	\$	
771015	STUDIO/FIELD	2,286.00	
771520	15' x 20' (300 sq. ft.)	10,447.00	
771825	18' x 25' (450 sq. ft.)	17,134.00	
772030	20' x 30' (600 sq. ft.)	20,926.00	
773040	30' x 40' (1200 sq. ft.)	45,638.00	
774060	40' x 60' (2400 sq. ft.)	76,015.00	

Kliegl is also available to work with you in the custom design of a lighting control and distribution system to meet your studio needs. Memory control is available using the affordable PERFORMANCE lighting control system. Please contact your Kliegl video dealer, sales representative or the factory direct, in order to arrange for a no-obligation review of your studio requirements.



### **Remote Lighting Kits**

### Klieglkit 4Q-TV

Portable Kit for 150 Sa. Ft. Area

### Klieglkit 5Q-TV

Portable Kit for 225 Sq. Ft. Area

The KLIEGLKIT 4Q-TV and 5Q-TV provide the ideal solution to the lighting requirements encountered in the remote TV and film location applications of today. In addition to portability, these kits contain the types of lighting fixtures the lighting professional needs in equipping an O.B. van for Electronic News Gathering.

The two kits are identical except for the inclusion of an additional SPOT head, with accessories, in the 5Q-TV kit. The carrying cases for either kit are the same. This allows one to start with a 4Q-TV kit and later add an additional SPOT or FLOOD head, with accessories, as required.

### Contents of 4Q-TV

1000W Focusing SPOTS with Switch, 20' Cord 2 - #1720-UG Diffuser Frames

2 - #117202 - #217204-Way Barn Doors 1000W Quartz Lamps 2 - FBY

2 - #1750-UG 1000W FLOODS with Switch, 10' Cord

2 - #217504-Way Barn Doors 1000W Quartz Lamps 2 - FHM4 - #14360Folding Stands 2 - #25E16/3UG Extension Cables, 25'

Carrying Case 1 - #1700CC

PRICE .....\$1,115.00

### Contents of 5Q-TV

1000W Focusing SPOTS with Switch, 20' Cord 3 - #1720-UG

Diffuser Frames 3 - #117204-Way Barn Doors 3 - #217203 - FBY1000W Quartz Lamps

2 - #1750-UG 1000W FLOODS with Switch, 10' Cord 2 - #217504-Way Barn Doors

1000W Quartz Lamps 2 — FHM 5 - #14360Folding Stands

2 - #25E16/3UG Extension Cables, 25' 1 -- #1700CC Carrying Case

. . . . . . . . . . . . . . \$1.390.00



4Q-TV Power Requirements: 120V AC/DC at 33.3 Amps. Weight: 64 lbs. 5Q-TV Power Requirements: 120V AC/DC at 41.66 Amps. Weight: 75 lbs.

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These kits may be purchased through your stocking video dealer.

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### VIDEO PRODUCTS

9700-B George Palmer Hwy. Lanham, MD 20801

### K128 Character Generator Specifications

General Description: Keyboard entry device for purpose of generating high resolution white alpha-numerics in video form. Unit self-contained requiring only AC power and sync pulse train. Used as video source or downstream keyer-inserter, Allows entry of information at any location on page. Audio 1/O included.

Character Specifications: Display Format: 128 characters - 26 upper case, 26 lower case, 10 numerals, 26 typewriter symbols, 10 math symbols, 8 Greek letters, 11 foreign language letters, 9 special symbols, 1 flash, 1 space. Character resolution: 768 elements (32 horizontal x 24 vertical); Nominal character height: 32 scan lines, large, 16 scan lines, small: Page format: programmable 17 - 24 character/line, 8 lines/page. Input: Full interlace composite video-sync per EIA RS170, RS330, EIAJ or similar standards.

### **KD-128 Expansion Memory Unit**

Fast random access page storage on flexible magnetic "Diskettes," to expand K128 titling system.

General Description: The KD-128 is a general purpose memory device containing up to 109K bytes of permanent memory, organized as 280 pages of 8 bit words.

When used with K128 equipped with roll and/or crawl, the KD-128 pages can be linked together to form credit rolls or news bulletins of up to 280 full pages.

### K50 Titling Unit

standards.

General Description: Keyboard entry device for purpose of generating white alphanumerics information in video form. Unit self-contained requiring only AC power and sync pulse train. Used as a video source of downstream keyer-inserter. Allows entry of information at any location or page. Independent program/preview channels, 4 full pages of memory.

Character Specifications: Display format: 64 characters - 26 upper case, 10 numerals, 27 typewriter symbols, 1 space. Character resolution 7 x 9 dot matrix. Nominal character height 36 scan lines. Page format: 16 characters/line; 8 lines/page. Input: Full interlace composite video-sync per EIA RS170, RS330, EIAJ, or similar





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TLX: 89-8327



KD-128

TITLERS K50 4 Page Character Generator. \$ 995.00 KS50 With Factory Installed Sync	DS128 Double Size Characters       \$1000.00         KM32 Companion 32 Page Memory for K128       1875.00         KD128 Minifloppy Disc System — 280 Pages       4250.00
KX50 With Factory Installed: Crystal Controlled Internal Sync Character by Character Flash Automatic Timed Page Advance Crawl Function	K128/MOD8 Includes K128, Roll/Crawl, Auto Center Independent Program/Preview, and 8 Internal Pages of Memory
KS Upgrade       200.00         KX Upgrade       600.00         K60 4 Page Character Generator       1295.00         (32 Character/16 line)       1295.00	K128/MOD16 Includes K128, Roll/Crawl, Auto Center, 16 Internal Pages, Independent Program/Preview, 3 Position Title Window, and MF246 Five Font Option
K128 SYSTEM	KMS128
K128 High Resolution 2 Page Character Gen.       \$3250.00         With MF246 Five Font Option       4450.00	Includes K128, Roll/Crawl, Auto Center, Independent Program/Preview, and KM32 Companion Memory
OPTIONS & ACCESSORIES: RC128TS Factory Installed 3 Speed Roll/Crawl	(32 Pages)
RC128VS Variable Speed Roll/Crawl       1000.00         PP128 Independent Program/Preview       950.00         AC128 Automatic Centering       550.00         IP008 Eight Internal Pages       (With PP128 Only)	KDS128 Includes K128, Roll/Crawl, Auto Center, Independent Prog/Prev, and KD128 Floppy Disc System \$8950.00 With MF246 Five Font Option 9950.00 Spare Diskettes 10.00

Control Assembly Corp. 1339 Sylvandell Drive Pittsburgh, PA 15243

Bruce L. Dawson & Associates 84 Belknap Beach Road P.O. Box 115 Prospect, KY 40059 (502) 228-4898

**EMC Corporation** 2979 Ualena Street Honolulu, HI 96819 (808) 847-1138

(412) 279-2264

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Comad Communications Ltd. 91 Kelfield Street, Unit 5 Rexdale Ontario, Canada M9W 5A3

#### Furrer Marketing Agency 4 Cours Des Bastions OH-1205 Geneva, Switzerland

TLX: 845 27237 Telesco

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Australian Video Engineering P.O. Box 248 231-233 Victoria Road Rydalmere NSW Australia TLX: 790-25328

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### Light-weight Video Equipment and Instrument Carriers

### **Model 3000**

Designed For SONY Video Equipment

Will carry most other equipment

#### Features of carrier:

- All-anodized aluminum lightweight
- · Completely-welded unit
- Locking casters on front and
- 21" wheelbase on 16" spoke wheels with ball bearings
- · Easy up and down stairs or over rough ground
- Completely-padded shelves
- Room for tapes
- Convenient cable holders
- Drilled plate in handle to accept camera elevator -2 1/4" hole
- · Easy to put in truck or station wagon
- F.O.B. Mesa, Arizona
- We ship U.P.S.
- 1-year limited structural warranty

#### Options:

- Waterproof dust cover
- Heavy-duty AC strip-switch, light circuit breaker and mounting bracket
- · Gimbeled battery box



Model 3000

- Tripod and light-holding attachment
- Light tubes

### **Model 4000** ADD-A-SHELF

Ideal for: Schools, colleges, hospitals, factories, or studios

#### Features of Carrier:

- Main Feature Light-weight
- All anodized aluminum
- Welded unit
- Bolt-in padded shelves
- Space shelves to fit your equipment
- Safety straps each shelf
- Easy up and down stairs
- 16" spoke wheels ball bearings air tires, on 21' wheelbase
- Locking castors on front
- Put in station wagon or truck
- Drilled plate in handle to accept camera elevator — 2¼" hole 1-year limited structural
- warranty
- F.O.B. Mesa, Arizona
- Total weight w/4 shelves -26 lbs.
- Height 45". Length 26". Width 23".



Model 4000

#### Options:

- Additional shelves
- Waterproof dust cover

#### PRICES START AT \$168.00.

### Deluxe ENG Carrier

Carries The Complete Color Portable VTR System Put All Your Equipment On Wheels

Model 3200 — 3 shelf carrier

#### Features:

- Rigid construction
- · Completely welded unit
- · One year limited structural warranty
- Designed and engineered to protect your video equipment
- 21" wheelbase on 16" spoke wheels ball bearings
- · Easy to go up and down stairs
- · Padded shelves for your equipment
- · Room for tapes and batteries
- Convenient cable holders
- Camera plate drilled to accept 7900 Quickset elevator
- · Designed to ship U.P.S.
- F.O.B. Phoenix, Arizona
- Waterproof dust cover (optional)
- · Semi-pneumatic tires
- · Air-tires (optional)

Model 3300 - 4 shelf carrier



**Model 3300** Length: 18" - Width: 23" - Height: 45"



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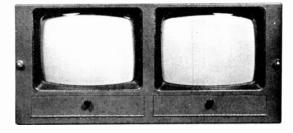
### 9" MONOCHROME VIDEO MONITOR





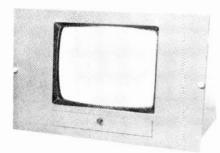
MODEL PMM-910

MODEL PMM-911



MODEL PMM-912

### 12" MONOCHROME VIDEO MONITOR



MODEL PMM-922





## Professional Quality PMM-900 Series Monochrome Monitors

#### **FEATURES:**

- Professional Quality
- 900 Line Resolution
- Modular Construction
- Underscan Option
- Cross Pulse Option
- Regulated Low and High Voltage

The Lenco PMM-900 Series Monochrome Monitors is the most advanced design of professional monochrome video monitors in the industry. The 900 Series monitor is a high resolution display device for use in broadcasting, industrial, and educational facilities where quality and reliability are most required.

The 100% modular chassis consists of five individually shielded circuit modules that plug in directly from the rear of the chassis. This unique and exclusive feature simplifies any required servicing allowing for a minimum of down time. The five plug-in modules are common to all the 900 Series monitors regardless of CRT size.

The PMM-900 Series Video Monitors are designed for continuous operation and to give stable pictures without adjustment. The regulated low and high voltage power supplies maintains constant picture size and brightness with line voltages between 105 and 130 volts AC (or 210 to 260 volts AC).

The Lenco PMM-900 Series monitors 900 line center resolution provides outstanding picture clarity which is necessary in most studio and educational facilities. This sharp, bright picture provides excellent viewing even under high ambient lighting conditions. This is extremely important to ensure full details when used in surveillance or observation systems.

Video response is down 3 DB at 20 MHz providing for 900 line center and 750 line corner resolution. Differential gain of the video amplifier is less than 5% for 50 volt kinescope drive. Size of the raster can be switched from the front to show all four sides and corners. Optional cross pulse features can be provided to display the sync signals in the picture area for analysis. DC restoration is standard and is switchable on the rear panel.

The PMM-900 Series Video Monitors meet or exceed all EIA RS-170 specifications and are compatible with 525/60 U.S. and 625/50 CCIR scan rates.

9" VIDEO MONITORS PMM-910 Chassis Only. \$699.00 PMM-911 Cabinet	
PMM-920 Chassis Only       \$725.00         PMM-921 Cabinet       799.00         PMM-922 Rack Mount       815.00         15" VIDEO MONITORS         PMM-930 Chassis Only       \$760.00         PMM-931 Cabinet       840.00	Chassis Only.       \$699.00         Cabinet       755.00         Dual 9" units, Rack Mount       1450.00         Rack Mount, Right Side Blank       775.00         Rack Mount, Left Side Blank       775.00         Rack Mount for Tek 529 or 1480 Right Side       775.00         Rack Mount for Tek 529 or 1480 Left Side       775.00         Rack Mount for Tek 528 on Right Side       795.00
PMM-930 Chassis Only \$760.00 PMM-931 Cabinet 840.00	Chassis Only \$725.00 Cabinet 799.00
FIGURE-502 FIGURE MODELLE	Chassis Only         \$760.00           Cabinet         840.00           Rack Mount         850.00
	Chassis Only \$840.00 Cabinet Only 935.00
23" VIDEO MONITORS PMM-950 Cabinet	Cabinet
PMM-002         15" Monitor Ceiling Mounting Kit         75.00           PMM-003         19" Monitor Ceiling Mounting Kit         75.00           PMM-004         23" Monitor Ceiling Mounting Kit         75.00           PMM-005         Pulse Cross         75.00	standard module)       \$40.00         15" Monitor Ceiling Mounting Kit       75.00         19" Monitor Ceiling Mounting Kit       75.00         23" Monitor Ceiling Mounting Kit       75.00         05       Pulse Cross       75.00



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### **Professional Quality** PMM-900 Series **Monochrome Monitors**

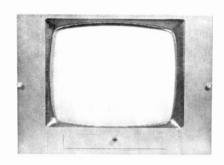
### 15" MONOCHROME VIDEO MONITOR



PMM-930



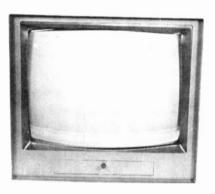
PMM-931



PMM-932

### 19" MONOCHROME VIDEO MONITOR

MODEL PMM-941



### 23" MONOCHROME VIDEO MONITOR



SPECIFICATIONS	
VIDEO INPUT:	
Level	ed
Level	ıh.
PERFORMANCE:	
Frequency Response1.25 dB at 15 MHz & -3 dB at 20 MH Differential Gain Less than 5% with 50 volts of kinescope driv Linearity Less than 2% of raster heigh Resolution 900 Lines Center, 750 Lines Corr Interlace Better than 29 Raster Size Regulation Less than 1% 0% to 100% AP Vertical Retrace Less than 1000 us	re nt ne %
Horizontal Retrace Less than 10u DC Restoration Switchable, Zero or 100% Back Porch Clar Discernable Grey Scale	S

System Standards	525/60 EIA, 625/50 CCIR. Exceeds RS-170 Specifications.
Voltage	75 Watts 120/240 volts AC at 50/60 Hz 5 to 130 volts, AC, 210 to 260 volts AC

Front Panel (under hinged cover)	. On-Off, H-Hold, V-Hold, Height, Contrast Brightness, Vertical Lin, Focus, Underscan
	Pulse Cross
Rear Panel	Horz Lin, Horz AFC, Vert Top Lin,
ENIVED ON MENTAL.	Horz Freq, 120 VDC Adj, 24 VDC Ad

ENVIRONMENTAL:	Hole Freq, 120 VDC Adj, 24 VDC Adj
Temperature	
Humidity	5% to 90%

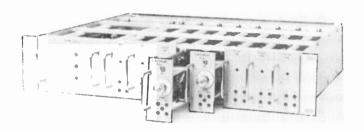
OPTIONS:				
Kinescopes	Etched a	nti-glare la	minated sa	fety shields
Pulse Cross Delay	Displays syr	c signals	in raster t	for analysis
Pulse input	Separate h	orizontal a	nd vertical	pulse input
		repla	acing comp	osite sync.

#### SAFETY: X-Radiation . . . . Complies with the HEW safety rules (42CFR. Part 78, applicable at time of manufacture Underwriters Lab... . . This monitor has been designed to meet or exceed U/L and CSA (Canadian Standards Association) engineering standards and requirements.



319 WEST MAIN ST. JACKSON, MISSOURI 63755 (314) 243-3147

### Modular Distribution Amplifier - Video, Pulse & Subcarrier

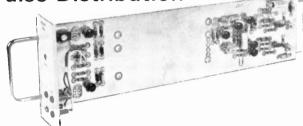


Lenco provides the most flexible family of distribution amplifiers available anywhere. The building block concept is used to provide for maximum flexibility and economy. You buy a basic video amplifier module and add "piggy back" boards to provide features such as: differential input, equalization, high gain and clamping. The pulse "D.A." is totally regenerative with its output fixed at 4 volts P.P. and width fixed equal to the incoming pulse at its 50% point. If delay is desired, add a "piggy back" delay board.

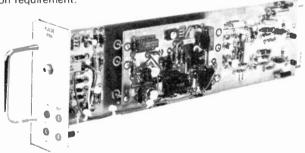
Each distribution amplifier has its own on board regulator which eliminates power supply crosstalk.

The PFM-100, eight module frame, houses a PPS-100 power supply
and any combination of eight D.A.'s\$385.00
<b>PPS-100</b> Power supply for PFM-100 frame
The PSF-200, four module frame, has a built in power supply, and
will house any combination of four D.A.'s \$400.00
PFM-001 100 Series Blank Panel - Single Width \$33.00
PFM-002 100 Series Blank Panel — Double Width \$38.50
PFM-010 100 Series Extender Board \$42.50

### **Pulse Distribution**



PPA-110 Regenerative Pulse Distribution Amplifier .... \$155.00 The PPA-110 is a basic regenerative pulse D.A. which can be adapted to a pulse delay D.A. with the addition of an accessory plugin circuit board. The PPA-110 is useful for any type of pulse distribution requirement.



PPA-111 Regenerative Pulse Delay Distribution

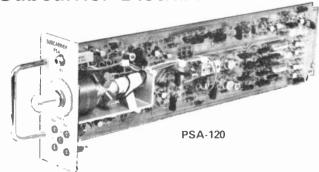
The PPA-111 is a PPA-110 Pulse Distribution Amplifier with the addition of a pulse delay circuit board. One control adjusts the total delay of both leading and training edges of the output pulse for maximum ease of adjustment. Minimum delay is 100 nanoseconds and maximum delay is 5.0 microseconds all with only one control. This amplifier can be strapped to provide two undelayed outputs and two delayed outputs. All other specifications are the same as the basic PPA-110 amplifier.



#### SPECIFICATIONS

Input Impedance:
Output: Four, 75 ohm source terminated
Input Level:
Output Level:
Output Pulse Width: Equal to the width of the input pulse at the 50% amplitude point.
Isolation between Outputs: Greater than 40 db
Tilt and Overshoots Less than 1.0%
Rise and Fall Time: 100 N Sec. $\pm$ 20°c
Delay:
Hum and Noise: Greater than -60 db
Temperature:0° C to 50° C ambient
Test Points:
Front Panel Controls:None
Internal Controls: None

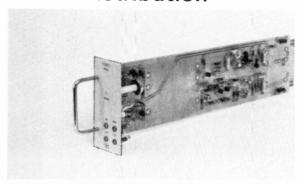
**Subcarrier Distribution** 





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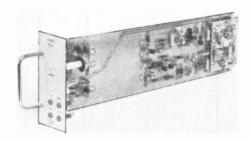
### Video Distribution



PVA-100 Basic Video Distribution Amplifier ...... The PVA-100 is a basic video distribution amplifier which can be adapted for expanded use. The PVA-100 specifications are common to all Lenco video distribution amplifiers.

#### **SPECIFICATIONS**

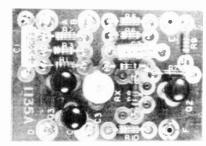
Input Impedance: Greater than 50K ohms, Less than 15 pf				
Output:Four, 75 ohms source terminated				
Input Level:				
Output Level:				
Isolation between Outputs: Greater than 40 db at 3.58 MHz				
Gain: ± 6 db				
Frequency Response: = 0.1 db to 8.0 MHz — 0.5 db at 15 MHz				
Tilt and Overshoots Less than 1.0° o				
Differential Gain: 0.1%, 10-90% APL 1.0 V.P.P. output				
Differential Phase:				
Hum and Noise:				
input and output				
Temperature:				
Test Points:				
Front Panel Controls: Gain ± 6 dB				
Internal Controls:Frequency response, Output DC offset				



PVA-101 Video Distribution Amplifier with Differential

tial input circuit board.

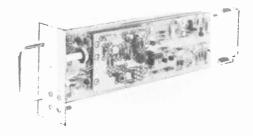
Features: Differential input, greater than 60 dB hum rejection; High gain, up to 20 dB additional gain; Equalization, up to 200 foot of coax. Input Level: 0.05 V.P.P. to 2.0 V.P.P. Gain: Up to 26 dB (internally preset). Internal Controls: Frequency response, equalization, DC offset.



1135A Differential Input "piggy back" board . . . . . \$40.00 When plugged into a PVA-100 D.A., will provide greater than 60 dB hum rejection, up to 20 dB additional gain, or equalization for up to 2000 feet of RG-11.



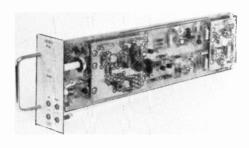
frequency by clamping the breezeway to a fixed potential, thereby eliminating any vertical tilt.



PVA-102 Video Distribution Amplifier with Breezeway 

The PVA-102 is a PVA-100 Video Distribution Amplifier with a breezeway clamp circuit board installed. The clamp circuit is extremely noise immune and restores the low frequency component of the video signal by establishing the breezeway and back porch at a fixed potential.

Color burst is not affected in either amplitude or phase. All specifications for the PVA-102 are the same as the basic PVA-100.



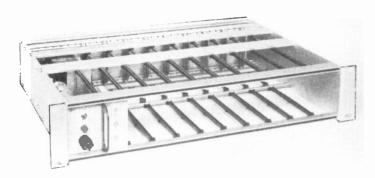
PVA-103 Video Distribution Amplifier with Differential breezeway clamp circuit board and D.A. input circuit board installed.



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### The 300 System



PFM-300 Frame and Power Supply . . . . . . . . . . . . . \$475.00

**Description**: The Model PFM-300 Frame is unlike any other system frame developed. Its unique engineering concept allows the PFN-300 to house any nine 300 System modules, in almost any system configuration, and in any frame position, without modification. This unique universal concept means that the PFM-300 is not dedicated to the original application, but can be added to, or changed to any other system configuration whenever it is desired.

The PFM-300 Frame is the heart of the 300 System and consists of a constant voltage transformer, the PPS-302 Power Supply, nine cells with connectors mounted on a 30 buss "mother" board and 72 BNC connectors mounted on the rear panel.

The constant voltage transformer supplies the PPS-302 Power Supply with 30 VAC  $\pm$  1% from any line voltage between 70 VAC to 150 VAC. The PPs-302 then feeds the power busses in the frame DC voltages of  $\pm$  15 and + 8 VDC. The individual system modules protect and regulate these voltages to  $\pm$  12 and + 5 VCD. The wide range of input voltages, an exclusive feature of Lenco, alleviates any concern about line surges, low input levels, or line "hits". Ideal for remote applications where power line levels are uncertain. The power cord is wired into the frame to prevent loss of the cord or the possibility of broken connectors.

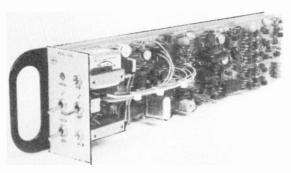
Another unique feature of the PFM-300 is that any module, placed in any position in the frame, is automatically fed the correct drives and/or signals. This is true for any additions or changes made at a later date. Frame rewiring or external looping of signals are almost never required.

The BNC connectors on the rear panel are mounted on an etched printed circuit board. This design concept allows for positive control of ground continuity and input isolation within each individual cell and also assures total isolation of grounds between cells. This prevents any chance of crosstalk or ground loops within the 300 System.

Height: 3½" (8.89 cm). Width: 19" (48.25 cm). Depth: 14" (35.56 cm). Weight: 11.25 lbs. (5.0625 kg).

#### ACCESSORIES

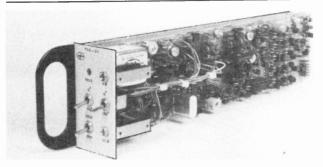
575.00 San Complete PEM 200 Frame \$75.00
PPS-302 Spare Power Supply for PFM-300 Frame \$75.00
PRI -305 300 Series Blank Panel — Single Width 25.00
PBL-306 300 Series Blank Panel — Double Width30.00
PEX-308 300 Series Extender Board
PEX-309 300 Series Extender for Double Width Units75.00



A temperature compensated crystal oscillator, operating at 14.318180 MHz provides the stable master frequency source from which all pulses and subcarrier are derived. Using digital dividing techniques, Subcarrier, as well as the Sync, Blanking, Horizontal and Vertical drive pulses, are produced virtually jitter free. All pulse widths and levels are fixed per EIA standards and cannot change. There are only three internal adjustments in the generator, subcarrier amplitude, lock range and vertical phase, which are set at the factory and seldom, if ever, require adjustment.

The Genlock circuit has a unique noise immunity circuit which makes the generator highly insensitive to noise or extreme changes in input levels. The incoming video is sensed by an extremely fast video presence detector, processed, and locks the generator automatically to the 50% point of the sync pulse. Genlock is accomplished within one second.

Other exclusive features include a clamped video feed, a field ident pulse is available if burst flag is not required, continuous adjustment of horizontal phase, instead of in 70 nS steps, vertical phase adjustable to two lines advance to compensate for enhancers, and three voltage regulators with current overload devices for power buss and module protection.



or other equipment that supplies unstable time base signals. The genlock circuit has been designed so that it will lock to either a helical RS-330 signal or a standard RS-170 signal. Not only will the genlock circuit follow any unstable time base signal, it will ignore the fact that information is missing during the head dropout period of a helical VTR. Unlike other helical genlock Sync Generators, the PSG-311 does not require a coherent burst input to achieve lock. The ultra-stable master frequence source from which all drives and subcarrier are derived is a temperature compensated crystal oscillator, operating at a frequency of 14.318180 MHz. Using digital dividing techniques, subcarrier and all drive pulses are generated virtually jitter free. There are only two internal adjustments, subcarrier amplitude and vertical phase. All pulse widths and levels are fixed within EIA standards and cannot be changed.

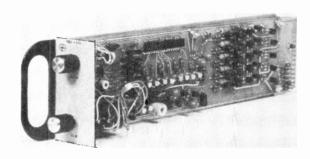
The PSG-311 offers exclusive features such as a strapping option to provide a frame ident pulse instead of burst flag, continuous adjustment of horizontal phase, instead of in 70 nS steps, and vertical phase that is adjustable from two and one-half lines delay to two and one-half lines advance, to compensate for in line enhancer delays.



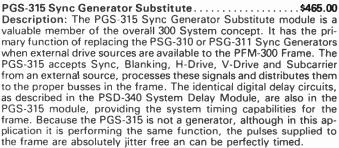
319 WEST MAIN ST. JACKSON, MISSOURI 63755

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### The 300 System

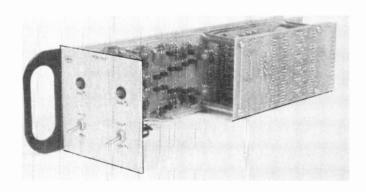


Features: Single Control System Timing / Provides System Flexibility / Jitter Free Pulse Distribution / Cost Saving Advantages.



The PGS-315 is identical to the PSD-340 System Delay Module, with the exception of the external connections. It has the ability to simultaneously delay the Sync, Blanking, H-Drive, V-Drive and Burst Flag up 1.5 uS with only one control knob. Burst Flag is generated and timed with respect to output sync and will follow sync as the composite delay control is adjusted. The burst position and width are adjustable, should system applications require it.

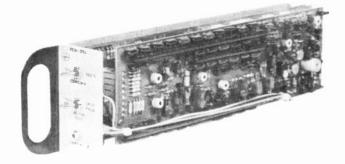
Subcarrier phasing is controlled by using a "push-pull" type switch and potentiometer combination, allowing over 180 degrees of phase adjustment on each position of the switch.



Features: Automatic or Manual Operation / Fail Safe Sensing Circuits / Complete Solid State Switching / Accepts External Generators / Senses All Inputs / LED Status Indicators.

The signals are switched by a diode gate, then fed to the frame and output connectors by an output amplifier to insure proper level and impedance. Solid state switching eliminates any possibility of relay "chatter", bounce, or dirty contacts as found in most relay type equipment. The digital sensing circuits are so accurate that the loss of any one pulse or the appearance of a non-coherent signal will either demand a switch or prevent one.

The PCO-317 has front panel switches to choose either automatic or manual control and to designate which generator is the primary source. The module is so designed that if both sources are lost, or if there is a loss of power, the module will revert to the designated primary source. Tri-state LED indicators indicate the condition of the two generators. The green light indicates that the generator is in service, while the red light indicates a failed source. When the secondary generator shows no light, it is indicating that the source is good and is in a standby condition, ready for service. A minor frame modification is required with the PCO-317, as well as external inputs from the second generator.



Features: RS-189-A, NTSC Standards / Alignment Test Signal / Composite Video Delay / Filtered I & Q Bandwidths / 75% or 100% Chroma Switch / Full Field Black Reference.

PCB-320 Encoded Color Bar Generator . . . . . . . . . . . . . \$825.00

Description: The PCB-320 Encoded Color Bar Generator is a precision Test signal generator engineered to conform to the EIA-RS-189-A and NTSC specifications. Reflecting the progressive concept of the 300 System, the PCB-320 includes the new SMPTE Alignment Color Bar Test Signal with chroma and black set signals. The encoder is a true NTSC standard as evidenced by the precise filtering of the I and Q channels shown by the waveform.

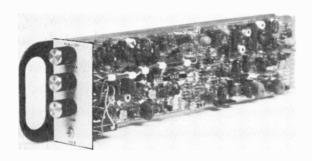
One of the exclusive features of the PCB-320 is the single control composite video delay circuit which, for the first time, allows system timing of test signals. Composite delay up to 1.5 uS is achieved, using the same techniques found in the PSD-340 System Delay module.



319 WEST MAIN ST. JACKSON, MISSOURI 63765

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### The 300 System



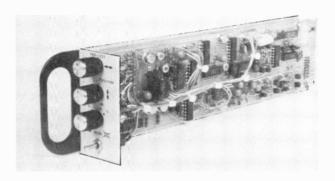
Features: Two Independent Generators / Composite System Delay / Optional Non-Composite Outputs / Two outputs Per Generator / Front Panel Color Control / Clamped Outputs.

The Black Burst section of the PBB-321 provides a "Color Black" video signal composed of composite sync, set-up, and color burst. This signal is used as the black input to switching systems, or may be used as a signal source to genlock remote sync generators to "House" sync.

The Color Background section produces a solid field of color and, when connected to the input of a special effects generator or video insert keyer, provides color backgrounds for titles and other inserts. A standard feature of all 300 System generators is a composite delay which provides for delaying the output signal up to 1.5 uS to assist in system timing.

Each generator has two clamped outputs with the option of either composite or non-composite signals. Burst phase is adjustable a full 360° by internal quadrant selector and front panel fine phase control. Front panel controls are also provided for luminance, hue, and chroma

All required input signals to the PBB-321 are supplied by the PFM-300 Frame.

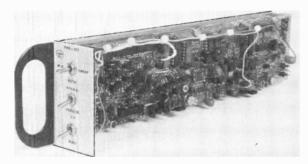


Features: Two Independent Generators / Composite System Delay Circuit / Optional Non-Composite Outputs / Exclusive Linearity Test Signal / Digital Safe Title Signal / Horizontal & Vertical Adjustments.

The Bar Dot Generator digitally produces EIA standard horizontal and vertical bars, cross hatch, and dot signals used in the testing for convergence of color monitors and camera sweep circuits. Horizontal and vertical position controls, plus pattern selection, are located on the front panel.

The Visual Reference Generator is a new exclusive production and technical aid, composed of digitally derived diagonal lines from corner to corner of picture blanking. It is the most severe test for linearity that can be performed on any monitor or CRT. The crossed diagonal lines identify the absolute electrical center of picture, no matter where it appears on the CRT. The other exclusive feature of the Visual Reference Generator is an adjustable rectangular shaped box that can be used to identify the "safe title" area or the usable area of the television screen. The output of the Visual Reference Generator section can be supplied as a non-composite signal and superimposed on the camera viewfinder to provide the camera safe viewing area and instant center of picture.

A single control "Composite Delay" feature provides for perfect system timing. The outputs of each generator section can be strapped for non-composite operation if desired. All required input signals and power are supplied by the PFM-300 Frame.

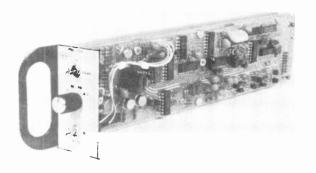


Features: EIA Multiburst Generator / Ultra-Stable Levels / Composite System Delay / 12 MHz Line Rate Sweep / Markers Every 2 MHz / Full or Reduced Amplitude.



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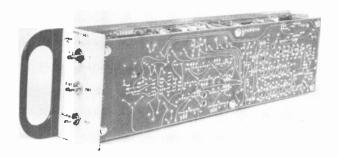




Front panel switches provide the choice between 5 or 10 step staircase, ramp signal, and APL levels of 10%, 50%, 90%, or bounce. A front panel switch is also provided for burst on-off and subcarrier on-off. Internal options include subcarrier in or out of phase with burst at either 20 or 40 IEEE units and standard or negative ramp

A composite system delay circuit for system timing is included as well as two composite or non-composite outputs.

Features: Complies with IEEE 206 Standards/ Optional Non-Composite Outputs / Composite System Delay / Exclusive Negative Ramp / True APL Bounce Test / Phase-Locked Subcarrier.



PPB-325 SIN<sup>2</sup> Pulse Window Generator ......\$825.00

**Description:** The Lenco Model PPB-325 Sin<sup>2</sup> Pulse Window Generator is another in the series of fine, precision, state of the art signal generators. Unique engineering and packaging techniques have provided the following nine precision test signals in a one module width plug-in unit: Modulated 12.5T & 20T, T, 2T, or T/2 pulses, window or bar signals and the exclusive "pluge" pulse. The PPB-325, with a combination of front panel switches and internal strapping options, can provide almost any combination of the nine signals. This feature was designed to allow the user to determine the proper test signals which are best suited for his particular system application.

The unique and exclusive Pluge pulse (picture line-up generator) is provided to adjust for monitor black level reference. The  $\pm$  2.5 IRE unit pulse at blanking should be used to assure proper monitor brightness and contrast adjustments.

The modulation of the 12.5T and the 20T pulses is phase locked to the input subcarrier and shifted in phase at the vertical rate. Pulse shaping of the T, 2T, and the T/2 pulses is derived by the use of 7 pole Thompson filters. This type of filter, commonly found in high quality precision test equipment, assures flat delay over a wide bandpass providing pulses with symmetrical and smooth responses with a minimum of overshoot, closely approximating a true Sin² pulse.

An exclusive feature of the PPB-325 is the "Line Alternate Switch". Lenco is providing this feature to allow the pulses to be placed under the window signal on alternate lines for instant system evaluation, using any existing waveform monitor.

Composite video delay, standard in all the 300 System test signal generators, is provided to allow up to 1.5 uS delay for system timing, along with the strapping option of composite or non-composite output signals.

Features: Nine Different Test Signals / Exclusive Pluge Pulse / 7 Pole Thompson Filters / Alternate Line Pulse Selector / Composite System Delay / Composite or Non-Composite Outputs



Features: Eliminates System Timing Problems / Replaces External Delay Devices / Provides System Flexibility / Single Control System Timing / Obsoletes Pulse D.A.s. / Obsoletes Subcarrier D.A.s.

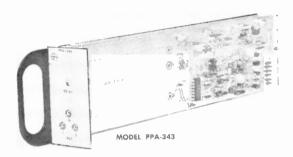
The PSD-340 receives sync, blanking, H and V drive plus subcarrier from the PFM Frame. The signals are then converted into digital information and sent to a unique digital delay circuit. This circuit has the ability to simultaneously delay the sync, burst flag, blanking, h and v drive pulses up to 1.5 uS, with only one control knob. The pulses are then converted back to analog signals, processed, and distributed to the proper output connectors on the frame. During the TTL logic sequence, the burst flag is generated and timed with respect to output sync. The burst position and width can be adjusted by internal controls to match system requirements.

The subcarrier is controlled by a unique phasing circuit, using a zero cross technique. Phasing is accomplished by using a "push-pull" switch and potentiometer combination. Over 180° of phase adjustment can be achieved on each position of the switch.

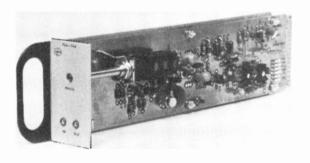


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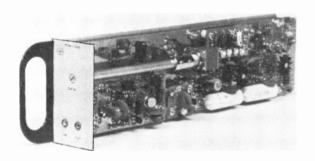
### The 300 System



Features: Regenerates Pulses / Input Noise Immunity / Optional Delay Assembly / Six Source Terminated Outputs / Sin<sup>2</sup> Waveshaping / Internal or External Input.



Features: Regenerated Subcarrier / Full 360° Phase Adjustment / Low Harmonic Distortion / Internal Input Option / Six Source Terminated Outputs / Excellent Stability.



Features: Differential Input Provided / 15 MHz Band Width / Low Distortion / Six Outputs / Automatic DC Offset Control / Versatile Ontions.

- p		
Option 1	Feedback Clamp Assembly	\$75.00
Option 2	Cable Equalizer Assembly	65.00
Option 3	Sync Adding Assembly	35.00

The PPA-343 is a precision device and represents the latest in the art of regenerative pulse amplifiers. Using the incoming pulse for timing only, the logic circuitry samples the 50% point to determine its width. The PPA-343 then regenerates a matching pulse that is clean, distortion free, and conforms exactly to the input pulse parameters. This method allows the PPA-343 to be impervious to input level changes, noise, or degraded input pulses.

An optional pulse delay assembly may be added to the module to provide a pulse delay of up to 5 microseconds. A strapping option on the module allows the choice of delaying either three or all six of the

The PPA-343 has two identical and independent output amplifiers, each feeding three outputs. The output levels are fixed at 4 volts p-p. A unique input straping option allows the module the choice of any of the five pulses to be fed internally from the PFM-300 Frame. This eliminates the need for external cables to feed the input of the unit. Should the frame be used as a distribution frame only, looping high impedance external inputs are also provided.

Option 1 Pulse Delay Assembly for PPA-343 (1137A) .... \$85.00

cuitry provides a pure, distortion free 3.58 MHz sine wave. The PSA-346 uses a zero cross timing technique in its design which provides a superior output signal with virtually no harmonic distortion and excellent stability. The advantage of this technique is that the amplifier becomes impervious to input noise, distortion, or level change. The PSA-346 offers six source terminated outputs whose phase is controlled by one front panel adjustment. This one control proides a full 360° of phase adjustment with a smooth, high resolution vernier potentiometer. The output levels are fixed at two volts peak to peak, but the PSA-346 does provide an internal adjustment which will vary the output level as much as ± 3 dB if required.

The PSA-346 also provides an internal strapping option which will allow the module to receive an input signal directly from the PFM-300 Frame. This, of course, eliminates the necessity of external cabling to the amplifier. Should the subcarrier signal to be distributed come from another source other than the PFM-300 Frame, high impedance looping input connectors are available.

The PVA-350 is flat to 15 MHz, has a unique automatic DC offset control, and offers low noise, excellent stability, and virtually no distortion. A differential amplifier on the input is standard in the PVA-350, and provides 70 dB of common mode rejection.

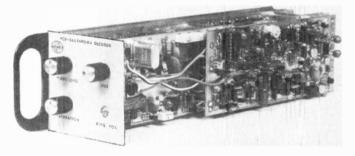
The versatility of the PVA-350 is illustrated by its choice of optional assemblies. Any or all of the optional assemblies can be attached to the amplifier without adding or removing straps or wire connections. The Option 1 Clamp Assembly is a feedback type clamp which is impervious to noise or extreme input level variations. It will maintain its clamp even when used with helical VTRs or other equipment which presents unstable time base signals. Up to 35 dB of clamping can be achieved.

The Option 2 Equalizer Assembly is a unity gain device providing up to 10.5 dB of equalization at 10 MHz. Exclusive variable adjustments for the low, mid and high frequency range will match any individual cable characteristic. No additional components are ever required.

cable characteristic. No additional components are ever required. The Option 3 Sync Add Assembly is designed to provide sync adding capabilities to the PVA-350 when required. Sync signals are automatically supplied to the PVA-350 from the PFM-300 Frame. Proper levels are maintained by a level control on the assembly.



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Features: 10 MHz Luminance Bandwidth / Comb Filter Separation / Optional Non-Composite Outputs / Superior Quality Decoding / Internal Genlock Sync Generator / Clamped, DC Coupled Outputs

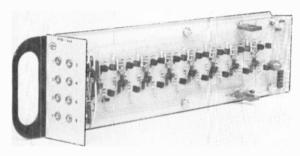
The PCD-363 Chroma Decoder exemplifies the unique engineering concept of the 300 System. A full combed filtered Chroma Decoder, with a full Genlock sync generator can now be supplied in a two module width plug-in device. Four PCD-363 Chroma Decoders can be mounted in one PFM-300 Frame, each operating independently from each other. The PCD-363 Chroma Decoder is especially valuable for color kine recording, large screen display, chroma

keying, or other uses where RGB signals are required from a composite NTSC color source.

The Input to the PCD-363 can either be standard NTSC RS-170 video or from any helical tape machine or other source which may show an unstable time base error. The internal genlock sync generator has a subcarrier lock in range of  $\pm$  150 Hz and shows a pulse jitter of less than 5 nS. Regenerated blanking and sync widths are fixed and can not change or be misadjusted. The genlock circuit has a unique noise immunity circuit which makes the generator highly insensitive to noise or extreme changes of video input levels.

The PCD-363, utilizing a two line comb filter separation technique, removes the chrominance from the luminance effectively without detectable distortion of the luminance channel. Thus, the PCD-363 is able to offer a luminance bandpass of at least 10 MHz. The wide luminance bandwidth and the superior transit response results in an extremely clean and noise free video signal. Color crawl is all but eliminated by the comb filter. The unique independent preset phase and color difference gain controls are provided to permit compensation for the various phosphor characteristics of differenc CRTs. The quality and the resolution of the decoded output signals of the PCD-363 is far superior to any other decoding device yet offered.

A regenerated composite sync output is provided along with the composite or noncomposite RGB signals. An optional second set of RGB outputs are also available on request.



Features: Eight Individual Amplifiers / Unique Routing Amplifier / 8 MHz Bandwidth / Unlimited System Applications / Pulse, Video or Subcarrier Distribution / Unity Gain.

 each having one input and one output with unity gain. Each amplifier can supply either subcarrier, drive pulses, or video signals as system applications require.

The design concept of the PFO-364 was that, no matter how carefully any system is designed, the need for "one more output" always arises. With the use of the PFO-364 there is no need to revert to the use of an extra standard type pulse or video D.A. with three to five outputs that are not needed. The PFO-364 can provide that one extra output...eight times.

Referring to the system concept of the PFM-300 Frame, there are sixteen possible signals in the frame available to the inputs of the PFO-364 unit. The number and type of signals, of course, depend on the number and types of units that are mounted in the frame. On the PFO-364 card there is a strapping option that allows the selection of any one of the sixteen signal sources to any, or all, of the inputs of the eight amplifiers.

Each amplifier cell is a unity gain, DC coupled device with a high impedance input and a source terminated 75 ohm output. The 8 MHz band width and unity gain features make the PFO-364 a truly universal pulse, video, or subcarrier routing amplifier. A high degree of isolation between the individual amplifier cells has been engineered in the unit to make crosstalk virtually non-existent.



**Features:** Fast, Easy to Use / Reliable / Built-in Calibration / Accuracy to  $\pm$  0.5 dB / CCIR-EIA Standards / Portable, Compact

VNM-428 Video Noise Meter ......\$1550.00

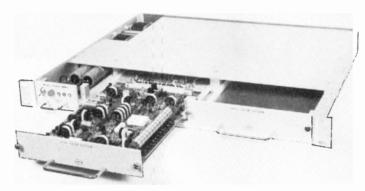
The Lenco Model VNM-428 Video Noise Meter is a newly developed, patented device which utilizes a different principle of operation than any other instrument now in use. The VNM-428 was designed specifically for the video signal-to-noise measurement requirements of TV studios, CATV, and microwave system users where portability, simplicity of operation, and accurate measurements are desired.

A major feature of the VNM-428 is the in-service capability of making accurate, real time signal-to-noise measurements even on live off the air signals. The VNM-428 is small, rugged, stable, and has a built-in calibrator that insures accuracy of  $\pm~0.5~\rm dB$  throughout the range of 20 dB to 55 dB. The signal-to-noise ratio is shown directly on a large LED display and is calibrated to EIA standards.

The Model VNM-428 employs the tangential noise measurement technique and overcomes the problems traditionally associated with the oscilloscope measurement of Gaussian noise in video waveforms. A variable and calibrated square wave is added to the waveform under test which results in the display appearing as two identical waveforms, one on top of the other, at a distance equal to the amplitude of the square wave. The VNM-428 measurement technique allows the noise on a signal to be compared with itself; thus, as the square wave is reduced, displaying a single trace, the square wave becomes equal to twice the RMS noise voltage of the signal. The amplitude of the square wave is measured, converted to a logarithmic potential (referenced to the peak-to-peak signal) and displayed on the digital panel meter as the signal-to-noise in decibels.



319 WEST MAIN ST. JACKSON, MISSOURI 63755 (314) 243-3147



Features: Four Channal Operation / Exceptional Long Term Stability / In-Service Access / Horizontal Aperature Correction / Internal Color Bar Generator / Non-Interacting Controls

#### 

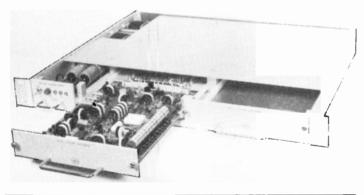
The CEC-822 was designed to meet the growing requirements for a high quality, stable, and trouble free four channel color encoder as a replacement for the older type encoders used in cameras and film chains. The CEC-822 is designed so that two CEC-812 Encoders will mount in one 1¾" rack frame operating independently with a common power supply.

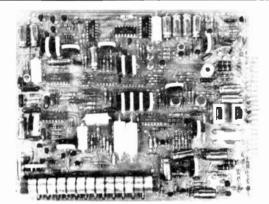
The CEC-822 produces an encoded video signal that meets all applicable EIA and NTSC standards. The CEC-822 has its own color bar generator for alignment of all parameters, including burst phase amplitude, I/Q quadrature and gain, chrominance to luminance ratio, and sync set-up. Horizontal aperature correction is also provided, using the "contours out of green" technique. The green tie switch, which is used for white and black balance, can also be used for monochrome operation in the event of a failure of either the red or blue tube of the camera.

The frequency response of the luminance channel is effectively flat to 7 MHz and down 3 dB at 10 MHz and provides aperature correction (boost) up to 10 dB at 2.9 MHz. Aperature correction is level dependent to provide enhancement proportional to the luminance level. An optional subcarrier (3.58 MHz) notch filter permits the user to reduce moire effects in the luminance channel by as much as 12 dB. System chrominance phasing can be adjusted through a full 360° and burst position, width, phase and amplitude are all independently adjustable.

Extensive care has been taken in the design of the CEC-822 Encoder to prevent any instability due to temperature variances or power supply crosstalk. Complementary symmetry, using transistor array integrated circuits, are used whenever temperature differentials could cause non-linearity between transistors. This technique is employed to insure minimum drift either with temperature or line voltage variations or component aging. Power supply crosstalk is minimized by isolating the negative and positive power supplies into five separate supplies each. The end result of these various stability techniques is an encoder that will maintain its specifications over an extended duration.

CEC-812 NTSC Color Encoder w/Color Bar	
Generator (RGBY)	\$ 995.00
PFM-802 Dual Encoder Frame w/Power Supply	
for CEC-812	470.00





Features: Replaces R-Y, B-Y Encoders / Horizontal Aperture Correction / Non-Interacting Controls / Internal NTSC Color Bars / 360° Chrominance Phasing / Temperature Stabilized.

#### 

The CEC-811 consists of a CEC-810 encoder and a PFM-801 rack frame. The CEC-811 is a stand alone encoder for use with any three tube color camera or RGB device. There are provisions in the encoder frame for a second CEC-810 encoder which would be totally independent. Inputs to the encoder frame are: red, blue and green video, sync, blanking, and subcarrier.

Description: The CEC-810 is a complete NTSC color encoder with a built in bar generator. Stability is maintained by the generous use of multiple transistor "IC" which insure matched characteristics. A green tie switch is provided to simplify balancing or allow for monochrome operation. Horizontal aperature correction is also provided, using the "contours out of green" technique. A level dependance control is provided in the aperture correction circuit to improve the signal to noise in the black region.

System chrominance phasing can be adjusted through a full 360° and burst position, width, phase and amplitude are all independently adjustable. A 3.58 MHz notch filter is provided with an adjustable depth of from 1 to 12 dB.

Two CEC-810s can be housed in a PFM-801 mounting frame which provides the power supplies and necessary interconnections, or the encoder can be plugged into an IVC 90 or 150 camera. The CEC-810 is a direct replacement for the R-Y, B-Y encoder shipped as standard equipment by IVC. If the CEC-810 encoder is used with the CSG-720 sync generator, an IVC 90 or 150 camera can be made completely self contained for remote operation.

#### ACCESSORIES:

ACCESSURIES:
PFM-801 Frame mount and power supply, with
provision for two CEC-810s\$460.00
CSG-720 Color sync generator for IVC Model 90 or
150 cameras
CXO- 815 3.58 Subcarrier Oscillator Assembly (for use
where external subcarrier is not available) 175.00



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### **MODEL VP-1**

The VP-1 is a device which will sample the signal on its "A" input and determine if true video is present. Loss of video or signal degradation beyond preset limits will cause the sensor circuit to activate a relay and connect the "B" input through to the output. When the "A" signal returns, the VP-1 will switch back to the "A" input. A set of form "C" contacts are provided for external equipment control or alarm. This device fincs application where it is desired to control remote equipment with the presence of video. Transmission systems will also find use for this device to protect against the loss of a video signal.



### **MODEL CSL-710**

Model CSL-710 Color Sync Generator with Gen-lock .. \$985.00 The CSL-710 is a digital color sync generator with gen-lock. It will gen-lock to either a standard video signal or a helical VTR. Internal circuitry automatically compensates for video and chroma level variations. Automatic circuitry is also provided to select the proper operating mode to make the CSL-710 virtually fool proof. All pulse amplitudes and width are fixed at E.I.A. values. The CSL-710 provides two isolated outputs for each pulse, a looping video input and front panel adjustments for phasing, subcarrier, horizontal and vertical timing.

### Two Year Warranty

Lenco, Inc., Electronics Division, guarantees this equipment to meet its specifications, be free from defects in workmanship, and to be free from manufacturing defects. Lenco, Inc., Electronics Division, will repair or replace at no charge any defective product for a period of two years from date of shipment. This warranty assumes that the equipment has been used under normal operating conditions and does not apply to any product or part thereof, which has been subject to misuse, neglect, improper

installation, modification or accidental damage. Units that fail under conditions other than those covered above will be repaired on a cost of components, plus labor basis.

Freight charges on all equipment returned to Lenco, Inc., Electronics Division, for warranty service will be accepted by Lenco, Inc., Electronics Division, for surface freight only. Return freight charges will also be paid by Lenco, Inc., Electronics Division.

### LISTEC TELEVISION EQUIPMENT CORP.

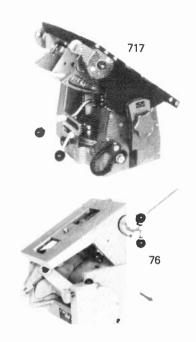
39 Cain Drive, Plainview, N.Y. 11803 (516) 694-8963

### PAN & TILT HEADS

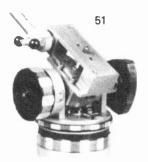


The Vinten Mark 3A Cam Head has long been established as the Broadcast Industry standard. Only the slighest touch is required to pan and tilt the Mark 3A fitted with the heaviest and most awkward loads. Improved friction controls provide finely adjustable pan and tilt drag with no backlash. Vinten's attention to close tolerances and highest quality workmanship yield silk smooth and long lasting performance. Cam sizes and adaptor plates are available to suit all camera load configurations.

The Mark 5 Cam Head offers all the quality and dependability of the Mark 3A in a smaller package. Its 60 degree tilt angle provides the cameraman with great flexibility and its light weight makes it easily transportable for field use. A perfect match for the new lightweight studio cameras, the Mark 5 head has the same effortless feel and robust construction as its larger counterpart.



ALL PAN & TILT HEADS FEATURE CONSTRUC-TION OF STAINLESS STEEL AND ALUMINUM AND MAGNESIUM ALLOY CASTINGS



The Mark 2 Type 76 Petrel Pan & Tilt Head now incorporates the Vinten Lubricated Friction System in both pan and tilt operations, providing smooth control for the most difficult camera movements.

The use of L.F. (lubricated friction) gives an extremely smooth action to both pan and tilt movements at all settings from zero to full drag. The Mark 2 Petrel embodies this new feature with only a marginal increase in basic weight.

For the new breed of lightweight, portable cameras Vinten offers the Model 51 Fluid Head. Features include exceptionally smoothe and variable torque, a quick release friction override and an externally adjustable vertical center of gravity compensator. Changing springs is not necessary when the camera load is changed. ENG and EFP cameramen favor the head's light weight and superior performance.

SPECIFICA	TIONS	Capacity	Tilt Range	Weight	Adjustment for Vertical Center of Gravity	Adjustment for Horizontal Center of Gravity	3/8" Bolt Fixing
MARK 3A	717	500 lbs.	50°	44 lbs.	5"-11" Cams (1" increments)	2¼" continuous	std.
MARK 5	716	165 lbs.	60°	22 lbs.	3"-8" Cams (1" increments)	2¼" continuous	std.
MARK 2	76	100 lbs.	40°	15 ½ lbs.	2"-71/2" continuous	4" continuous	std.
FLUID	51	50 lbs.	60°	9 lbs.	1"-9" continuous	4" continuous	std.

<sup>\*</sup>At 4 inch center of gravity





	Ltwt.	Std.		Tracking	¾ Elevation
TRIPOD	Combo.	Tripod	¾ Tripod	Dolly	Unit
SPECIFICATIONS	3063	718	739	719	737
Load Capacity:	100 lbs.	200 lbs.	200 lbs.	250 lbs.	200 lbs.
Height Range:	24-72''	27-53½′′	22-34"	9''	7-23''
Weight: 38lbs.	(Tripod,Dolly & Elevation Unit)	26 lbs.	26 lbs.	23 lbs.	20 lbs.
Wheel Diameter:	5′′			5′′	

(Cor	LIGHTWEIGHT TRIPODS  mplete with Pro Junior or Mitchell Adaptor)		HEAVY DUTY TRIPODS (Complete with Mitchell Adaptor)
3063 (	Combination Tripod/Elevation	718	Standard Tripod with Stabilizer \$1,000.00
(	Unit/Dolly	739	Three-Quarter Tripod with Stabilizer970.00
3061	Tripod475.00	719	Dolly with Wheel Tracking
3062 E	Elevation Unit	699	Elevation Unit (30" rise)
3060	Dolly	737	Elevation Unit (22" rise)

Prices and specifications subject to change without notice



#### LISTEC TELEVISION EQUIPMENT CORP.

39 Cain Drive, Plainview, N.Y. 11803 (516) 694-8963

### STUDIO PEDESTALS



The top of the line Fulmar Pneumatic Pedestal's extremely smooth and quiet motions through the lowest and widest range have earned it the Guild of Television Cameramen's Award. Fingertip control, unsurpassed stability and heavy weight capacity make the Fulmar indispensible to the discriminating producer/broadcaster.

#### **FULMAR 702**

Capacity								.350 lbs.
Range								21-59′′
Minimum	١	۸	/i·	d	tl	٦		34′′
Weight								.330 lbs.

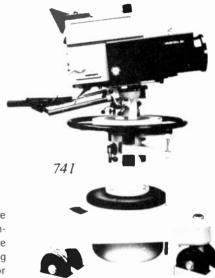
\$10,500.00

#### FEATURES COMMON TO ALL VINTEN PEDESTALS

- Single Ring Steering/Elevation Control
- Crab and Tricycle Steering
- Adjustable Cable Guards
- 3 Pairs of Wheels each with 2 Ballraces
- Adjustable Friction and Brake Controls

## FEATURES COMMON TO 702 AND 741 PEDESTALS

- Trim Weights and Tray
- Low Pressure/Large Tank Pneumatic System
- Aluminum and Magnesium Castings/Welded Stainless Steel Construction
- Adjustable Column Ballraces for Vertical Rigidity
- Pneumatic System Pressure Gauge (702 only)



TERN 741 same effortless and sn ning Fulmar pedestal. studio requiring a to older and bulkier ped

The Tern Pneumatic Standard Studio Pedestal shares the same effortless and smooth performance as the award winning Fulmar pedestal. The Tern is the ideal choice for the studio requiring a top quality pedestal or for upgrading older and bulkier pedestals at modest cost. (See below for a complete list of features)

## PORTABLE PEDESTALS



Easy to set up in the most awkward surroundings, the PortaPed will pneumatically counterbalance loads up to 100 lbs. The PortaPed's self-leveling action allows easy set-ups on escalators, bleachers or uneven terrain. Even with its built-in air pump (no external charging apparatus is required) the PortaPed is lightweight and quickly foldable. Put it on its optional castoring, folding dolly or folding/crabbing/tracking dolly and you have fingertip booming on location.

#### **PORTAPED 56**

Capacity Range			10	0 lbs: 7-55°
Minimum	W	idth		28'
Weight			3	0 lbs

\$3,250.00





#### LISTEC TELEVISION EQUIPMENT CORP.

39 Cain Drive, Plainview, N.Y. 11803 (516) 694-8963

### **DIGIVISION**

#### MONITOR PROMPTING SYSTEMS

The Digivision Prompting System consists of a lightweight, (14 lbs.) \*12", professionally engineered, black and white monitor for below the lens positioning, complete with monitor, hood and semitransparent high quality mirror (equivalent to 85% transmission). Both units are encased in a virtually non-destructible lightweight plastic molding. Total weight of the monitor, hood and mirror assembly is only 22 lbs., the lightest in the industry.

The monitor, hood and mirror assembly is attached to the pan and tilt head by means of two adjustable length support rods. There are absolutely no connections necessary to the television camera and all centering and positioning is undertaken using sliding brackets. The attachment of the monitor and hood assembly to the support rods takes less than ten seconds, also by far the fastest assembly to date. In the case of all Vinten cam heads complete with wedge adaptors, there is no other hardware involved. With respect to other makes of cam heads, a sandwich plate is positioned initially between the television camera and cam head. This plate accepts the Digivision support rods and need not be removed if the system is not utilized.

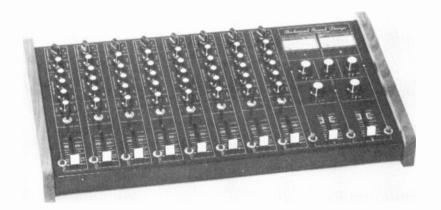
\* 17" available upon request



12" Digivision Monitor Prompting System attached directly to Vinten Cam Head.

## Richmond Sound Design

## MODEL M82B BROADCAST AUDIO CONTROL CONSOLE



#### **FEATURES**

- Production and On Air Capabilities
- State-Of-The-Art Transformless Inputs
- Full Equalization Facilities
- Complete Monitoring Facilities

#### **APPLICATIONS**

- · Production and Recording
- On-Air Audio Control
- · Re-Recording, mixing and processing
- Remote Audio Control

#### M82B Input Facilities

- Professional XLR type microphone input connector
- Professional telephone patch bay type line input connectors
   Tip-ring-sleeve line level send-receive channel access jack
- Calibrated Attenuation switch selecting mic input on 0, 10, &
- 20, tine inputs on A & B positions, respectively
   Foldback level: foldback signal is derived from each input pre EQ to minimize accidental feedback or changes in foldback.
- quality as EQ is adjusted for main mix.

  High, Mid, and Low Equalization has wide adjustment range,
- continuously variable boost/cut, active filter design

  Echo Send Level: echo send signal is derived post EQ & fader
- and may be used as an auxiliary monitor or foldback channel
- Toggle selector provides exclusive or combination output assignment capabilities
- Environmentally sealed straight-line fader
- Cue button provides both post EQ/pre fader listen and monitor/meter solo function, muting normal output monitoring and metering without affecting main mixes or creating pops

#### Output

- Illuminated professional specification VU meters switchable to any input or output channel
- Echo Returns are pre master faders with individual level controls
- Sealed straight-line master faders, normal position 15dB below maximum
- Master Foldback level control
- Dual concentric master Monitor level controls
- Master Echo Send level control
- Mechanical light-reflecting Cue bottoms for operator monitoring and metering of Foldback mix, Air (playback) signal, or Echo Send mix
- Separate phone jacks for Foldback and Echo Send outputs
- Tip-ring-sleeve two channel echo return jack
- Separate tip-ring-sleeve jacks for line out/air return (play-back); channels 1 & 2
- Tip-ring-sleeve two channel Monitor jack will drive headphones directly or feed line levels to monitor amplifiers

specifications subject to change without notice

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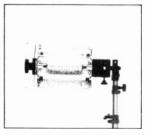
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## location lighting equipment



#### tota-light

The Lowel Tota-light uses 1000, 750 and 500 watt tungsten halogen lamps at 120 volts, and an 800 watt lamp at 220/240 volts The Tota-light is exceptionally compact and delivers extraordinarily wide angle yet efficient illumination One unit can provide very even coverage of four walls from the corner of a room. Totalights adjustable reflecting doors can concentrate light in a horizontal pattern, they can compensate for normal fall-off when lighting from an angle Tota-light is a semihard source and with its efficient umbrella-a small softlight. The gel frame and umbrella lock into

Tota-light mounts on standard 5/8" and smaller studs. By attaching it to the tota-mount, the unit fits securely atop open and closed doors, and gaffer-tapes on walls and windows [t] weighs 22 ounces [ 0.6 kgs ] without cable



#### omni-light

The Lowel Omni-light uses 650, 600 and 420 watt tungsten halogen lamps at 120 volts, a 650 watt lamp at 220/240 volts, and a 250 watt lamp for 30 volt battery operation. Omni-light is a focussing unit with smooth beam patterns. Its spot/flood range is unprecedented—as much as 11:1.

Omni-light has its own accessory system, and also uses many of the Tota-light's components. Omni-light changes in seconds from a hard light into a semi-soft source; or into an umbrella-soft light A responsive thumb operated focus control allows one hand operation.

Omni-light can be stand or camera mounted, and hand held for news work. With the tota-mount accessory it gaffer-tapes to walls and windows and hangs atop doors. Omni-light weighs 27 ounces [ 0.8 kgs ] without cable.



#### d light

The Lowel D light uses 1000, 750 and 500 watt tungsten halogen lamps at 120 volts; and 1000 watts at 220/240 volts The light has a 7 1 focussing range with a smooth transition between its flood and spot positions. In seconds you can replace the standard reflector with a non-focussing super-spot reflector, to make the D light an exceptionally long throw instrument

The D light's modular barndoor/ accessory system includes various scrims, dichroic, diffusion and safety glass components

The D light has a constant-tension tilt system (like all other Lowel equipment). This allows fast, convenient, one-handed tilting. The light fits standard 5/8" (and smaller) studs. It weighs 3 pounds 8 ounces [ 1.6 kgs.] with built-in cable.



#### softlight

The Lowel Softlight 1500 uses either two 750 watt, or two 500 watt tungsten halogen lamps at 120 volts At 220/240 volts, it accepts apair of 800 watt lamps The Lowel Softlight provides large-source, indirect illumination characterized by soft shadows and highlights. It is brighter than many 2000 watt conventional units. Yet it requires only 12½ amps at 120 volts, so it can be plugged directly into a wall outlet.

Accessory barndoors on the Lowel Softlight control lens flare and give subtle shading of light. The reflective shell will not scorch or discolor The frame folds up for storage and travel. The Lowel Softlight 1500 weighs 6 pounds 14 ounces [ 3 2 kgs ] with cable

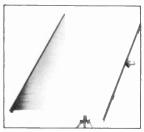


### lowel-light

The Lowel-light uses standard reflector flood and spot lamps, to a maximum of 500 watts. Its light-weight, compact size and unique mounting methods make it ideal for concealment within a scene.

The Lowel-light clamps to pipes and stands with its notch-and chain fastening. The strong, resilient baseplate wedges into crevices, may be nailed or gaffer-taped to many surfaces. The Lowel-lightweighsonly 10 ounces [ 0 3 kgs ] with its built in cable.

The Lowel-light barndoor slips on R-40 size lamps without the use of tools. It folds flat on removal. Made of aircraft alloy aluminum, it weighs only 7 ounces [ 0.2 kgs ]



#### variflector

The Lowel Variflector II is a sun and artificial light reflector which stores (with stand) in a compact tube. It has adjustable brightness and spread control. A finger operated lever provides a 3:1 flood range. It can reduce power requirements indoors by reflecting an existing source back onto the subject. The reflecting element is tough, washable, aluminized mylar, embossed with a patterned surface that gives a bright, smooth light pattern. This flexible sheet is backed with stiff aircraft aluminum slats which roll neatly for storage.

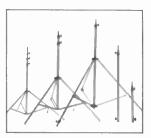
Variflector II has a sturdy, wide based, leveling stand for field use. The unit sets up quickly. Side channels open wide and clamp to the reflector panel. The channels lock to the crossbar, which mounts on a 5/8" stud. The unit can pan, tilt and rotate diagonally.



#### link

The Lowel-link system is our functional approach to the problems of oversized, over-specialized grip equipment. It consists of just a few basic components which link together in many extremely useful ways. They interlock without tools. They make rugged floor-to-ceiling poles, booms, sun diffusers, seemless paper supports, and many other devices.

These Lowel-link components are sturdy in use but disassemble for compact storage. While the system was designed with location work in mind, some of it has proven itself very useful in studios as well.



#### stands

Lowel stands and poles have a high strength-to-weight ratio They open and close easily, yet lock securely Each is made of thick wall, aluminum alloy tubing and has standard 5/8" studs. Reliable collar-clamping is used on all sections. Leg geometry has been designed to let you use stands close to one another

The Omni-stand is intended for the Tota-light and Omni-light. The Link-stand is ideal for the D light, softlight and link components. The variflector stand is compatible with the Vari-flector, or with lights and rigs which need extra-wide-base stability. Its adjustable leg allows levelling for uneven surfaces. The Full pole and Half pole serve many functions in the Link system. They also extend the Link and Variflector stands to unusual heights.



Lowel-Light Manufacturing Inc. 421 West 54th St., N.Y., N.Y. 10019 212 245-6744 Telex: 666597UW. West Coast: 3407 W. Olive Ave., Burbank, Calif. 91505. 213 846-7740

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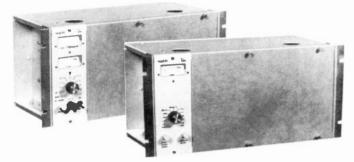
## MARTI Electronics, Inc.

P.O. Box 661 • 1501 N. Main • Cleburne, Texas 76031 • 817/645-9163

#### **AURAL STUDIO-TRANSMITTER LINK**

SOLID-STATE AM-FM, MONO-STEREO, INTER-CITY RELAY 950 MHZ.

- ★ Direct FM Modulator
- ★ All Solid-State
- ★ Field Proven Varactor Final
- ★ Plug-in Modular Construction
- \* Solid-State Ovens and Hi-Accuracy Crystals
- \* RF Sensing for "Out of Status" Alarm Indication
- ★ Current Limiting in Regulated Power Supply



Frequency Response: 0.5 db. from 30 Hz to 15,000 Hz.

Distortion: 0.5% or less, 40 Hz to 15,000 Hz.

Signal To Noise: -66 db. or better. Ref. 400 Hz. Mod. 100%

Carrier Frequency Stability: ± .0005%.

Temperature Range: -20 Degree C to +60 Degree C

## RMC-20 Digital Remote Control



Features: Fully digital command telemetry (FSK) • Single push-button channel select • Telemetry accuracy 0.1% for directional antenna monitoring. RMC-20S does not require operator to calibrate each time data taken • Channel capacity 5, 10, 15 or 20 channels • 10 amp 120 VAC 5 amp 240 VAC UL recognized relays • Test meters built-in for setting levels and test • Quartz clock synchronized • Radio link or wire line operation • Large digital LED readout at both studio and remote unit • Decimal point location can be selected for each channel.

#### STEREO SYSTEM

STL-8 System, Stereo, complete with two (2) STL-8F Transmitters, two (2) R-200/950F Receivers, HRC-8 Transmitter Combiner and MTS-1 Receiver Combiner. Furnished complete with crystals and tested on final frequency.

\$4160.00

\$1395.00

325.00

445.00

175.00

\$895.00

290.00

25.00

\$1495.00

2945.00

\$395.00

345.00

\$225.00

186.00

205.00

\$1012.00

#### TRANSMITTERS & ACCESSORIES

STL-8F/H Transmitter, 8 watt, complete with crystal and tuned to frequency. 120/240 VAC. 8 % " x 19" Horizontal Rack construction. For AM & FM Broadcast application.

HRC-8 Transmitter Combiner. For combining the outputs of two STL-8 Series transmitters into common antenna system. Furnished complete with inter-connect cables to transmitters.

#### RECEIVERS & ACCESSORIES

R200/950F/H Receiver, complete with crystal and tuned to frequency. 120/240 VAC. 8%" x 19" Horizontal Rack construction. For AM & FM Broadcast application. Includes Down Converter.

ASO-200A Automatic Switchover Unit for "hot standby" switching between two R-200/950 Series

receivers. 120/240 VAC. Rack mount. 3 ½" x 19"......
MTS-1 Matching "T" Section. For combining the inputs of two R-200/950 Series receivers from a common antenna system.

#### REMOTE CONTROL & ACCESSORIES

RMC-2AX(10) Remote Control System, 10-channel, solid-state. Complete with Studio & Transmitter units. Rack mount. 120 VAC.

RMC-20 Digital Remote Control System, a Maximum of 20 Channels, solid-state. Complete with Studio & Transmitter units. Rack mount. 120 VAC. Basic 10 channel System.

#### SUB-CARRIER GENERATORS & RECEIVERS.

SCR-8H Sub-Carrier Receiver, solid-state, tuned to 39 khz. 120/240 VAC. 3½" x 19" Horizontal Rack construction.

### MONITOR, PROGRAM AND RF AMPLIFIERS PGM-20 A Program Amplifier. 120/240 VAC. 3½" x

#### **ANTENNA PACKAGE "AA"**

(2) 4' Parabolic Antennas, c/w Mounting Brackets. (2) Male Type N Connectors for LDF4-50 ½" Foam HELIAX.

(2) Female Type N Connectors for LDF4-50 ½" Foam HELIAX.

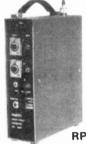
(2) PG-3B 3 foot Jumper Cables.

#### **Broadcast Quality Remote Pickup Equipment**

#### 450-470 MHz • Solid State

150-172 MHz • Solid State

★ FCC TYPE ACCEPTED ★ Broadcast Quality Compressor Limiter ★ 115 V. AC or 13 V. DC Operation ★ Four Mixing Inputs ★ Continuous Duty Broadcast Service ★ Modular Construction ★ Quartz Crystal Filter in Receiver ★ Continuous Subaudible Tone Encoding (Optional)







**RR-50 RECEIVER** 

RPT-1			
TRANSMITTERS RPT-40 40 watt, solid-state, complete with crystal & tuned to 150 MHz	\$1045.00	RECEIVERS R-30/150 Solid-state, complete with crystal & tuned to 150 MHz, for use with RPT-40 and RPT-1/150 Series transmitters.	\$595.00
RPT-40-2 Dual Frequency, 40 watt, solid-state, complete with crystals & tuned to 150 MHz band, maximum frequency separation 0.5 MHz.	1150.00	R-30/150-2 Dual Frequency, solid-state, complete with crystals & tuned to 150 MHz band, for use with RPT-40 & RPT-1/150 transmitters.	630.00
RPT-25 25 watt, solid-state, complete with crystal & tuned to 450 MHz	1195.00	R-50/450 Solid-state, complete with crystal & tuned to 450 MHz, for use with RPT-25 and RPT-1/450 Series transmitters.	725.00
plete with crystals & tuned to 450 MHz band, maximum frequency separation 1.5 MHz	130.00	R-50/450-2 Dual Frequency, solid-state, complete with crystals & tuned to 450 MHz band, for use with RPT-25	7.00.00
tuned to 150 MHz	575.00	R-100/450 Solid-state, complete with crystal and tuned	760.00
plete with crystals & tuned to 150 MHz band, maximum frequency separation 0.5 MHz.	595.00	to 450.925 or 455.925 MHz. Group S (100 KHz) channels. For use with RPT-25S	745.00
RPT-1/450 0.7 watt, solid-state, complete with crystal & tuned to 450 MHz	575.00	Response: ± 1 DB from 30 to 15,000 KHz.  Distortion: Less than 1%  Noise: -58 DB or better	
complete with crystals & tuned to 450 MHz band, maximum frequency separation 1.5 MHz.	595.00	RR-30/150 Solid-state, Portable - Mobile Repeat Receiver complete with crystal & tuned to 150 MHz with	
TRANSMITTER ACCESSORIES TPS-TC-1 Mobile Control Assemblage, required for 12 VDC operation for RPT-40 and RPT-25 transmitters	\$70.00	de-code circuitry and high-pass filter to eliminate en- coding tone. Operates of 12 VDC or 120 VAC RR-50/450 Solid-state, Portable - Mobile Repeat Re-	\$595.00
ENC-1 27 HZ encoder for transmitters listed above. Specify transmitter model number	38.00	ceiver complete with crystal & tuned to 450 MHz with de-code circuitry and high-pass filter to eliminate encoding tone. Operates of 12 VDC or 120 VAC	725.00
RPT-40 & RPT-25	98.00	RECEIVER ACCESSORIES 585-001 Interconnect cable between RR-30/150 and	72000
talk switchXT-1A Hi-Accuracy crystal for any Model Marti Trans-	70.00	RR-50/450 Series Receivers and RPT-40 and RPT-25 Series Transmitters when used with TPS-TC-1 control	
mitterBASE STATION	17.95	assemblage as Unattended Automatic Mobile Relay  MRA-150 RF Preamplifier, solid-state, 10 db gain,	\$15.00
Mark 70W Telemote Remote Control with Broadcast Quality Line termination units	\$315.00	150-170 MHz complete with 120 VAC Power Supply MRA-450 RF Preamplifier, solid-state, 10 db gain, 450-460 MHz complete with 120 VAC Power Supply	135.00 135.00
crystal & tuned to the 150 MHz. band, FCC Type Accepted to meet Base Station Specifications. Complete with RMH-2 Shelf, 585-005 Base Station RF Cable and 585-007 Base Station Mute Cable.	1072.00	XR-1A Hi-accuracy crystal for any Marti Manufactured Receiver.  O-1A Oven for Hi-Accuracy crystal for XR-1A Crystals.	17.95 12.50
RPT-25 25 watt, solid-state Transmitter, complete with crystal & tuned to the 450 MHz. band, FCC Type Accorded to most Base Station Specifications. Complete	1072.00	<b>DFR-1A</b> Dual frequency kit for any model Marti Receiver less crystal. Must be installed at Factory	35.00

1224.00

cepted to meet Base Station Specifications. Complete with RMH-2 Rack Shelf, 585-006 Base Station RF Cable and 585-007 Base Station Mute Cable.....

## Why you should have your own catalog...

- ☑ Places your complete product line in your customers' hands beats sending specification sheets one at a time.
- ✓ Sells the items your salespeople forgot to mention or that customers didn't know you handled.
- Saves your firm travel and entertainment expenses.
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- ☑ Is there at purchasing decision time.
- And what do you tell your prospect when he says, "Send me your catalog!"

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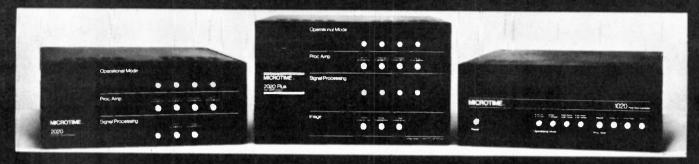
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## MICROTIME — Select Your Technology

If you are in the market for video signal processing equipment that will produce the best possible pictures — then look at MICROTIME. We can provide you with the complete range of video correction products for Time Base Correction, Image Processing, Noise Reduction, Color Correction, Velocity Correction, and Dropout Compensation using the technology that does it best.

### Digital



#### 2020 Electronic Signal Processor

Digital signal processor for any VTR.
Provides 58 dB signal-to-noise ratio, Auto-Trac 2, Velocity Correction, and Image
Processing which provides 3 dB visual
noise reduction. DOC, Line Error Detection
and 24 H line correction range options are
available.

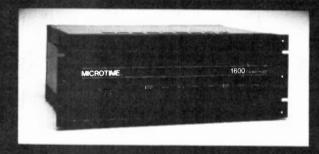
#### 2020 Plus Total Signal Corrector

The most comprehensive signal corrector to process a signal from any video source. Provides Velocity Correction, Image Plus Processing, Auto-Trac 2, and 58 dB signal-to-noise ratio. Line Error Detection, 24 H line correction range, and DOC available.

#### 1020 Time Base Corrector

Sensible time base correction for nonsegmented helical scan VTRs. Low cost and high performance are featured with 4 H line or 24 H line correction range, internal sync generator, optional Image Processing, DOC and Velocity Correction.

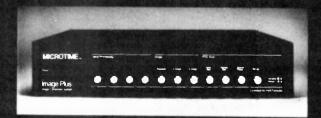
#### CCD



#### 1600 CCD Time Base Corrector

Lightweight, portable TBC designed for broadcast quality Electronic Field Production and other applications where ¾" VTRs are used. Incorporates charge-coupled device technology to provide low cost and excellent performance. Includes 55 dB signal-to-noise ratio. 4 H line correction range, Auto-Trac 2 and optional Image Processing.

### **Image Processing**



#### Image Plus Correction System

Provides horizontal and vertical detail improvement, reduces luminance and chrominance noise by 6 dB, corrects group delay errors and reduces chroma hue shift and cross color errors to improve any signal.

Microtime, Inc. 1280 Blue Hills Avenue Bloomfield, Ct. 06002 (203) 242-0761 TWX 710-425-2390

**MICROTIME** 

#### MODEL 6618 BROADCAST SIX CHANNEL AUDIO CONSOLES

#### Mono and Stereo

Micro-Trak's Model 6618 is a high quality, conventional console for the budget minded station operator. The 6618 provides six mixing channels with three push button selected inputs to each channel for a total of 18 inputs. Line switches are push button latch logic controlled with individual LED indicators to show which channel is in use. The 6618 also includes an internal 10 watt per channel stereo monitor amplifier. Output line amplifiers supply +8 dBm levels of outputs of both mono and stereo program. The 6618 also includes an in-built cue speaker system. A separate headphone amplifier with push button selection of program cue or external input is also provided. A dual relay muting system allows for switch selected muting of the main studio monitor amplifier and also provides muting for additional line level monitor output by any or all channels. Spare form C contacts are provided on both muting relays for external function such as on-the-air lights. The 6618 is ideal for an upgrade for your mono facility now, which can later be applied to stereo uses.



#### THE "S" SYSTEM

Micro-Trak's newest operating audio system is the "S" System. "S" stands for Studio and Micro-Trak's "S" System is a complete operating studio in one package. Provided with the Model 6618 Six Channel Stereo/Mono console, two Model 6401 Stereo Phono Preamplifiers and two Micro-Trak turntables equipped with Model 303 Tone Arms and Stanton 500AL cartridges, the "S" System comes with internal wiring ready for the normal broadcast studio. Beautifully designed to be used as a single stand-alone package, the 30" x 80" long operating desk provides plenty of space for adjacent cart machines. Reel-to-reel equipment, where required, can be mounted on an accessory roll-about Series "S" Tape Recorder Cabinet. In addition to providing table space for the console and turntable, the "S" System provides 17½ inches of vertical panel space for 19 inch rack mounted at either end of the pedestal. Rack panel equipment may be mounted at both the front and the rear of the cabinet. System "S" is the easy way to convert your studio from A.M. mono to A.M. stereo, to add that new studio you've been thinking about, or to upgrade an older F.M.

#### THE "D" SYSTEMS

Micro-Trak's "D" Systems offer more versatility than any other small broadcast production/disco system on the market today. With a choice of five audio consoles, four or five channel stereo or mono broadcast and disco teamed with Micro-Trak quality turntables, equipped with 303 Tone Arms and Stanton 500AL cartridges, the system meets all the requirements of the most discriminating broadcaster. Micro-Trak's "D" systems are shipped to you completely wired, tested, and ready to operate as they are taken from their shipping cartons. Just plug in external cables and you are ready to go. If you are thinking of remote production, or disco or a combination, order the Micro-Trak compacts.



#### MICRO-TRAK TONEARMS Model 303 and 306

Micro-Trak — the name was created to define the most widely used Tone Arm in broadcast history. Tracking capabilities to a tenth of a gram, resonance below 10 Hz, high compliance, rugged, dependable strength offered by an impregnated wood body and super smooth performance with jewel bearings make the 303 and 306 Tone Arms the best buy for the broadcaster today. 30,000 broadcast and professional users demonstrate how their rugged simplicity of design can give you the best possible performance. Specify Micro-Trak 303 12" and 306 16" Professional Tone Arms for your studio.



#### MICRO-TRAK "S" LINE FURNITURE

Micro-Trak's "S" line furniture has been designed to be striking in visual appearance and to optimize operational performance of your broadcast studio. Currently five pieces are offered; the "S" operating desk, either with the Under Pedestal as in the "S" System or with four steel tubing legs. Additionally, the "S" line offers a double turntable cabinet, a single turntable cabinet, and a roll around reel-to-reel tape machine cabinet. These units are durably constructed of one and one eighth thick high density particle board offering high strength, high mass for noise free operation in your studio. Standard finish on the "S" line is formica finish oak providing a beautiful feeling in your studio atmosphere. Specify Micro-Trak "S" line furniture wherever you need high quality and beautiful appearing studios.



Micro-Trak offers two battery powered portable sport/remote consoles designed with the sports broadcaster in mine. The Sport II is a two channel console which has two selectable inputs on channel two. The first channel being a primary microphone, the second channel being switch selectable between microphone and a high level input for the color man or a tape cartridge machine input. In addition, there is a third microphone input which is not mixable which feeds the headset output for the primary announcer to allow a spotter to feed him information on the play action. The Sport headset amplifier provides a separate output to each ear of the primary announcer, one side for monitor, the second side for the spotter input. Monitor input is switch selectable between cue program and an external monitor source such as an off-air portable radio. The Sport provides one monaural output channel which is metered and output levels are at the plus 8 dBm point. A self-contained battery pack provides fifty-five hours of operation from sixteen "C" size manganese alkaline flashlight batteries. Available as an option is one 110 volt power supply. Also available is an accessory case which provides space for headsets, microphone, etc. If you are sending your man to the ballpark, send him with a Micro-Trak Sport.

TELEPHONE 413 536-3551



Specifications Subject to Change Without Notice.



### MICRO-TRAK CORPORATION

620 RACE ST., HOLYOKE, MASSACHUSETTS 01040

USA

TELEX 95-5497

NAB 391

#### MICROTRAN

COMPANY, INC.

#### **AUDIO-POWER TRANSFORMERS**



141 E. Mineota Ave., P.Q. Box 236 Valley Stream, N.Y. 11582 Phone: (516) 561-6050 TWX: 510-225-8412

- PC POWER
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- DC-DC CONVERTERS TOROIDAL INDUCTORS



IMMEDIATE DELIVERY FROM DISTRIBUTORS

MICROPHONE/TRANSDUCER INPUT TRANSFORMERS

FOR PROFESSIONAL SOUND STUDIOS BROADCAST MIXING CONSOLES CONTROL & INSTRUMENT AMPLIFIERS



Double Mu-metal Shielded. ¾" D x 1¼" H. 7-.040 pins ¼" H.



BICROTRAN

Fig. -S SINGLE THREADED STUD MOUNTING Double Mu-metal shielding. 3" color coded leads. 5%" D x 1%6" H. %6" D stud Wide bandwidth — Broad frequency response — Hi efficiency. Extremely low distortion. Power level range up to +0 dBm. Negligible hum pick-up due to nested Mu-metal shields and unique gapless core construction. Ease of mounting and orientation for minimum hum pick-up. Polarizing voltage connection for condenser microphones. Subminiature size permits close spacing to adjacent circuitry. Low microphonics.

No.   Pri:Sec   Primary   Secondary   @ 50 Nz   Response   Seyer P/N‡   S.   S.   S.   S.   S.   S.   S.   S	Part	Nominal Turns Ratio	Nominal Impe	dance Ratio	Typical Open Circuit Pri. Impedance	Frequency	Replaces Threaded Stud Mounting		Each of 1-9 m
\$105.+ 1:15 200 45,000 2.000 30.15,000H±-1db 35,1015,006 17.40 22.65 \$107.+ 1:15 200,50 Split 45,000 2.000 30.15,000H±-1db 35,015,006 17.40 22.65 \$108.+ 1:10 20.00 20.00 30.15,000H±-1db 35,1015,006 17.40 22.65 \$108.+ 1:10 20.00 20.000 30.15,000H±-1db 35,1015,006 17.40 19.20 \$2.65 \$108.+ 1:10 20.00 20.000 30.15,000H±-1db 35,1015,006 17.40 19.20 \$2.65 \$11.+ 1:7.1 200 10,000 2.000 30.15,000H±-1db 35,1015,006 14.45 19.05 \$116.+ 1:5 200,50 Split 5,000 2.000 30.15,000H±-1db 35,1005,003 14.93 19.20 \$118.+ 1.5 200,50 Split 5,000 2.000 30.15,000H±-1db 35,1005,003 16.20 \$125.+ 1:1 600 CT 600 3,750 30.20,000H±-5db 35,1005,003 16.20 \$2.040 \$10.50 Split 5,000 \$1.50 Split 5,000 Split	No.†	Pri:Sec	Primary	Secondary				-\$	-SP
-SP Type is replacement for STR/BV37 & 370 PC pins. + DRDER BY COMPLETE PART NUMBER (\$101.5P	\$105-† \$107-† \$108-† \$111-† \$116-† \$118-† \$126-† \$130-† \$100-FB	1:15 1:15 1:10 1:7.1 1:5 1:5 1:1	200 200/50 Split 200 200 200 200/50 Split 600 CT 10,000 Rig	45,000 45,000 20,000 10,000 5,000 5,000 600 10,000 ht angle mo	2,000 2,000 2,000 2,000 2,000 2,000 3,750 100,000 punting brack	30-15,000Hz ±1db 30-15,000Hz ±1db 30-15,000Hz ±1db 30-15,000Hz ±1db 30-15,000Hz ±1db 30-15,000Hz ±1db 30-20,000Hz ±3db 30-15,000Hz ±3db	351,015,006 351,215,006 351,010,005 351,007,004 351,005,003 351,205,003 TR-145/BV35508 TR-145/BV35508	17.40 19.20 14.85 14.40 13.95 16.20 14.70 13.80	19.20 18.15 20.40 19.20 18.00

TELEPHONE COUPLING TRANSFORMERS FIG. U DESIGNED TO MEET



FCC PART 68 For interconnect of voice/data modem terminals to telephone lines. Permits optimum use of voice/grade telephone lines for broadband computer modems over a wide dynamic signal range with minimum distortion. PC construction.

- Impedance Matching: ±10% over entire frequency range.
   Distortion: 0.5% max.
   Long Balance: Per FCC 68.310.

#### DIMENSIONS

Series	Width	Depth	Height	Weight
T1000	3/4"	1940"	7/16"	.4 oz.
T2000	49/64"	11/10"	23/20"	.5 oz.
T3000	11/64	61/64"	27/2"	1.2 oz.
T4000	11569"	1560"	11/4"	3.5 oz.
T5000	141/64"	11160"	1560"	5.5 oz.
T6000†	161/14"	15599"	141/64"	9.5 oz.

†Channel frame mounting 23/8" M.C.

	No.	Apalication	Impedance	Impedance	No.	1-9★
	T1104	Coupling	600	600	U	\$5.70
- 1	T2104	Coupling	600	600	U	4.65
- 1	T2106	Coupling	600 C.T.	600 C.T.	U	4.95
- 1	T2108	Coupling	600	900	U	4.65
- 1	T2110	Coupling§	900	900	Ü	4.95
- 1	T4113	Coupling	900/600 @	600 Split	Ŭ	7.65
- 1	20440		60/75 mA D.C.		_	7.00
- 1	T6112	Coupling§	600	900/600 @	U	15.75
- 1	T2220			100/120 mA D.C.	100.000	
- 1		Hybrid‡	600(4W)	600/600	U	6.15
- 1	T3220	Hybrid‡	600(4W)	600/600	U	6.60
- 1	T4220	Hybrid‡§	600(4W)	600/600@	U	11.40
- 1	T5220	11. 5. 4.440		60 mA D.C.(2W)	200	
- 1	13220	Hybrid‡§	600(4W)	600/600@	U	21.00
- 1	T2316	Bridging	4000	100 mA D.C.(2W)	2227	
- 1	T4415		4000	600	U	4.80
- 1	14413	Holding Coil		, 1.3 hy	U	5.10
- 1	T7410		@ 100 mA D.C			
- 1	17410	Holding Coil	1.0 hy @ 0 mA,		Q-F	7.95
- 1			(a 25 mA D.C.			
- 1	T8410	Holding Coil	1.0 hy @ 0 mA,		Q-F	8.40
L		77 11 11 11	@ 40 mA D.C.	11.512	_	

Primary

Secondary

#2 required for Hybrid operation, trans-hybrid loss 45 db typical.

#2 selectrostatic Shipid. Level — 15 to +7 dBm.

#2 request Engineering Application Bulletin F232.

#### PRECISION HI-FI ACCESSORIES

### AUDIO-VIDEO INDUSTRIAL GRADE DEMAGNETIZERS

#### STEREO CENTER CHANNEL OUTPUT MATCHING TRANSFORMER FOR MONAURAL EXTENSION SPEAKERS

Designed for the Audiophile who wishes to convert a Stereo system to Monaural or wishes to modify or enlarge his Stereo system. Permits "hole-in-the-middle" fill in with 3rd channel speaker. Matches impe-

dance, polarity and power level. 30 watts. Response 40 to 20,000 Hz.

User net \$14.50 **HM-90** 

#### HUM-BUCKING TELEPHONE PICK-UP COIL

Hum free transcription, no con-nection to phone. Perfect for high impedance tape recorders and dictating machines. Rugged construction of high impact plastic. HP-70

User net \$13.50 TELEPHONE PICK-UP COIL

For recorder or direct feed into am-

plifier — Use as probe for locating hum. Equalized pick-up level. · Universal design - tinned leads.

Black finish with 68" cable

· Size: 5/8" D. x 21/2" L. Wgt: 11/2 oz.

**HP-61** User net \$6.15

#### **BULK TAPE ERASER FOOT SWITCH**



User net \$27.50

#### MAGNETIC TAPE EDITING PEN

For erasing small areas of sound and video from magnetic tape or film. Syllables, program material, and errors may be removed. Press to operate switch 115V 50/60 Hz at 10 watts. Active tip area 1/4" D. Size: 5/8" D. x 8" L. Weight: 6 oz.

HD-35M



User net \$47.50

Part

#### TAPE HEAD DEMAGNETIZER

Removes permanent magnetism. Protects tape from erasure. Minimizes noise and distortion. Extended pole piece for easy access. Polished end prevents scratches. 117V. 50/60 Hz, 1 Amp.

Size: 4" x 11/4" D. Weight: 7 ozs.



#### HAND HELD BULK TAPE ERASER



A compact bulk tape eraser. For magnetic tape up to 1/2'' wide. For cassettes, cartridges and reels. Erases recorded signals and noise instantly, when passed over tapes or sound film, without rewinding. Removes background noise below level of new tapes or film. 117V. 50/60 Hz, 4 Amps. Size: 436"x2½"x436" Wt.2½ lbs. HD-15

User net \$14.50

Adapter hub for NAB reels for 36" spindle. Wt. 1/2 lb. (not illustrated). HD-11-AD User net \$4.25

#### **HEAVY DUTY BULK TAPE ERASER**

TEAMY BUILT FALLS. The Problem of the property of the problem of t HD-11M



User net \$49.50

#### INDUSTRIAL AUDIO/VIDEO/COMPUTER **BULK TAPE ERASER**

For bulk erasure of up to 1" For bulk erasure of up to 1" tape. Ideal for cassettes, cartridges, and reel diameters from 31/4" - 101/2". Erasure 65-90 db below saturation level. Designed and constructed for heavy industrial use. Fuse and pilot light. 117V. 50/60 Hz, 10 Amps. Size: 4" x 6" x 8". Weight: 15 lbs.

User net \$102.50

#### PROFESSIONAL AUDIO/VIDEO/COMPUTER **BULK TAPE ERASER**

For tapes up to 2" wide by 17" diameter. For cassettes, cartridges, and reels. Erasure to 90 db below saturation. Designed and constructed for heavy duty professional use. Double fuse and pilot lights for safety. 115V. 50/60 Hz, 20 Amps. Size: 4" x12" x14". Weight: 33 lbs.



User net \$262.50

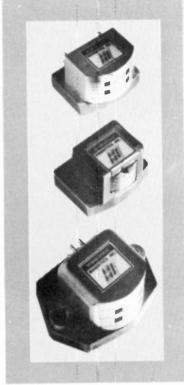
★ Quantity pricing schedule (Transformers only): 10-49 less 10%, 50-99 less 16¾%, 100-249 less 33⅓%. Contact factory for pricing over 249 pieces.

(612) 927-8841

the preferred source for magnetic tape head replacements

## ampex-scully-revox-magnecord

## PROFESSIONAL TAPE HEADS



## MMI HEADS EQUAL OR EXCEED ORIGINAL MANUFACTURERS' EQUIPMENT SPECS.

GAP: All of the heads produced by MMI have .024" depth of metal at the gap for longer life with minimal change in head characteristics as wear progresses. (Exception: Ferrite erase heads).

FACE: All of the heads produced by MMI have full metal face construction to minimize oxide loading and promote even wear, with no dishing, craters or other aberrations in the tape-to-head contact area.

LAMINATION: All of the heads produced by MMI have WIDE lamination stacks — the only way to obtain smooth, even frequency response. Wide contact area will also increase head life.

All heads produced by MMI are given INDIVIDUAL 100% testing.

All heads produced by MMI are DIRECT RETRO-FITS, complete with illustrated instructions for easy do-it-yourself installation.

### RELAPPING

No charge head evaluation

### REFURBISHING

Send us your assembly. We will ultrasonically clean everything, install new heads if yours cannot be relapped, replace any worn or missing minor hardware, adjust & test.

72 HOUR SERVICE — FREE LOANER SERVICE

#### **HEADS FOR CART MACHINES**

Ampro, ATC, Collins, Garron, Gates, ITC, Macarta, Moulic Spec., RCA, Schafer, SMC, Sparta, Spot Master, Tapecaster.

**NOW... DIGITAL HEAD REFURBISHING** 



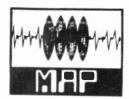
3104 West Lake Street Minneapolis, Minn. 55416 HERE IS THE MMI WARRANTY THERE JUST ISN'T ANY BETTER.

Except for wear (which is inevitable) and abuse (which seldom occurs when handled by competent professionals), the very simplicity of the installation permits MMI to extend the most liberal warranty in the industry.

MINNEAPOLIS MAGNETICS, INC.

UNCONDITIONALLY GUARANTEES THESE PRODUCTS.

PROFESSIONAL AUDIO AND CUSTOM TAPE HEADS, EQUIPMENT DESIGN-PRECISION MACHINING/ASSEMBLY



#### A UNIT OF MODULAR DEVICES, INC.

50 Orville Drive 
Airport International Plaza Bohemia, New York 11716 
516-567-9620

A COMPLETE LINE OF MODULAR EQUIPMENT FOR . . . . . . . . AM - FM - TV BROADCASTING

FEATURING . . . MAP AUDIO OPERATIONAL AMPLIFIERS & VCA (VOLTAGE CONTROLLED AMPLIFIER) MODULES.

SOUND & COMMUNICATIONS

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POWER SUPPLIES . . .

#### IMPAC TM SERIES PC CARD SYSTEM

MAP IMPAC IS A COMPLETE & HIGHLY VERSATILE SYSTEM OF PLUG - IN PC CARD MODULES, IDEAL FOR USE IN MIXERS, CONSOLES, SOUND DISTRIBUTION & SWITCHING SYSTEMS, IMPAC OFFERS THE OPTION OF SELF - CONTAINED OR REMOTE - CONTROLLED OPERATION, UTILIZING STATE - OF - THE - ART VCA LEVEL CONTROLS & F.E.T. SWITCHING TECHNIQUES.

MODEL 4820 AUDIO DA

MODELS 1-9
4003 (AM - 27) MICROPHONE PREAMP \$119,00 4004 (ABL - 27) BRIDGING LINE AMP 119,00 4006 (AL - 27A) LINE - MIX - DIFF, AMP 96,00 4007 (PM - 40A) IS WATT POWER AMP 119,00 4008 (AT - 27) TAPE PREAMPLIFIER 117,00 4009 (AP - 27) PHONO PREAMPLIFIER . 106,00 4010 (PPI - 27) PEAK INDICATOR
ACCESSORIES

SYSTEM SPECIFICATIONS . . .



MODEL 4050 500 MA

MODEL 6022

1 - 9

\$ 70.00 85.00 279.00 260.00 34.00 425.00

#### TM SERIES MODULAR BROADCAST CONSOLES **IMPAC**

A NEW SERIES OF INTEGRATED MODULAR PROFESSIONAL AUDIO CONSOLES ENGINEERED FOR VERSATILE APPLICATIONS IN AM-FM RADIO & TELEVISION BROADCASTING AND PRODUCTION.

MAINFRAMES (FULLY WIRED LESS MODULES) . . .

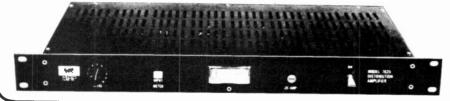
6012 (DAYTON) 12 CHANNEL STEREO - MONO (FM - AM)
RADIO BROADCAST - PRODUCTION
CONTROL CENTER...\$ 8295.00
6022 (SPRINGFIELD) 16 X 2 MONAURAL (TV - AM)
AUDIO CONTROL CENTER...\$ 6195.00
6032 (BURBANK) 16 X 4 MONAURAL (TV - AM)
AUDIO CONTROL CENTER...\$ 10425.00

MODULES ... (FOR 6012)
6010 MIC INPUT WITH PAN 6011 LINE - MED, LEVEL INPUT 6013 BLANK PANEL (FOR 6022) 475.00 456.00 25,00 6020 MIC INPUT MODULE 6021 LINE - MED. LEVEL INPUT 6023 BLANK PANEL (6022 OR 6032) \$ 445.00 465.00 25.00 (FOR 6032) 6030 MIC INPUT MODULE \$ 479.00 479.00 6031 LINE MED. LEVEL INPUT EQUALIZERS & OSCILLATOR . . . 3100 GRAPHIC - SHELF EQ. 3270 RECIPROCAL PEAKING & SHELVING EQ. 3600 PRECISION OSCILLATOR 3000BP BLANK PANEL \$ 415.00



#### AUDIO DISTRIBUTION AMPLIFIER (IX8) — MODEL 7820

370.00



- ●(8) 600 OHM OUTPUTS AT +20 DBM EACH
- TRANSFORMERLESS DIFFERENTIAL AMPLIFIER
- ●ONLY 3 3/4 IN, HIGH
- BUILT IN POWER SUPPLY

\$369.00

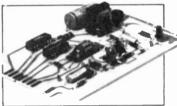
PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE -MAP 9/78

**MONEY SAVING OPPORTUNITIES** 

TO USE THE **TELEPHONE** REMOTE CONTROL

Here are some of the HIGH-SPEED TONE SIGNALING DEVICES from Monroe Electronics, Inc.

#### COMPONENTS - Ready for you to assemble - from \$69



3137A-1
Unattended Automatic Telephone
Answering Device and Coupler automatically activates upon receipt of telephone
high level ring signal and provides both a
bi-directional audio path between public
network and customer owned equipment,

and a relay contact closure to activate customer equipment. FCC Part 68: This unit is certified for direct connection to

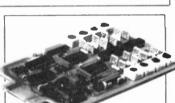
public telephone network



3185
4 Digit Sequence Dual Tone Signal Detector. This unit will latch its relay output contacts upon receipt of a correct sequence of up to four digits (touch tone® or dual tone). It will un'atch its output upon receipt of the same initial digits but with a different last digit. On board switch permits programming to 1, 2, 3, or 4 digits, latching, momentary, or alternate action of output relay.



3178-1 Scanner verifier card, either of two audio tones for each of 10 alarm points



Use your regular touch button telephone

Ambient temperature of building areas

Closed circuit TV circuits

Entrance ways, overhead doors

 Microwave transmitters Energy conservation systems

 Security systems Antenna systems Telephone equipment Radio/telephone interconnection

equipment

to control:

Touch Tone® Decoder decodes all 16 touch tone® frequency combinations, and provides bcd solid state output.

# Illustrated:

#### MINI SYSTEMS ... Wired and Assembled

921 Status verifier 10 point alarm status report unit. Unit sends telephone caller a series of tones indicating "The on/ off" condition of 10 sets of status indicating relay contacts.

929A Automatically answers incoming phone calls, and upon reception of a four digit code, transfers a relay contact. Includes 3137A-1, 3185, and 424 power unit wired to-

gether in this mini system.

939A Wired mini system including 3185 4 digit tone detector, and 424 power unit. For hard line wire, radio, or microwave inter-



922 Unattended answering device which releases when calling party hangs up.

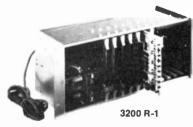
937 Wired 3137A-1, 424 power supply which serves as an unattended automatic telephone coupler to customer owned

equipment. Unit has timed release-capacitor programmable to 21/2 minutes

951 Connects to telephone line, and converts touch tone signals to a one out of 10 output. For interface to external equipment, such as teletypewriter upon receipt of proper tone code.



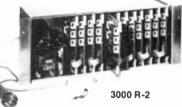
### COMPLETE REMOTE CONTROL AND STATUS MONITORING SYSTEMS



3200R-1 Broadcast transmitter status alarm and remote control unit. It monitors tolerance bands in the 0 to 10 dc reference tolerance banos in the U of to to creterince output of transmitter and/or status relay contact closures. or opens. If status changes, unit siezes telephone line, dials preset number, and notifies called party of problems by a series of 10 tones each representing a monitored function. Called party acknowledges receipt of alarm by entering touch tone® code. He may then perform remote control operations by submitting proper tone codes. submitting proper tone codes

3200R-2 10 to 60 Channel 2 Digit Tone Receiver System accepts 2 digit address plus the \* to latch, and the # to unlatch. Available also with momentary contacts for "raise/lower" applications. Automatic telephone answering circuits built in.

3000R-3 Complete simplex radio auto-patch. Provides call-in or call-out radio to landline telephone interconnection on an automatic basis. Built in timer and logic assure fail-safe operation.



Monroe electronics also manufactures a status reporting system which calls a central location (studio) and causes receiving unit to print date, time and fault. Provision is also made for building status reporting such as intrusion, temperature, air flow, etc. Write for technical literature covering your application.

®Touch Tone is a registered trademark of AT&T.



#### MONROE ELECTRONICS, INC.

200 Housel Ave., Lyndonville, N.Y. 14098 Phone: 716-765-2254 Telex: 91-9188

3000 R-3



## FRED A. NUDD CORPORATION

1743 Route 104 • Ontario, NY 14519 315/524-2531

### MONO-POLES

MODEL	HEIGHT (ht. over tower)	OUTSIDE DIA. of SECTIONS inches	MAX. OVERTURN MOMENT in lbs.	MAX. ANTENNA WIND LOAD psf	WIND LOAD CENTER (ft. over tower)
M-15	15	3.5	53,520	225	10'
M-20	20	4.5	102,480	306	13.33
M-25	25	4.5	162,960	526	14.06
M-30	30	5.5	230,330	560	16.88
M-40	40	6.625	480,000	941	22.5
M-50	50	8.625	759,500	1,003	28.13
S-40	40	6.625 8.625	588,000	1,350	26.67
S-50	50	6.625 8.625	759,500	1,303	33.33
S-60	60	6.625 8.625	1,165,600	1,735	40.0
S-70	70	6.625 8.625 10.75	1,708,000	2,244	46.67
S-80	80	6.625 8.625 10.75	2,132,800	2,359	53.33
0.400		12.75			
S-100	100	6.625	2,484,508	1,845	66.67
(S-100H)	(100)	8.625 10.75	(3,120,256)	(2,640)	(66.67)
S-120	120	12.75 6.625 8.625 10.75 12.75	4.476,675	3,083	80.0
		15.0			

WIND LOADS BASED ON 50/33 PSF, INCLUDING 300 MM TOP BEACON AND MAXIMUM DEFLECTION OF 3/4" IN 10 FEET.



#### OTHER PRODUCTS AND SERVICES INCLUDE:

Custom design, fabrication and installation of towers, mono-poles and tower brackets and hardware.

Engineering services, modification and repairs to towers.

Tower inspections as well as service contracts and emergency service.

Our towers and mono-poles are designed to EIA specifications and are fabricated in our 14,000 sq./ft. shop located in Ontario, New York.





## THE WORLD'S FINEST CAMERA SUPPORT EQUIPMENT

Because your camera support system is only as good as its weakest component, O'Connor has designed the most complete professional support system.

In order to help you utilize many of the other fine products on the market, we continue to produce an

increasing variety of interchangeable options and accessories. For each head there are numerous camera platforms to accommodate every camera. Various bases, including the innovative O'Connor "claw ball" bases with the ultra positive grip, enable one to use any O'Connor head with most 16MM and 35MM tripods and dollies. Other accessories include, adaptors, hi-hats, double video handles, handle extensions and casters for the Hydro-Ped. For more information on these O'Connor extras, contact your dealer or send for our brochure.

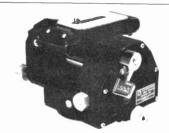
## **MODEL C**



The O'Connor Model C is a professional quality head designed for lightweight 16mm cameras weighing up to 15 lbs. The smooth-flowing action of large motion picture cameras can be ach eved with small 16mm cameras mounted on this lightweight, 6 lb. head. The Model C is designed for the professional who's engaged in field production, news and documentary work. This head is terrific for wildlife photography and is very popular with the amateur who demands perfection.

Employing the same principles as larger O'Connor heads, the Model C provides supersmooth panning and tilting, with the camera under perfect control at all times. Infinitely variable fluid drag prevents sudden starts, stops and jerks.

## MODEL 30



The 30 is small and weighs just 5 lbs. yet it will handle motion picture and video cameras weighing 10 to 30 lbs. One of the standard features is a unique new counterbalance which can be adjusted in the field. It comes with an entirely new drag mechanism which is continuously adjustable through 360 panning and  $\pm$  60 tilt.

and ± 60 tilt.

The end result is a beautifully designed small head which has all the features and smooth-steady action which has made O'Connor the favorite of professionals throughout

## MODEL 50-D



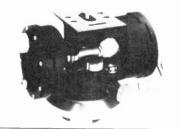
Here is an exceptionally lightweight head for cameras weighing up to 50 lbs. It is extremely maneuverable, yet it provides steady, smooth, jerk-free panning and titting. The O'Connor Model 50-D is considered a standard for making fine documentaries and has proved itself invaluable for critical assignents where perfection is desired. Its compact size and light weight make it ideal for location shooting, news work and field production.

Several improvements have recently been made on this head, eliminating breakaway

made on this head, eliminating breakaway friction, improved seals, a stronger body cast-ing and other features which make it the ulti-mate head for 5D lb. cameras.

Camera

## MODEL 100-C



This low profile, lightweight head provides ultra-smooth panning and tilting for cameras weighing up to 100 lbs. Built of magnesium and aluminum alloy castings, the O'Connor 100-C weighs orly 16 lbs.

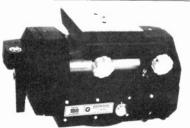
Now the cinematographer is in complete, positive, flexible confrol of his camera, free to follow the action at any speed, in any direction, knowing the head will obey the agent.

tion, knowing the head will obey his every tion, knowing the head will obey his every command. Panning and litting can be done simultaneously, controlled by the same adjustable handle, which can be attached to either side.

The highest degree of professional cine-

matography is attainable with the O'Connor Model 100-C

## MODE 150-XR



Studio-type motion picture and television cameras weighing up to 150 lbs. are handled with ease when mounted on this beautiful 25 lb. O'Connor 150-XR.

This head is completely counterbalanced

This head is completely counterparance at all times including extreme tilt positions, making operations much easier. It leatures pan and tilt drag adjustments with dial indicators and an independent pan and till lock. A removable and adjustable camera mounting clate can be mounted to the camera and an other control of the camera and an extreme the camera and an extreme counterparance and an extreme camera mounted to the camera and an extreme camera mounted to the camera and an extreme camera camera. plate can be mounted to the camera and ar

adjustable feature will accommodate different lenses and film magazines. Built of magnesium and aluminum castings, the lightweight 150-XR provides exceptional maneuverability

**Hydro-Ped** 



Here is an ingenious concept in camera support equipment which provides the professional cameraman with many advantages over traditional tripods. The Hydro-Ped levels and locks hydraulically on any terrain up to

and locks hydraulically on any terrain up to 40 and is four times as rigid as a conventional tripod in torsion and bending. The center column is hydraulically adjustable from 30 to 60 inches at a selected speed which you control. The column is hydraulically balanced so that it can handle its own weight and the weight of the column is hydraulically balanced. and the weight of the camera and head up to 100 lbs on the column, Each unit is tested to 400 lbs on the legs before you ever see it. Built to travel, the O'Connor Hydro-Ped is made of a sturdy magnesium and aluminum

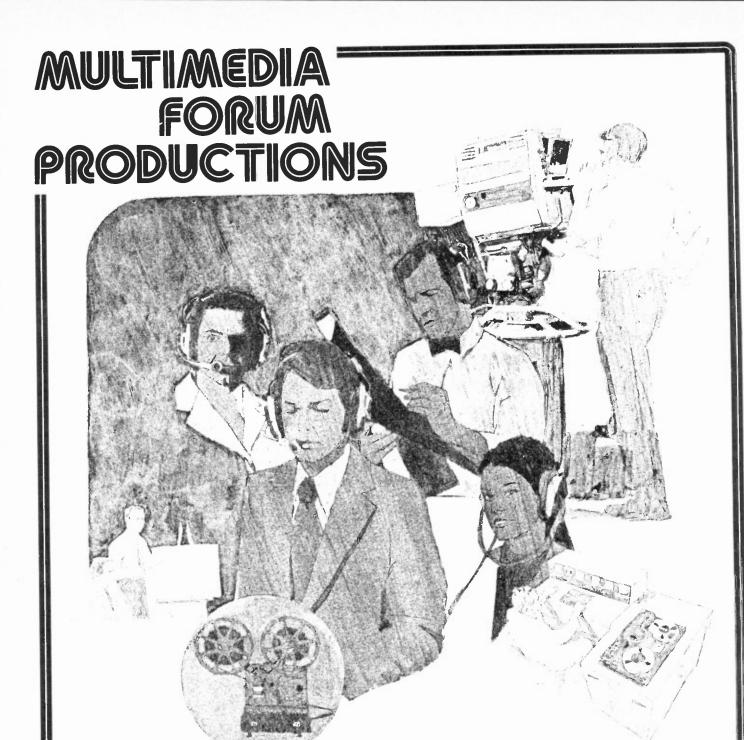
construction, weighing only 29 lbs. and folds to 30 inches long and 9 inches in diameter. A single centered handle with comfortable grip makes it easy to tote even in the terrain

#### O'CONNOR ENGINEERING LABORATORIES, INC.

100 Kalmus Drive, Irvine Industrial Complex Costa Mesa, California 92626 Telephone (714) 979-3993 - (213) 627-4057 Cable Address "OCELINC"-telex: 685 641

#### O'CONNOR ENGINEERING LIMITED

11 Rue des Moraines 1227 Carouge Geneva, Switzerland Tele: (022) 42 79 38-Telex: 23 329



• Stage shows • Multi-media presentations • Complete color video studios • Free screening facilities

Multimedia Forum Productions has some surprises in store for you. We're more than just a deluxe meeting and presentation facility. We can now offer you imaginative and innovative software to present in our facility—or anywhere else, for that matter.

Multimedia Forum Productions is now proud to present fullservice program production. And we mean it.

Full-service means having the creative staff to develop your ideas, script your message and channel your thoughts.

Full-service means having the production team to produce in any medium—IN-HOUSE. We handle the writing, photography, cinematography, audio recording, artwork, printwork, meeting itineraries, videotaping, music composition, set design, lighting design, set construction, stage direction...well, full-service just means that if you've got the message, we've got the medium. Call Jim Gentry and ask him about it.

### Multimedia Forum Productions in Crown Center

A subsidiary of Hallmark Cards, Inc. 2450 Grand Avenue, Suite 400, Kansas City, MO 64108 (816) 274-8321

Where Productions Mean Impact

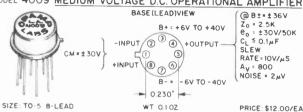
#### AMPLIFIERS - OSCILLATORS POWER SUPPLIES - AUDIO CONSOLES F.O.B. LOS ANGELES, CA. Send for FREE CATALOG and 50 APPLICATIONS



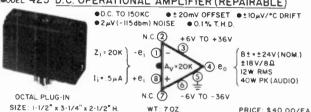
#### OPAMP LABS INC.

1033 N. SYCAMORE AVENUE LOS ANGELES, CA. 90038 (213) 934 - 3566

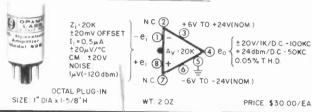




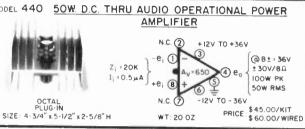




#### MODEL 425 D.C. OPERATIONAL AMPLIFIER



MODEL 440 50W. D.C. THRU AUDIO OPERATIONAL POWER



#### MODEL SM-100 DUAL 50W. OR MONO 100W. D.C. THRU AUDIO OPERATIONAL POWER AMPLIFIER



DESCRIPTION: PANEL-CHASSIS WITH HARDWARE, TWO 440KR POWER AMPLIFIER KITS, ONE WIRED AND TESTED 536 POWER SUPPLY, PC-SM 100 CONVERTIBLE STEREO, 50W OR MONO 100W PRINTED CIRCUIT BOARD AND ALL NECESSARY COMPONENTS. SIZE: 7" Hx 19" Wx 7" D

WT:15 LBS PRICE: \$200.00/KIT \$280.00/WIRED

PR-FA

30 45

30

40

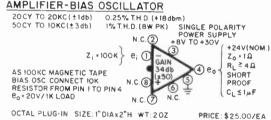
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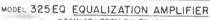
2x3x2 H \$30

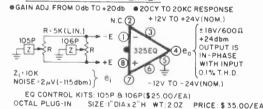
3x4x3.25 H

3 x 4 x 1.75 H

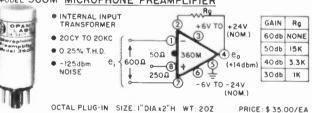




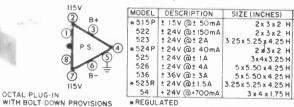




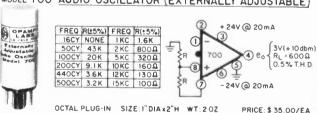
#### MODEL 360M MICROPHONE PREAMPLIFIER



#### POWER SUPPLIES (REPAIRABLE)



#### MODEL 700 AUDIO OSCILLATOR (EXTERNALLY ADJUSTABLE)



#### MODEL 1010 10 x 10 MATRIX-TRANSFORMER ISOLATED INPUTS



#### AND OUTPUTS

- 10K INPUT IMPEDANCE
- UNITY GAIN
- 24 dbm OUTPUT
- 80 db ISOLATION
- LIGHTED PUSH-ON/OFF SW
   BARRIER TERMINALS ON BACK PANEL
- INTERNALLY REGULATED P.S.

SIZE:8-3/4"Hx19"Wx14"D WT:32 LBS PRICE: \$ 2,200.00

#### **AUDIO CONSOLES**



1604-TV

DESC	PR	ICE
DESC	KIT	WIRED
BIN-2 OUT	\$4,100	\$6,300
		9,500
	5,900	9,500
	7,400	11,800
	6,700	11,100
20 IN-8 OUT	10,900	17,000
	12 IN-4 OUT 12 IN-4 OUT 16 IN-4 OUT	8 IN-2 OUT \$4,100 12 IN-4 OUT 6,000 12 IN-4 OUT 5,900 16 IN-4 OUT 7,400 16 IN-4 OUT 6,700

DATE: AUGUST, 1977

## PANASONIC'S New Portable ENG/EFP Camera

## Panasonic<sub>®</sub>

**ENG/EFP Portable Color Camera** 

Model AK-750P/EN



ENG/EFP PORTABLE COLOR CAMERA, Model AK-750P/EN

Panasonic introduces our first ENG/EFP color camera, AK-750P/EN: a three PLUMBICON® tube, broadcast quality, self-contained portable color camera for electronic news gathering and electronic field production. All the controls necessary for operation are built into the camera head. The operating controls are on the front of the camera for convenient use. And the camera head weighs less than 16 lbs. (excluding the lens). The AK-750P/EN is a versatile camera. It can be adapted for studio use with the optional studio viewfinder and optional Remote Control unit (RCU). Whether in the field or in the studio, the AK-750P/EN can handle the job.

#### **SELF-CONTAINED PORTABLE OPERATION**

For a completely portable ENG/EFP system, the AK-750P/EN goes anywhere with the Panasonic NV-9400 ¾" portable VCR. To control the start/stop function on the portable VCR, the AK-750P/EN has a trigger switch on the handgrip for recording; for VCR playback, a separate button is located on the rear of the handgrip. The AK-750P/EN can also be used with any other VTR. For convenient use, the 1.5" CRT viewfinder (1.4" actual visual size, measured diagonally) tilts and adjusts. And the detachable shoulder pad has an adjustable handgrip to facilitate hand-held use of the camera.

To make the AK-750P/EN a totally self-contained ENG/EFP camera, a directional microphone with a wind screen is mounted on the front with a standard Cannon connector, so different microphones can be used.

Field versatility is necessary in an ENG/EFP camera. The AK-750P/EN works in a multi-camera system because of the built-in genlock function for EFP system use. The AK-750P/EN also works from three different power supplies: the standard BP-100 battery pack, the optional AC adaptor for NV-9400/AK-750P/EN system use; or the optional studio Remote Control Unit (RCU). To carry the AK-750P/EN and accessories, the optional carrying case PC-400 provides protection with its hard shell while on the go as an active ENG/EFP camera.

R-124

#### STUDIO OPERATION

When a high quality TV camera is required in the TV studio, the AK-750P/EN fits the bill. What is required is the optional 4.5" CRT viewfinder (3%" actual visual size, measured diagonally). Two other options are the zoom lens and its studio conversion kit. This provides flexible cable control of the zoom and focus. With the optional RCU you then have an ENG/EFP camera working in a studio multi-camera system. The AK-750P/EN connects to the RCU via a multi-pin cable. And the RCU provides automatic cable compensation, subcarrier phase, and horizontal phase controls. The RCU also has adjustments for R and B pedestal, R and B gain, total pedestal, manual iris, auto/manual iris switch, and an automatic white-set switch. The AK-750P/EN features rear panel controls for R, B, G, -G, NTSC, and white balance viewfinder selection switches. These controls allow R-G, R+B, B-G, and B+G viewing on the studio viewfinder for registration adjustments. It also features white balance, total pedestal, R and B pedestal, R and B gain, and R and B horizontal and vertical centering.

For versatile use with the RCU, an optional chroma key generator can be added. This produces a blue chroma key output for direct connection to a special effects generator.

Note: PLUMBICON is a registered trade mark of N.V. Philips' of Holland for TV camera tubes.

Specifications Subject to Change Without Notice.

## PANASONIC'S New Portable ENG/EFP Camera

#### Model AK-750P/EN continued

#### **QUALITY ENGINEERING FEATURES**

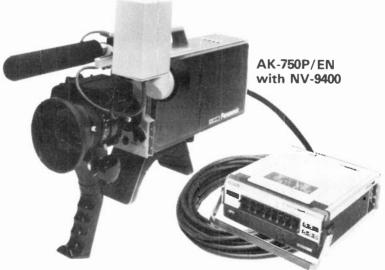
#### **AK-750P/EN CAMERA**

- 1) Self-contained portable ENG/EFP operation.
- 2) Dichroic mirror optical system with parallel arrangement of three 3/3" PLUMBICON tubes.
- 3) System use with the Panasonic NV-9400  $\,^3\!4^{\prime\prime}$  portable VCR.
- 4) Studio system use with Remote Control Unit (RCU) and optional 4.5" viewfinder (3¾" actual visual size, measured diagonally) for studio operation.
- 5) NTSC output for use with any VTR.
- 6) 1.5" CRT viewfinder (1.4" actual visual size, measured diagonally) rotates for convenient use. Viewfinder detaches for studio operation.
- 7) Front mounted microphone.
- 8) Works from three different power supplies: Standard battery pack, BP-100, optional ac adaptor for NV-9400/AK-750P/EN system use; also the Remote Control Unit (RCU) provides power.
- 9) Internal RS-170A sync generator with genlock circuitry for EFP system use.
- 10) High signal/noise ratio of 49dB with the recommended illumination of 200 footcandles at f/4.
- 11) Minimum illumination is only 20 footcandles at f/1.8.
- 12) High horizontal resolution of 500 lines at center.
- 13) Gamma correction adjustable from 0.45 to 1.0.
- 14) Built-in horizontal aperture correction and 1-line type vertical aperture correction; optional 2-line type vertical aperture correction.
- 15) Die-cast chassis for rigid alignment of the optical system.
- 16) Color bar generator with front mounted camera/color bar switch.
- 17) Electronic color temperature conversion with three settings: 3200°K, 4700°K, and 7500°K.
- 18) Color temperature conversion filter for 6000°K, and a color temperature/neutral density filter for 6000°K and 25% light reduction.

- 19) Standby/0 db/+6 dB switch, mounted on front of camera.
- 20) Front mounted white set button.
- 21) 1.5" viewfinder has built-in video level indicator, battery warning indicator and tally light.
- 22) Operating controls: R, B, G, -G, NTSC, and white balance viewfinder selectors; horizontal and vertical R and B registration adjustments; auto/remote/manual iris switch; iris adjustment; R and B gain and pedestal controls; total pedestal control; automatic white set/manual switch.
- 23) Shoulder pad detaches for tripod mounting; also has adjustable handgrip.
- 24) Removable side panels.
- 25) M-type lens mount with standard C-mount adaptor; optional zoom lenses with servo iris control for automatic or manual iris control.

#### **OPTIONAL REMOTE CONTROL UNIT (RCU)**

- 1) Connects to AK-750P/EN via a multi-pin cable.
- 2) Provides automatic cable compensation and features a fine adjustment.
- 3) Operating controls for: total pedestal; R and B pedestal; R and B gain; horizontal and vertical R and B centering; white-set button; subcarrier phase shifter, coarse and fine adjustments; horizontal phase; servo iris control; intercom jack; tally light; power on/off.
- 4) Optional Blue Chroma Key plugs into RCU; features hue, delay and clip controls. Produces chroma key output direct to SEG external key input.
- 5) External sync, subcarrier and line view loop-through inputs.
- 6) Two NTSC composite outputs, one non-composite output, 1 chroma key output and tally/intercom connector.



Specifications Subject to Change Without Notice.

## PANASONIC'S Broadcast Quality Color Studio Camera

#### **COLOR STUDIO CAMERA**

Model AK-920 is a fully self-contained, broadcast quality color studio camera complete with internal Y I/Q encoder, RS-170 sync generator, and multi-function viewfinder.

#### **Recommended System Options:**

AK-9220 remote control unit.

AK-9620 vertical aperture corrector.

AK-9720 RBG cable equalization module. PV10X15BIE zoom lens.

#### Camera Features:

RBG prism optical system and three 1" PLUMBICON\* pick-up tubes for high quality pictures.

Internal, broadcast quality Y I/Q encoder.

Internal EIA RS-170 sync generator.

Horizontal resolution 500 lines at center.

High signal-to-noise ratio: luminance S/N 48dB, with recommended illumination.

High sensitivity: recommended illumination is just 150 footcandles at

Gain switchable for higher sensitivity: with +6 dB switch, minimum illumination is 15 footcandles at f/1.8.

Gamma correction is adjustable from 0.45 to 1.0 (unity).

To enhance edge detail and improve high frequency response, horizontal aperture correction is built into the camera head. The amount of correction is adjustable.

Vertical aperture correction can be added to the camera head, with the optional AK-9620 vertical aperture corrector.

NTSC composite or non-composite output (switchable) from camera head.

#### Reliability and Serviceability:

Advanced solid state circuitry, including large scale integrated circuits (LSI).

Aluminum-alloy die-cast chassis assures high stability of the optical alignment.

Both side panels of the camera head can be removed for easy maintenance access.

Maintenance timer located inside the camera head.

#### Testing and Installation:

Color bar output for adjustment of encoder.

Focus wobble for beam alignment.

Beam on-off switch for protection of the PLUMBICON\* tubes during stand-by

Sawtooth signal generator for adjustment of processing amplifier. White balance check circuit in viewfinder.

R, B, G, R-G, B-G display in viewfinder assists in adjustment of registration.

#### **Viewfinder Features:**

 $5\,\%^{\prime\prime}$  (measured diagonally) monochrome CRT. Can be switched to display line view signal.

Also displays test signals.

Tilts 25° up or down for convenience of camera operator.

Long viewfinder hood included.

#### Optional Remote Control Unit (RCU) AK-9220:

For use with external sync in multi-camera systems. Critical controls are protected by a hinged front panel.

Operating controls include red and blue gain, pedestal, and horizontal and vertical centering; total pedestal; iris; cable equalization; and camera power.

RBG output for use with external encoder or chroma key generator. Cable length equalization switch for camera cable lengths of up to

1,000 feet, or coax cable lengths of up to 2,000 feet.

When using the RBG output with more than 100 feet of camera cable, the optional AK-9720 RBG cable equalization module is recommended.

Video outputs from the RCU include one NTSC non-composite and two NTSC composite video signals.

\* Registered trademark of N. V. Philips' of Holland for TV camera: tubes.

Model AK-920



Full System Compatibility:

with optional zoom lens

Standard BNC connectors for interface with other video equipment. External synchronization, with RCU:

Only SYNC and SC are required.

RCÚ has self-contained subcarrier phase shifter with coarse and fine phase adjustments.

RCU supplies the camera head with a special mixed synchronizing signal consisting of both SYNC and SC in one line.

When using coaxial cables between the camera head and RCU, just two are required: one for video output, the other for the special SYNC/SC signal from the RCU.

The phase of the horizontal component of the external sync can be delayed up to 1H at the camera head, so that the video output at the RCU is exactly timed with respect to the external sync.

Tally lights:

Large tally light on front of camera head, for high visibility by studio talent.

Tally lights on rear of camera and viewfinder for convenience of camera operator.

Tally light on RCU.

The power supply for the tally lights is self-contained. Tally light switching must be controlled by an external source, such as a Panasonic special effects generator.

Intercom system:

Party-line intercom system; also switchable to private-line, for communication between camera head and RCU only.

Two intercom jacks on camera head: one for camera operator, the other for floor manager.

Intercom jack on RCU.

Power for the intercom system is self-contained.

#### Lens Options:

Recommended lens: PV10X15BIE.

Flexible cable controlled 10:1 zoom, 15mm-150mm, f/1.8.

Built-in 1.67X and 2.5X lens extenders.

Built-in neutral density filters.

Servo-iris for automatic light control.

Iris can be adjusted manually at camera head or RCU.

Other zoom lenses (18:1 and 34:1) also available.

AK-9012 is 75mm, f/4.0 lens for film chain use.

CONTINUED NEXT PAGE

## **AK-920 Broadcast Quality Studio Camera**

#### SPECIFICATIONS:

Composition of AK-920

AK-9120-AK-9320: Accessories: Self-contained color camera head

Tally light number plates, 3 pcs. Viewfinder hood for field use, 1 pc.

**AK-9120 CAMERA HEAD** 

Power Source: Pick-up Tubes:

120V AC, 60 Hz, approx. 110 watts AK-920 (supplied without tubes), AK-920IT with ITV grade, PLUMBICON tubes (XQ-1076R, XQ-1071B), AK-920ST with studio grade, PLUMBICON tubes (XQ-1075R, XQ-10705R, XQ-10705R), XQ-10705R, XQ-10

1070G, XQ-1070B).

Scanning Standard: Synchronization:

525 lines, 60 fields, 30 frames Internal EIA RS-170; external sync with optional remote control unit

Video Output:

1.0 Vp-p NTSC composite or 0.714 Vp-p NTSC non-composite (switchable), 75 ohms, BNC connector

Video Frequency Response:

Less than 4 MHz:

Horizontal Resolution:

+ 1 dB, - 2 dB Center: more than 500 lines Corner: more than 400 lines

+05 dB

Registration Error:

Within 80% of picture height: less than 0.2% Elsewhere: less than 0.4%

Geometric Distortion:

Within 80% of picture height: within 1% within 2%

Illumination Required:

Recommended: 150 footcandles at f/4

Minimum, with + 6 dB gain: 15 footcandles at f/1.8

Signal-to-Noise Ratio:

Test Signal Generators:

With recommended illumination, and without gamma and aperture correction: luminance signal 48 dB Self-contained color bar, focus wobble, and sawtooth signal generators

Automatic Light Control

Circuitry:

Color Conversion Filters:

Self-contained for Canon servo-iris lens Built into camera head, for 4000° K, 5600° K and 7500° K

**Aperture Correction:** Horizontal:

Vertical:

Self-contained, peaks at 2.9 MHz + 0.1 MHz, adjustable at camera head Optional, with AK-9620

Encoder:

**Operating Controls:** Remote/local switch Manual iris

Total pedestal Viewfinder selector R and B gain R and B pedestal Camera/color bar switch Beam on/off

+ 6 dB gain R and B horizontal centering

R and B vertical centering Two intercom jacks Power on/off

Tally Lights:

Top front and rear panel (requires external switching)

**External Sync Input:** 

From AK-9220 RCU only; signal consists of combination of SYNC and SC; switchable for camera cable, or one coax cable with BNC connector

**Operating Ambient** 

Temperature:

32° F to 104° F (0° C to 40° C)

**Operating Ambient Humidity:** 

Less than 90%

Dimensions (approx.): Weight (approx.):

10 3/8" (W) x 17 ½" (H) x 17 ¾" (D)

55 lbs. without lens

**AK-9320 VIEWFINDER** CRT:

5%" (measured diagonally) monochrome CRT

Resolution: Controls:

Brightness, contrast Rear panel LED (requires external

Tally Light:

switching)

\* Registered trademark of N.V. Philips' of Holland for TV camera tubes.

Line View Function:

Switchable with camera view; line view input from AK-9220 and

Display: Red, blue, green, R-G, B-G, NTSC

signals or white balance check (selectable at camera head) 25° up and down in each direction

Approx. 4 1/3" (W) x 3 1/4" (H)

Horizontal: less than 7%

Vertical: less than 5%

Sweep Geometry: Less than 5% Optional Accessories

**RBG Output:** 

**External Sync Input:** 

Line View Input:

Scanning Size:

Sweep Linearity:

AK-9220 REMOTE CONTROL UNIT (RCU)

Power Source: 120V AC, 60 Hz 30 watts Video Input:

1.0 Vp-p NTSC composite or 0.714 Vp-p NTSC non-composite,

75 ohms, BNC connector

Video Output: 1.0 Vp-p NTSC composite, 75 ohms,

x 2 BNC connectors 0.714 Vp-p NTSC non-composite,

75 ohms, BNC connector 0.714 Vp-p, 75 ohms, BNC

connectors: 1 line each Red, Blue

and Green

SYNC: - 4 Vp-p, 75 ohms or hi-Z,

**BNC** connectors

SC: 2 Vp-p, 75 ohms or hi-Z, BNC connectors, phase adjustable at RCU

1.0 Vp-p composite, 75 ohms or

hi-Z, BNC connectors 5-pin connector

Intercom, Tally Input: Operating Controls:

Power on/off

Cable length equalization

H phase SC phase Rand B gain

R and B horizontal centering R and B vertical centering

R and B pedestal Total pedestal Manual iris Intercom jack

Cable Equalization:

Camera cable: switchable for 50, 100, 300, 500, 700 and 1,000 ft. cable lengths

Coax cable: switchable for 100, 200 600, 1,000, 1,400 and 2,000 ft.

coax cable lengths

Tally Light: Front panel (requires external switching) **Rack Mounting:** Requires 3½" of vertical rack space in standard 19" racks

**Operating Ambient** Termperature:

32 °F to 104°F (0°C to 40°C)

**Operating Ambient Humidity:** 

Less than 90%

Standard Accessory: Tally/intercom 5-pin plug, 1 pc. **AK-9620 VERTICAL APERTURE CORRECTOR** 

Printed circuit board; plugs into AK-9120 6 MHz ±1 dB

Frequency Response of Video Signal:

Maximum Correct Level: 10 dB (adjustable) **AK-9720 RBG CABLE EQUALIZATION MODULE** 

Function:

Adds cable equalization to RBG signals; recommended when camera cable length is more than 100 ft. Controlled by cable equalization switch on AK-9220 RCU front panel

Control: LENSES

PV10X15BIE:

Flexible cable control zoom with servo-iris, lens extenders, neutral density filters and bayonet mount 15mm-150mm, f/1.8

Without Extender: With 1.67X Extender: With 2.5X Extender:

25mm-250mm, f/3.0 37.5 mm-375mm, f/4.5 18:1 and 25:1 also available Film chain lens, 75mm, f/4.0

Other Zoom Lenses: AK-9012: **CAMERA CABLES** 

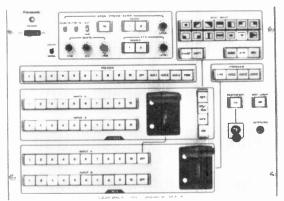
25A-50: 50 feet 25A-100: 100 feet

TRIPOD VP-300:

Deluxe, heavy duty tripod

## PANASONIC'S Broadcast Quality Color Production Systems

## Panasonic<sub>®</sub>



AS-6100 Special Effects Generator

For broadcast quality color production, Panasonic has a whole system of production equipment: the AS-6100 self-contained special effects generator; the AS-2000 chroma key generator; and the AS-1000 color sync generator. These units provide a broadcast quality production system and add versatile special effects capabilities.

#### AS-6100 SPECIAL EFFECTS GENERATOR

For a self-contained broadcast quality special effects generator, Panasonic introduces model AS-6100, the latest generation of advanced color video signal equipment. AS-6100 features ten video inputs, 4 input buses, two sets of fade/wipe levers, fourteen wipe patterns, positioner, spotlight, colorizer, two downstream key inputs, two external inputs plus auxiliary inputs. All this provides a wide variety of special effects for creative television programming.

This special effects generator is ideal for use with the Panasonic AK-920 and AK-750 broadcast quality cameras, and can be used with any NTSC color television production system. And because it is a self-contained special effects generator, it is also ideal for a mobile production unit

#### SWITCHING INPUTS AND WIPE MODES

For downstream mixing of up to three cameras with special effects, or just for simple set-ups, the AS-6100 has four input buses with two fade/wipe levers. AS-6100 accepts ten composite or non-composite video inputs, plus three auxiliary inputs for non-synchronous video sources, such as VTRs.

When any of the ten program inputs is not in use, it automatically produces a black burst when selected. All pushbuttons light up when pressed to show the inputs and functions selected. AS-6100 supplies intercom power and tally light switching for ten cameras.

The fourteen different wipe patterns can be adjusted with both the positioner and the wipe levers; they can also be used with sharp or soft edges. Wipes can be performed in the normal, normal-reverse,

#### AS-1000 Color Sync Generator



AS-2000 Chroma Key Generator



or reverse wipe modes.

There is also "spotlight" feature, adjustable in size and position with the wipe levers and positioner, for highlighting a particular area. This is done by reducing the A-bus signal by one half, thus "spotlighting" a particular subject in the B-bus signal.

#### **COLORIZING AND KEYING**

For versatile special effects, AS-6100 features two key inputs for external keying: chroma keying can be performed when the AS-2000 chroma key generator is used in conjunction with the AS-6100. The fully adjustable colorizer allows the addition of color to the background of the key signal. The two inputs for downstream keying can also be colorized and their edges highlighted, using hue, saturation and luminance controls. The downstream keyer can be keyed into the program by "CUT" or "FADE" modes.

The external key inputs can be "WIPED" into a program with any one of the fourteen different patterns.

#### **AS-2000 CHROMA KEY GENERATOR**

The AS-2000 chroma key generator adds an extra dimension of special effects to the AS-6100 SEG. It can also be used with other special effects generators that accept external key signals. Coarse and fine hue adjustments are provided by a rotary switch and variable resistor; the key signal delay is adjusted by a second variable resistor. Non-composite RGB inputs are required.

#### **AS-1000 COLOR SYNC GENERATOR**

The AS-1000 color sync generator produces broadcast-stable EIA RS-170 sync using a crystal oscillator. It also genlocks to incoming, non-synchronous composite video signals or composite sync. For studio adjustments it generates encoded EIA RS-189 and full field color bars with adjustable phase. AS-1000 also has a built-in subcarrier distribution amplifier to provide four subcarrier outputs: one with fixed phase and three with independently adjustable phase.

#### QUALITY ENGINEERING FEATURES

#### **AS-6100 SPECIAL EFFECTS GENERATOR**

- Vertical interval switching of 10 program inputs, 2 external key inputs, 2 downstream key inputs, and 3 auxiliary inputs for film chains, VTRs, etc.
- Downstream mixing of up to three cameras.
- Fourteen wipe patterns with soft/sharp edges; normal, normalreverse, and reverse wipe modes; wipe positioner; spotlight function.
- Wipe key; external key; downstream keyer.
- 5. Black burst on any of the ten program inputs.
- 6. Can mix composite and non-composite video inputs.
- 7. Effect, color Matte, three preview and three program outputs.
- Fully adjustable colorizer with hue saturation, and luminance controls: colorizes downstream keyer and background of key signal.
- Two sets of mix and effect pushbuttons and levers permit mixing of three inputs using downstream keyer.
- 10. Edge highlighting of downstream keyer.
- 11. Downstream keyer can be keyed into the program by "CUT" or "FADE" modes.

- Color Matte output can be connected to a program input for dissolves and wipes to an adjustable color background.
- 13. Self-contained unit allows use in mobile operation.

#### **AS-2000 CHROMA KEY GENERATOR**

- For use with AS-6100 or any other special effects generator that accepts external key inputs.
- 2. Keying hue selection adjustable through 360°.
- 3. Coarse and fine hue adjustments.
- Variable resistor adjusts key signal delay.

#### **AS-1000 COLOR SYNC GENERATOR**

- 1. Generates EIA RS-170 sync.
- Genlocks to incoming, non-synchronous composite video signals or composite sync.
- signals or composite sync.

  3. Generates encoded EIA RS-189 and full field color bars with adjustable phase.
- Internal subcarrier distribution amplifier provides four subcarrier outputs: one with fixed phase and three with independently adjustable phase.

## **PANASONIC'S Time Lapse Recorder**

## Panasonic.

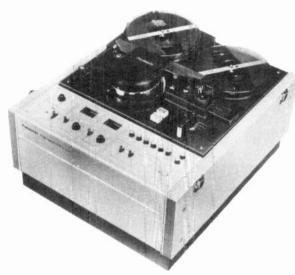
#### FEATURES:

- 1. Provides a continuous record of events lasting up to 108 hours.
- 2. Versatile system application: designed to mate with Panasonic sequential switchers WJ-506, WJ-507 and WJ-510. Deluxe model WJ-510 features alarm circuitry for sophisticated security applications.
- 3. Front panel time select pushbuttons for 1H (normal), 9H, 18H, 72H, 108H and 1 SHOT modes.
- 4. In 1H (normal) mode, tapes are recorded in accordance with the EIAJ #1 black-andwhite standard and are fully compatible with other EIAJ standard VTR's.
- 5. True time lapse system records 9, 18, 72 or 108 hours on a single 7" reel (2400 ft.) of video tape.
- 6. 1 SHOT mode records single pictures, one at a time. When used with a timer to provide momentary contact closure at specified intervals, maximum recording time can be greatly extended:

Number of sec- onds between each contact	Maximum recording time (approx.)
12	30 days
60	5 months
144	1 year

7. Complete stop action playback capability in 1 SHOT mode: the VTR plays back a single picture (one field) when the 1 FIELD button is pressed. To obtain a perfect still frame picture, the 1/3 FIELD button may be used to eliminate any noise on the screen.

#### Model NV-8030



- 8. Alarm mode permits return to normal (1H) or 9 H record mode when the alarm input is activated.
- 9. Activation of alarm mode by alarm sensor (door switch, etc.) or by WJ-510 Auto Alarming Sequential Switcher.
- 10. Alarm output (6V DC, 120 ohms) can be used to activate external devices (warning lights, buzzers, etc).
- 11. Unique alarm memory system permits rapid search of tape to find portions that have been recorded in alarm mode.
- 12. No disturbance of horizontal picture lines when the tape is recorded at low speed and played back at any higher speed.
- Audio record/playback capability in 1H, 9H and 18H modes.
- 14. Designed for high reliability, with three motor tape drive system, specially de-

- signed die cast chassis, ball bearings, and HPF<sup>TM</sup> video heads.
- 15. Maintenance timer shows elapsed operat-
- Trigger output for use with WJ-506, WJ-507 and WJ-510 sequential switchers.
- Sequential operation of up to three NV-8030's by cascade connection: when the end of tape is reached on one VTR, the next VTR is started automatically.
- Automatic gain controls for video and audio levels; manual control with illuminated level meters.
- V-pulse (switchable) can be added to video output during playback when needed for better stability.
- 20. Horizontal resolution 300 lines at center in normal (1H) mode.
- 21. Digital tape counter.

#### SPECIFICATIONS:

**Power Source:** Power Consumption:

AC, 120V, 60 Hz Approx. 75 Watts Video Recording System:

2 rotary heads, USA standards (525 lines, 60 fields)

Video Modulation System: Both sideband FM

Tape Speed:

Normal 1H: 7-1/2 i.p.s. 9H 5/6 i.p.s. 18H 5/12 i.p.s. 72H 5/48 i.p.s. 108H i.p.s.

Repetition Rate of Fields: 1H 1 field every 1/60 sec. Normal 9H 1 field every 0.15 sec. 18H 1 field every 0.3 sec.

72H 1 field every 1.2 sec. 108H 1 field every 1.8 sec.

Reel Size: 7 inches Tape Width: 1/2 inch Heads: Video:

2 rotary heads Audio/Control: 1 stationary

1 full track, 1 for audio dubbing

Recording/Playback Time: 60 min./9 hr./18 hr./72 hr./108 hr./1shot Fast Forward/Rewind Time: Less than 9 min.

Horizontal Resolution (monoscope test pattern) Frequency Response:

Signal-to-Noise Ratio:

More than 300 lines

Video: greater than 2.5 MHz Audio: 60~10,000 Hz

Video: better than 40 dB Audio: better than 40 dB

Input:

Video: min. 0.5 Vp-p

75 ohms unbalanced Audio: MIC 0.25mV (-72 dB)

600  $\Omega \sim \! 20$  K  $\Omega$  unbalanced AUX 0.056V (-25 dB) 220 K Ω unbalanced

Alarm Reset Input: +12VAlarm Input: Short 1 Shot Input: Short

Video: 1.0 Vp-p, 75 ohms, sync negative Audio: 1.0 Vrms, 300  $\Omega$  or less unbalanced Output:

Alarm Output: +6V DC, 120 ohms + 5V

Alarm Recover Output: Camera Switching Output: - 10V (Negative pulse) **AC Power Outlet:** 

AC 120V, max. 150 watts Dimensions: 16器"(W) × 13器"(H) × 19品"(D)

Weight: Standard Accessories: 430(W) × 336(H) × 500(D) (mm) Approx. 66 lbs. (30 kg) 7" empty reel (1 pc.)

VTR/TV connection cable, 5 ft. (1 pc.) Video splicing tape (1 pc.)

Head cleaner set (1 pc.)

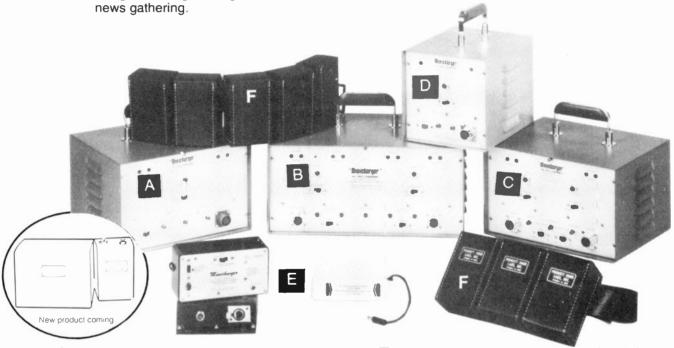
The specifications of model NV-8030 are for the NORMAL (1H) mode, unless otherwise specified.

## PERROTT ENGINEERING LABS, INC.

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## MINICHARGER® AND MINIPACKS® FOR ALL YOUR POWER NEEDS!

A 20-year record of reliability has been built into MINICHARGERS and MINIPACKS. This far superior line of equipment was developed under the finest standards of design and engineering. The result is an equipment line that has revolutionized



- The PE-74-1 MINICHARGER is designed to charge the battery for the Ikegama 35, or any double system.
- This is the PE-76 MINICHARGER, incorporating the largest charging capacity of the line. The PE-76 has been designed and engineered primarily for network, station and laboratory use. It will provide charge for two 30-volt units simultaneously, including double RCA's, double Thompsons, double Tashibas or a double-belt power system.
- The PE-74-2 MINICHARGER is engineered to charge any two single belt systems; two Tashibas, two RCA's or two Thompsons.

- The PE-74-4 is capable of charging any single belt system. The weight is only eight pounds!
- The PE-90 battery and charger is a team that has been going strong through the years. This compact battery is designed to power any Sony 3800, BVU 100 and BVU 50.
- The MINIPACK silver-zinc cell batteries will provide no less than three hours of camera power for the Sony, Hitachi, Ikegama, RCA, Thompson and others, as well as at least three hours for the JVC-4400, the VO-3800 and all other VTR's. Often, power life has run up to three to four times the power-life of any other battery on the market.

Speak directly to the company president. Call collect (703) 524-1668 for your needs

#### A PROVEN FAIL-SAFE VIDEO POWER SYSTEM



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## Alpha Mini Mixer

4-FADER STEREO AUDIO MIXER



 Substantial "Head Room" – Distortion Free Operation at 18 dbm Output

4 Inputs

 Response +/- 0.5 dbm 30 hz-20 KHz On Program Line

 Distortion—Less than 0.3% +8 dbm Output

 Plug-in Integrated Circuits Permit Replacement in Seconds

 Phone Amplifier with 10 Watts Output— Response +/- 0.5 db, 30-15,000 Hz— Distortion Less Than .5%

· Cue Position In All Channels

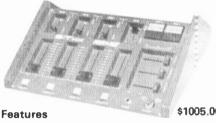
• 100% Solid State

 Crosstalk Between Channels Better Than —65 db

Back Lighted VU Meters

• Separate Bass and Treble Controls

## **Disco-Tech**4-FADER STEREO AUDIO MIXER



 Modern Slide Attenuators for Ease of Multiple Mixing

 Substantial "Head Room" – Distortion Free Operation at 18 dbm Output

8 Inputs – Switchable to 4 Faders

Response + /- 1.0 dbm 30 Hz-20 KHz
 On Both Cue and Program Lines

• Distortion – Less than 0.3% +8 dbm Output

 Plug-in Modules Permit Replacement and Interchange In Seconds

 Phone Amplifier with 10 Watts Output— Response +/- 1.0 db, 30-15,000 Hz— Distortion Less than .5%

· Cue Position In All Channels

100% Solid State

 Standard Unit Supplied with 8 Interchangeable Low Level and High Level Input Cards

 Crosstalk Between Channels Better Than —65

Back Lighted VU Meters

• Separate Bass and Treble Controls

· Remote Start Switch For Each Fader

#### **Custom 2 Turntable**

INSTANT START
PROFESSIONAL TURNTABLE



eatures

\$325.00

Turntable Powered By 60 Hz Synchronous Motor (Also Available In 50 Hz)

- Speed Change May Be Made While Platter Is Turning
- 45 RPM Adapter—Originated By QRK, Built Into Precision Platter
- Full 5.5 lb. Precision Platter Virtually Reduces Rumble

Speed Indicator Lights

- Instant Start (Full Speed In Less Than 1/16th Revolution)
- Rugged Construction With Only 3 Moving Parts
- Stereo Rumble Less Than -52 db (NAB Standard -35 db)
- Lifetime Guarantee Against Any Defects In Workmanship

• Full 1 Year Warranty On Parts

- Rim Drive Assures Minimum Rumble, Maximum Starting Torque
- . Two Standard Speeds: 33, 45

#### 12C Instant Start

BROADCAST PROFESSIONAL TURNTABLE w/320 tone arm, F-3 Cartridge, shelf base



\$305.00

#### Features

- Instant Start (Full Speed In Less Than 1/16th Revolution)
- Rugged Construction With Only 3 Moving Parts
- Stereo Rumble Less Than 48 db (Exceeds NAB Standards)
- Lifetime Guarantee Against Any Defects In workmanship
- Full 1 Year Warranty On Parts
- Rim Drive Assures Minimum Rumble, Maximum Starting Torque
- Three Standard Speeds: 33, 45, 78
- Turntable Powered by 60 Hz Synchronous Motor (Also Available in 50 Hz)
- Speed Change May Be Made While Platter is Turning
- 45 RPM Adapter—Originated by QRK, Built Into Precision Platter
- Full 5.5 lb. Precision Platter Virtually Reduces Rumble

#### S-260/S-320

#### Tone Arms

MICROPOISE PROFESSIONAL TONE ARMS



#### Features

- Tubular Construction
- Tracks At Less Than 1 Gram
- Tracking Error Under 1° Horizontal Movement
- 100% Shielding
- Open Front For Visible Location Of Stylus In Grooves
- Cartridge Shell Accepts All Standard Stereophonic or Monophonic Cartridges
- Meets Or Exceeds The Critical Requirements of Ultra-High Compliance Cartridges
- Clean Modern Design, Chrome Finish
- Made In USA
- Manufactured By A Company That Has Produced Quality Tone Arms And Turntables Since 1944
- Vertical Height Adjustment Permits Setting Tone Arm Parallel To Record Surface
- Resonance Below 10 Cycles With Average Pick-Up Virtually Dampened Out
- Separate Balance And Stylus Pressure Adjustment Easily Obtained By Rotation Of The Counter Weight Or Micropoise Knob
- Removable Shell For Ease Of Replacement Of Stylus

#### Alpha AC Speed Control



#### Features

- +/- 10% Speed Variation
- Can Be Remote Controlled
- Solid State
- Compact Low Profile
- No External Wiring Necessary

\$195.00

3650 Woodhead Drive, Northbrook, Illinois 60062 Phone: (312) 498-0700, Telex: 72-4362



#### SAMSON MINI FLUID HEAD\*

oad Capacity 20 lbs. (9.1 kg)	
ilt Angle ± 90°	
an Rotation	
Dimensions 4" × 5" × 6"	
(10.2 × 12.7 × 15.2 cm	)

4.5 lbs. (2.0 kg) Weight...

\$470.00 \*4-72800-2 Mini Fluid Head with Pro Jr. Base 470.00 4-72801-0 Mini Fluid Head with Ball Base 4-72802-8 Mini Fluid Head with Samson Column Base 470 00 4-72803-6 Mini Fluid Head w/Pro Jr. Base -470.00 No 3/8" Stud

(For use with 4-70150-4 Tripod) For ENG, E.F.P. and Cine applications. Use with any Samson tripod, pedestal or column.



#### SAMSON GEARED MOVIE HEAD #4-72612-1 \$145.00

Load Capacity. . . 15-25 lbs. (6.8-11.4 kg) 45° up, 90° down Tilt Angle . . . . .

MEADS

360° Pan Rotation.

6" × 61/2" × 71/2" Dimensions  $(15.2 \times 16.5 \times 19 \text{ cm})$ 

2 lbs. (1 kg) Weight.....

For 8mm or 16mm motion picture applications. Use with any Samson tripod, pedestal or column.



#### **SAMSON JUNIOR FLUID HEAD\***

Load Capacity	30 lbs. (13.6 kg)
Tilt Angle	± 85°
Pan Rotation	360°
Dimensions	4" × 6" × 6"
	$(10.2 \times 15.2 \times 15.2 \text{ cm})$
Weight	7.0 lbs (3.2 kg)

Weight . \$595.00 \*4-72850-7 Jr. Fluid Head with Pro Jr. Base 4-72851-5 Jr. Fluid Head with Ball Base 595.00 4-72852-3 Jr. Fluid Head w/Samson Column Base 595.00 595.00 4-72853-1 Jr. Fluid Head w/Pro Jr. Base No 3/8" Stud (For use with 4-70150-4 Tripod)

> For ENG, E.F.P. and Cine applications. Use with any Samson tripod, pedestal or column.



#### **SAMSON FRICTION HEAD\***

Load Capacity. . . 25-35 lbs. (11.4-15.9 kg) 45° up, 90° down Tilt Angle

360° Pan Rotation.

5½" × 6½" × 6½" Dimensions  $(14.1 \times 16.6 \times 16.6 \text{ cm})$ 

21/2 lbs. (1 kg) Weight

4-72011-6 Standard Counterbalance Spring (25 lb. cap.) \$85.00 4-72013-2 Heavy Duty Counterbalance

Spring (35 lb. cap.) 95.00 3/8" x 16 mounting screw available

on special order.

For Studio and remote applications. Use with any Samson tripod, pedestal or column.



#### HERCULES HYDRO FLUID HEAD\*

Load Capacity	50 lbs. (22.7 kg)
Tilt Angle	± 80°
Pan Rotation	360°

 $.6'' \times 5'' \times 6''$ Dimensions  $(15.2 \times 12.7 \times 15.2 \text{ cm})$ 

. 8.5 lbs. (3.9 kg) Weight

4-52810-3 Hydro Fluid Head with

Pro Jr. Base \$850.00 4-52811-1 Hydro Fluid Head with Ball Base 850.00 4-52812-9 Hydro Fluid Head with

Samson Column Base 4-52813-7 Hydro Fluid Head w/Pro Jr. Base

No 3/8 " Stud

(For use with 4-70150-4 Tripod) 850.00



For studio and remote applications.

Use with any Samson tripod.

pedestal or column.

#### SAMSON CAM HEAD #4-72300-3 **\$285.00**

Load Capacity . 40 lbs. (18.1 kg) Tilt Angle . . . . 30° up, 40° down

Pan Rotation . . 360°

81/2" × 61/2" × 41/2" Dimensions . . .

 $(21.6 \times 16.6 \times 11.5 \text{ cm})$ Weight 5 lbs. (2.3 kg)

1/4" × 20 Camera Mountings Screw. Adjustable Fore & Aft 31/2 "(8.9 cm) Mounting surface

 $3\frac{1}{2}" \times 6"$  $(8.9 \times 15.2 \text{ cm})$ 

3/8" × 16 mounting screw available on special order



#### SAMSON GEARED STILL HEAD #4-72512-3 \$155.00

Capacity.... 15-25 lbs. (6.8-11.4 kg)

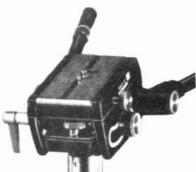
45° up, 90° down Tilt Angle. 15° Side Tilt

Pan Rotation. 360°

 $81/2" \times 61/2" \times 6'$ Dimensions .  $(21.6 \times 16.5 \times 15.2 \text{ cm})$ 

For studio photographic applications, Use with any Samson tripod, pedestal or

Prices and specifications subject to change without notice



**HERCULES CAM HEAD** #4-52304-9 \$470.00

Load Capacity , 80 lbs. (36.3 kg)  $35^{\circ}$  up,  $45^{\circ}$  down Tilt Angle

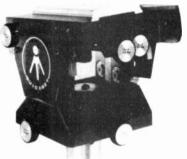
Pan Rotation . . 360°

Dimensions . . .  $5" \times 9" \times 10"$  $(12.7 \times 22.9 \times 25.4)$ 

. 21 lbs. (9.5 kg) Weight

For studio and remote applications. Use with Hercules tripod and dolly for remote, Hercules and Gibraltar pedestals for studio work.

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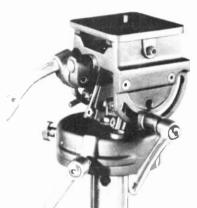
#### **HERCULES CAM HEAD** #4-52330-4 \$685.00

Load Capacity . 140 lbs. (63.6 kg) . Up to 50° up & down Tilt Angle . . . Pan Rotation . . 360° Dimensions . . 8½" × 9½" × 9½"

 $(21.6 \times 24.1 \times 24.1 \text{ cm})$ Weight 251/2 lbs. (11.6 kg)

Specify type of camera, lens, and teleprompter for Cam designation.

For studio and remote applications Use with Hercules tripod and dolly for remote, Hercules and Gibraltar pedestals for studio work.



#### HERCULES DUALOK FRICTION HEAD #4-52611-7 \$330.00

Load Capacity . Up to 50 lbs. (22.7 kg)\*

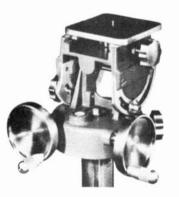
Tilt Angle 45° up, 90° down Pan Rotation . . 360°

Dimensions . . .  $6^{3}/4^{\prime\prime} \times 6^{1/2}^{\prime\prime} \times 5^{\prime\prime}$  $(17.1 \times 16.5 \times 12.7 \text{ cm})$ 

. 7 lbs. (3.2 kg) \*Choice of counterbalance springs

Hercules Movie Friction Head #4-52021-9 is the same as #4-52611-7 except for locking controls.

For studio and remote applications. Use with Hercules tripod and dolly or Hercules mobile pedestal.



#### **HERCULES GEARED HEAD** #4-52211-6 \$365.00

Load Capacity . 15-50 lbs. (6.8-22.7 kg)\* 45° up, 90° down Tilt Angle . . . .

Pan Rotation . . 360°

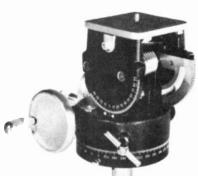
Dimensions . . .  $7'' \times 6'' \times 6^{3}$ /4"

 $(17.8 \times 15.2 \times 17.1 \text{ cm})$ 

Weight . . . . . 7 lbs. (3.2 kg)

\*Choice of counterbalance spring

For use with instruments where smooth uniform movement is required. Use with Hercules tripods, pedestal or column,



#### HERCULES CALIBRATED HEAD **#**4-52926-9 **\$775.00**

Load Capacity . 15-30 lbs. (6.8-13.6 kg)

Tilt Angle . . . . 45° up, 90° down

Pan Rotation . . 360°

Dimensions . . .  $7'' \times 6'' \times 6^{3}/4''$ 

 $(17.8 \times 15.2 \times 17.1 \text{ cm})$ 

Weight . . . . . 9 lbs. (4.1 kg)

Calibrations: Azimuth in 1° (0° 360°)

w/Verniers; Elevation in 1° ( + 90° -45°) w/Verniers, Verniers at

15 minutes

For precise instrument movement where adjustment and no backlash is critical. Use with any Hercules tripod, pedestal or column.



#### HERCULES AND GIBRALTAR CRADLE HEADS

#4-52451-8 and #4-62454-0 \$775.00

Load Capacity . 150 lbs. (68.2 kg) Tilt Angle ... 70° up. 40° down

Pan Rotation . 360°

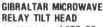
Dimensions . . .  $18'' \times 11'$ /4"  $\times 6$ /4"  $(45.7 \times 28.6 \times 15.9 \text{ cm})$ 

Weight . . 25 lbs. (11.4 kg)

The Hercules and Gibraltar Cradle Heads differ only in the size of the mounting

studs.

For remote and studio applications. Use with Hercules or Gibraltar tripods for remote. Use with mobile or counterbalance pedestals for studio



#4-62050-6 \$430.00

Load Capacity . 1,000 inch - pounds Fore on Tilt Axis

Tilt Angle 30° up, 38° down

Pan Rotation . . 360°

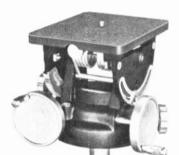
Dimensions . . .  $61/2" \times 61/2" \times 7"$ 

 $(16.5 \times 16.5 \times 17.8 \text{ cm})$ Weight . . . . . 30 lbs. (13.6 kg)

Calibrations: Azimuth in 1° (0°360°)

Elevation in 1° ( ± 45°)

For microwave relay application. Use with Gibraltar field tripod.



#### **GIBRALTAR GEARED HEAD**

#4-62225-4 \$775.00

Load Capacity . 50-200 lbs. (22.7-90.9 kg) Tilt Angle . . . . 53° up, 67° down

Pan Rotation . . 360°

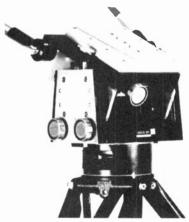
Dimensions . . .  $10'' \times 10'' \times 12''$ 

 $(25.4 \times 25.4 \times 30.5 \text{ cm})$ 

Weight . . . . . 18 lbs. (8.2 kg)

Model 4-62922-6 is the same as above with addition of calibrated pan and tilt. Model 4-62926-7 is the same as Model 4-62922-6 with addition of verniers.

For precise instrument movement where adjustment and no back-lash is critical. Use with Gibraltar tripods.



#### **GIBRALTAR CAM HEAD** #4-62302-1 \$1325.00

Load Capacity . 375 lbs. (170.5 kg) Tilt Angle . . . . ± 50° up & down

Pan Rotation . . 360°

Dimensions . . .  $13" \times 11" \times 10"$  $(33 \times 28 \times 25 \text{ cm})$ 

Weight . . . . . 46 lbs. (20.9 kg) Specify type of camera, lens, and

teleprompter for Cam designation.

For remote and studio applications. Use with Gibraltar Field Tripod for remote work. Use with counterbalance pedestal for studio work

## QuickSet A

## TRIPODS

SAMSON TRIPOD

#4-73010-7 \$195.00

3650 Woodhead Drive, Northbrook, Illinois 60062 Phone: (312) 498-0700, Telex: 72-4362



#### **HUSKY TRIPOD\***

Load Capacity . . Up to 17 lbs. (7 7 kg)

Height Extended

.... 57"-72" (144.8 182.9 cm)

Height

Telescoped . . 23"-31" (58.4 78.7 cm) (Dependent on model)

Column Rise . . . 16" (40.6 cm)
Tilt Angle . . . . 60° up. 90° down

Pan Rotation . 360°

Weight . . . 7 lbs. (3.2 kg)

\*5 95534 9 2 section legs 5 95542 2 3-section legs 5 95549 7 4-section legs 150.00

All have anti-drop columns and counter balanced heads included.

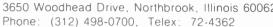


For remote or studio applications. Use with Husky dolly for mobility.





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#### HERCULES TRIPOD WITH ELEVATOR

\$425.00

#4-53021-8

Load Capacity . 150 lbs. (68.2 kg)

Maximum

Height.... 73"(185.4 cm)

Minimum

Height 33"(83.8 cm) Column Rise . . 18"(45.7 cm) Weight ..... 19 lbs. (8.6 kg)

A 3/4 size version is available under #4-53220-6.

55"(139.7cm)

Height . . . . 26" (66.0 cm)

For studio or remote application, Use with any Hercules panhead, Dolly provides mobility.



\$775.00

Load Capacity . 200 lbs. (90.7 kg)

Height. . . . . 85" (215.9 cm)

Height .... 42"(106.7 cm) ..... 42 lbs. (19.1 kg)

> A 3/4 size version is available under #4-63120-6.

Maximum

Height . . . . 65" (165.1 cm) Minimum

Height . . . . 30" (76.2 cm)

For studio and remote applications Use with any Gibraltar panhead

#### GIBRALTAR HEAVY DUTY FIELD/STUDIO TRIPOD \$525.00

Load Capacity . 400 lbs. (181.8 kg)

Maximum

Height. . . . . '?1/2" (108 cm) Minimum

Height . . . . 25% "(64.8 cm) Weight . . . . . 24 lbs. (10.9 kg)

For studio and remote applications. Use with any Gibraltar panhead.

## DOLLIES





#### HERCULES AND GIBRALTAR DOLLIES

#4-56020-7 \$235.00

500 lbs. (226.8 kg) Load Capacity . . Wheel Size Diameter .

 $4'' \times 1'' (10.2 \times 2.5 \text{ cm})$ Wheel Circle Diameter . . . . 45"(114.3 cm)

7" × 13" × 28" Folds to .....  $(17.8 \times 33.0 \times 71.1 \text{ cm})$ 

The same dolly w/4" wheels is available in a 3/4 size ver

sion under #4-56100-7. \$235.00







Load Capacity........... 500 lbs. (226.8 kg) Wheel Size Diameter . . . . .  $8" \times 1\frac{1}{2}" (20.3 \times 3.8 \text{ cm})$ 

 $(27.9 \times 33.0 \times 71.1 \text{ cm})$ 

Weight . . . . . . . . . . . . . 41 lbs. (18.6 kg)

sion under #4-56160-1. \$510.00





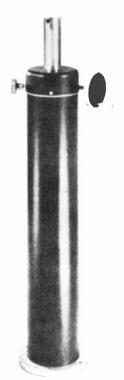


PEDESTALS

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#### SAMSON STATIONARY PEDESTAL #4.78100.1 \$220.00

Load Capacity 25 lbs. (11.4 kg)
Maximum Height 48" (121.9 cm)
Minimum Height 30" (76.2 cm)
Weight 10 lbs. (4.5 kg)

#### HERCULES STATIONARY PEDESTAL \$360.00 #4-58001-5

Load Capacity	8	0	lbs. (36.4 kg	
Maximum Height	5	0	" (127.0 cm)	
Minimum Height	3	2	" (81.3 cm)	
Weight	1	2	lbs. (5.5 kg)	

## GIBRALTAR STATIONARY PEDESTAL \$550.00 #4-68000-5

Load Capacity	200 lbs. (90.7 kg)
Maximum Height	52" (132.1 cm)
Minimum Height	32" (81.3 cm)
Weight	20 lbs. (9.1 kg)

For fixed locations. Use with any panhead from respective category

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#### HERCULES MICROSCOPE STAND \$265.00 #4-59750-6

Load Capacity. . . . . 25 lbs. (11.4 kg) Horizontal Reach. . . . 12" (30.5 cm) Maximum Height . . . 31" (78.7 cm) Minimum Height . . . . 13" (33 cm) Weight........... 10 lbs. (4.5 kg)

Mounted on Base (Optional) #4-59800-9

Dimensions . . . . . .  $20'' \times 28'' (50.8 \times 71.1 \text{ cm})$ 



#### SAMSON ELEVATOR COLUMN UNIT #4-79000-2 \$130.00

Load Capacity . ..... 25 lbs. (11.4 kg) Maximum Height . . . . 24" (60.9 cm) Minimum Height . 6"(15.2 cm) Weight . . . . . . . . 6 lbs. (2.7 kg)

#### HERCULES ELEVATOR COLUMN UNIT #4-59001-4 \$250.00

Load Capacity . . . . . . 80 lbs. (36.4 kg) Maximum Height . . . . 24" (60.9 cm) 



#### SAMSON STATIONARY COLUMN UNIT \$145.00

#4-75810-8

(includes side arm & head)

Load Capacity... 15 lbs. (6.8 kg) Maximum

Height. . . . . . . 30" (76.2 cm)

Minimum Height . . . . . . 12"(30.4 cm)

.... 8 lbs. (3.6 kg)

Weight . . .

Horizontal Reach........ 10" (25.4 cm)

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WE'RE KNOWN BY THE COMPANIES WE REP

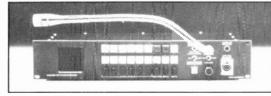
601 south main street, spring valley, new york 10977 (914)356-3700 telex 996534



## "TW" INTERCOM SYSTEM MASTER STATION—SERIES 800 IN-LINE MICROPHONE PREAMPLIFIER HIGH PERFORMANCE MICROPHONE MIXER



SPK-20RM



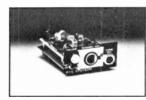
801



BP-102



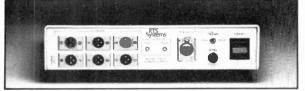
5BF-202



SCR-110



1400



PS-10



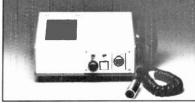
2CRM-L



DT-108



DT-109



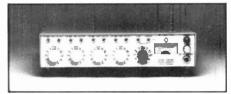
SPK-10-L



SETCOM SINGLE



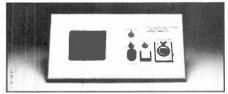
SETCOM DUAL



HPM-41



CM-102



WM5-102

The TW Intercom System is a high performance closed-circuit intercommunications system designed for entertainment and industrial operations. The system arrangement can be customized from a variety of user stations (some are shown above) TW features include: up to 50 units on line without loading; flashing call light; adjustable sidetone; powerful headphone amplification; carbon dynamic mic headset capability, mic level limiting; and two (or more) charine! operation. Our refined Phase III circuitry permits a 12 volt battery power source, low-cost multi-channel operation; dry line capability, two-, three-, or four-wire configurations; increased operation range; balanced line options, and a variety of custom adaptations. The system is completely field serviceable and handsomely packaged, providing super service under the toughest conditions. We also offer a series of interface units for coupling RTS systems with other brand intercoms, cameras. and telephone lines. In addition, RTS produces the Model 801 Master Station, a multi-functional communications control

center with six intercom channels, two IFB circuits, two SA circuits, a built-in flexneck microphone and speaker, and a variety of outstanding capabilities.

The Model 1400 In-Line Microphone Preamplifier is a battery powered, high performance device featuring super specifications in a durable, compact housing. RTS professional equipment also includes our new HPM-41 Microphone Mixer. This high-performance device offers four inputs with switchable attenuation and lo-cut filters; overall limiter: peak indicating LED; powerful headphone amp; AC / battery power, line level and mic level outputs, transformer-balanced inputs and outputs; AB microphone power; phantom powering; and outstanding electrical specifications. For more information cail or write



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## AUDIO EQUIPMENT THAT <u>DEFIES</u> COMPARISON — PRICE OR PERFORMANCE

The headline above is not just another hollow advertising claim. It is simply a statement of facts. A fact that started out as a goal over eight years ago and is the result of both an intensive developmental program and an ongoing awareness of your, the broadcasters, needs.

The products shown on these pages are but representative examples of over 150 items manufactured or sold thru RAMKO RESEARCH. From turntables, audio consoles, distribution amplifiers, and audio switchers to cart machines, tape winders and mic and line amplifiers.

We openly encourage your comparison with anything else on the market. Write, wire or call COLLECT for further information. Better yet, take advantage of our 2 week trial offer and prove us to yourself. We will both come out ahead.

Sincerely,

RAY KOHFELD

President/Director of Engineering

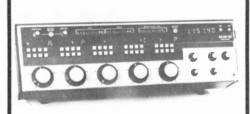


TURNTABLE PREAMPS. Leaders in their field. MP-8 & SP-8 — Bal. out; 0.05% dist.; 68dB gain; +8dBm out (+21dBm max); S/N —77dB down ref. to 12mv in @ 1kHz & +8dBm out. ±1dB RIAA, remote scratch & brilliance activation. Mono, stereo, table top, and rack mount versions. \$98 to \$166.

ESP-38 — Bal. out; 0.03% distortion; S/N, —85dB down referred to 12mv in @ 1kHz and +8dBm out; ±0.5dB RIAA; remote & local scratch, brilliance, rumble filter and mono activation; +8dBm out (+21dBm max.), +60dB gain. Left & right Hi/Lo equalization trimmers and recessed level controls. Built-in turntable remote start/stop relay. Stereo only. Price — \$325.



AUDIO DISTRIBUTION AMPLIFIERS. Available in 12 different rack and table top versions. All inputs and outputs may be used balanced or unbalanced and in any combination on the same amplifier. All outputs are individually amplifier isolated and will work into any load over 125 ohms without change in distortion or response. Response 10Hz to 30kHz,  $\pm$ 0.5 dB. Distortion 0.1% or less. Hum and Noise 98dB down referenced to  $\pm$ 20dBm out. Channel separation —75dB. DA's start as low as \$145 for our 1x30 mass feed model, thru our 1x6 line and mic level units, to our modular 20x80 rack mount design. No need to pay more or settle for less. Price —\$145 to \$2,276.



DC38 SERIES AUDIO CONSOLES. Outstanding versatility and advanced technology. Unparalled features such as 4 inputs per mixer, high Z balanced bridging inputs accept mic level thru high level, patch-panel input gain select, DC control of all audio, back lit alpha numeric readouts above each mixer, solid state LED VU meters, dual channel (plus mono mixdown channel on stereo), solid state switching and muting for noiseless operation, selectable muting, plug in electronics, and optional built in Clock/Timer. Available mono or stereo and 5, 8, or 10 mixer versions. 4 year warranty with 2 week trial period. Price — \$2,400 to \$4,980.



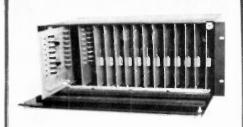
DC-12 SERIES AUDIO CONSOLES. A remote control console with low profile control head and rack mount electronics that may be located up to 90 feet away. Features 2 inputs per mixer, silent illuminated touch switches, dual channel (plus mono mix down channel on stereo), solid state LED VU meters, DC control of all audio, patch panel input gain select, selectable solid state muting and switching, slide faders with dual cue entry and plug in electronics. Since the DC-12's are totally modular you may order any number of mixers and add on later. Twelve channels may be accomodated and an additional 8 may be added via the DC-12 extender. 4 year warranty. Price — \$4,700 to \$5,900.



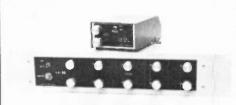
SC-5, DC-5, & DC-8 SERIES AUDIO CONSOLES. This series of consoles, whether single or dual channel; table models or rack mount; 5 or 8 mixers, mono or stereo, feature illuminated touchpad audio select switching, solid state LED VU meters, Simul-Q monitoring capability, full-range gain selects on each input, selectable solid state cue and monitor muting on all channels, and plug-in electronics. DC control of all audio with built-in relays for on-air lights and aux. muting. Options include 4 and 8 channel extenders, Simul-Q latching and remote control of AC equipment. These popular consoles have recently been up-dated to incorporate many new features. Price — \$864 to \$2,298.



PORTABLE CONSOLE. P5M — A full 5 mixer audio console in miniature. Bal. in & out, 8 inputs, 3 of which are mic/line selectable & individual compressors on mic channels #1 & #2. Tone gen., cue and monitor feed with gain controls & phones select with gain control. Last 3 channels equiped with Q switch & the first 2 channels provide muting. A folding stand is part of the unit and may be removed for rack mounting. +8dBm out nominally (+18dBm max); ±2dB, 20Hz to 20kHz; S/N —75dB high level and —62dB mic level. Max gain of 90dB and distortion of 0.3%. Compression/limiting range of 35dB and a slope of 50:1. 934" W x 9½" D x 3½" H. Price — \$545.



AUDIO ROUTER/ AMPLIFIER. The most versatile, feature loaded switcher on the market. Plug in cards for up to 16 inputs & 12 outputs. Each input has an amplifier and level adjust for attenuation and up to 17dB of gain. Output cards feature dual bal. 600 Ohm outputs, momentary BCD coded controls (may be slaved from other locations), LED output status lights show thru the front panel, and on-board mono/stereo select switch. A smoked plexiglass front panel allows the operator to tell the status of any output. Also on the front panel are 2 rows of silent momentary contact switches. One row for output selection & one row for input select. Contact RAMKO for further information and specs. Price \$\infty\$716 \\$2,108



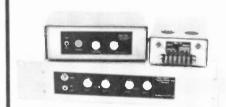
LINE AMPLIFIERS. The ideal solution for your line level problems can be found in one of the 4 different models offered. LA-2 (table top or rack) and LA-55/10M: mono or stereo, balanced or unbalanced high impedance inputs, +21dBm maximum input level, +21dBm maximum output into 600 ohm balanced line, frequency response +0 —1dB 10 Hz to 50kHz, distortion 0.008% at +8dBm out. The LA-2 is a 2 channel amplifier. The LA-55/10M is a modular rack mount unit with up to 5 stereo or 10 mono channels. The LE-3 is a 3 channel mono line amplifier with equalization for high and low frequencies and is also modular. Gain of all units, variable to +20dB. Price — \$16 to \$469.



DUAL MIC COMPRESSOR/AMPLIFIERS. Portable dual mono & stero mic limiters that amplify, mix, limit and control gain. The DML-dual mono is used where 2 separate mics must be independently amplified and compressed and mixed into a common 600 ohm output. Primary and backup batteries (or an optional AC supply). Includes tone generator & talkback ability. The DML-1S is an AC powered, stereo version. Input: —60dB nominal, —18dB max. Gain: 90dB max. Limiting Output Level: DML-2M, +10dBm. DML-1S, +18dBm or +8dBm. Balanced Inputs and Outputs. Dist.: 0.3%. Attack Time: 2 microseconds. Noise: 60dB below limiting output. Size 2½" H x 5½4" W x 8½" D. Price — \$239 to \$274.



MIC/LINE AMPLIFIERS. Dual function for microphone or line. The MLA series are ideal for remote broadcasts, churches, mixer expansion, emergency situations. Front panel controls for mic or line selection and level. Mic input —60dB in for +4dBm out. Line input balanced bridging with gain variable +2ddB.—18dBm in provides +8dBm out with an additional 13dBm of headroom. Distortion is 0.1% or less. Response: Mic channel ±2dB 20Hz to 20kHz. High level channel: ±1dB 5Hz to 30kHz. Inputs may be used bal. or unbal. XLR Mic connectors. Single or dual channel, table top or rack mount. Price —\$128 to \$195.



STUDIO MONITOR AMPLIFIERS. Exceptional reproduction with high performance and versatility. 7 different models to choose from. MA-7 (mono), MA-14 (stereo): 5W per channel into 8 ohms. Response: +0, —2dB 20 Hz to 19kHz at rated output. Distortion: 0.4% max. at 1kHz and rated output. Input: 5k unbalanced, 0.7V in for max. output. Table top or rack mount. 25W RMS per channel into 8 ohms. Inputs: high Z balanced bridging. Response: ±1dB 15Hz to 90kHz at rated output. Distortion: 0.6% at rated output. Built in muting circuit with input and output level controls and bass contour adjust. Price — \$96 to \$269.



AUTOMATIC CARTRIDGE & CASSETTE LOAD-ER. Precision wind your own carts and cassettes and save up to 40% on reloading costs. The ACL-25/E is simple to use, just dial in the time desired and push the run switch. The ACL stops automatically, precisely to —O, +1 second of playback time. The exclusive playback speed selector ends mental gymnastics figuring tape length versus playback speed. Simply set the selector to 17/8, 33/4, or 71/2 i.p.s. and the ACL does the rest. An optional cassette adaptor enables you to wind both carts and cassettes on the same machine. An optional pancake adaptor is also available. The ACL-25/E has a nominal winding speed of 30 i.p.s. Price \$325.



TECHNICS PROFESSIONAL SERIES BY PANA-SONIC. Ramko Research is proud to be one of the largest distributors of this extraordinary equipment. The SP-10MKII and the SL-1500-MK2 Turntables have set new standards by which turntables will be judged for many years. These direct drive units with Quartz-phase locked speed control maintain speed within 0.002%. Wow and flutter is 0.025% WRMS and Rumble —73dB. Also available are reel to reel tape recorders, portable and fixed cassette R/P units, power amps, parametric equaliziers, tuners, and a series of studio monitor speakers that will astound you with their phase-linear reproduction.

## OTHER PRODUCTS OFFERED BY RAMKO

TELEX

Cart Machine

**FIDELEPAC** 

Cartridges, erasers, storage racks, alignment carts, etc.

NAGY

Splicers

**TECHNICS** 

Complete line



11355 "A" Folsom Blvd. Rancho Cordova, Calif. 95670 (916) 635-3600

"YOUR KEY TO QUALITY"

## A Lasting Answer

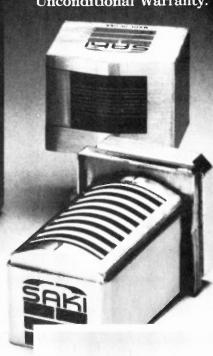
For Your Studio and Duplicating Head Requirements.

## Think Ferrite

Ferrite heads are available for Ampex, Electro Sound, Mincom, Scully and major studio and duplicating recorders. 10 times the life of a metal head. Saki heads are available in all track formats. There are thousands

of hot pressed glass bonded Saki Ferrite heads in field service all over the world. And of course, we still make high quality metal heads.

Unconditional Warranty.





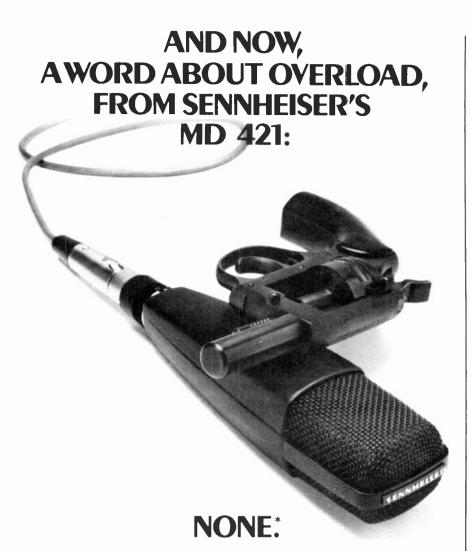
SAKI MAGNETICS INCORPORATED

(A California Corporation)



Stereo Cassette Head

1649 12th Street • Santa Monica, California 90404 (213) 450-1551



A lot of engineers are worried about overload these days. And no wonder: Rock groups. Country groups. Jetports. And other high program and ambient sources make it more

necessary than ever for microphones to be overload-free as well as accurate.

Like our tough MD 421 cardioid dynamic.

In this test with a starter's pistol, we measured an instantaneous sound-pressure level of some 175 dB—well beyond what any musical instrument or voice can produce - while the oscillogram measured no clipping or ringing.

Whether you need a microphone to capture transient sound like this pistol shot.

or "face the music" on stage at 130+dB in a disco or recordina session, consider our MD 421. You'll discover its precise cardioid directionality, rugged design and wide, smooth response are ideal for rock-concert, recording and broadcast applications.

The price won't overload you either.

\*Outdoor test with Tektronix scope, set for 10V/division vertical, 01 ;isec/div horizontal 22 cal starter's pistol mounted 15 cm from MD 421 measured pressure of 111,000 dynes/cm² (175 dB SPL) Smooth, rounded scope trace indicates total lack of distortion

10 West 37th Street. New York 10018 (212) 239-0190

Suggested profesfesional user's net price ..... \$265.00

Please ask for the nearest Sennheiser distributor by calling:

> (212) 239-0190 (EAST COAST)

> > OR

(213) 877-4424 (WEST COAST)

The MD 421 is just one of the many products developed and manufactured by Sennheiser. Technical and price information for other Sennheiser microphones and headsets will be gladly furnished upon request.



### MICROPHONES AND ELECTRONIC COMPONENTS

AREA CODE 312/866-2200 + CABLE: SHUREMICRO TWX: 910-231-0048 TELEX: 72-4381



Model SM7: A dynamic microphone with a very smooth, flat, wide-range frequency response; cardioid polar pattern, uniform with frequency and symmetrical about the axis; internal "air suspension" shock isolation; highly effective pop filter; extremely good rejection of electro-magnetic hum due to a built-in hum rejection system; bass roll-off and mid-range emphasis. The Model SM7 was field-designed to be the finest dynamic microphone available for music recording and reproduction.

Model SM11: The Shure Model SM11 is a miniature dynamic lavalier microphone designed for use in television broadcasting (on-camera), sound reinforcement, in certain radio and motion picture applications, and similar uses where a small, professional-quality, versatile microphone is required. Flat, natural response, tailored for lavalier use: 50 to 15,000 Hz.

Model SM11 . . . . . . . . . . . . . . . . . \$66.60

Model SM33: A compact and rugged unidirectional ribbon microphone combining wide range response and a supercardioid directional pattern. The performance characteristics are ideal for studio use in broadcasting and recording and for critical sound reinforcement applications. Built-in shock mount for quiet operation. Slotted Response Selector Switch. Frequency response: 40 to 15,000 Hz.

Model SM33 .....\$219.00

Models SM53 and SM54 are designed for professional applications requiring the ultimate in sound quality and control. Broad, smooth frequency response: provides clean, natural reproduction of both voice and music. Cardioid directional pattern: Integral acoustic "pop" filter on the SM54. Mechanical noise isolation. Type: Dynamic. Frequency Response: 70 to 16,000 Hz

Studio Gradient Model 300 is a bidirectional microphone for recording, broadcast and sound reinforcement which provides sound pickup at the front and rear of the microphone, but greatly reduces pickup at the sides. Features: Voice-Music switch, vibration-isolation unit mounted in live rubber, multi-impedance switch. Frequency response: 40 to 15,000Hz.

Model 300 .....\$150.60

**Gradient Model 315S:** Microphone feature frequency response of 50 to 12,000 Hz that reproduces voice and music in a clear, natural tonal quality. Bidirectional "Figure 8" pickup pattern.

Uni-Ron® Unidirectional Model 330: Highly recommended for motion-picture, TV, radio and professional recording studios; patented "Uniphase" system; the true super-cardioid pickup pattern; a ribbon transducer provides extended smooth response of 30 - 15,000 Hz; multi-impedance switch; lifetime swivel; vibration-isolation unit mounted in live rubber.

Model 330 .....\$123.00

Model SM82 hand-held, self-contained, unidirectional, condenser microphone containing its own line level amplifier, peak limiter, and battery. It is designed to provide a line level output for use in a variety of broadcasting situations, and in sound reinforcement or recording applications where a line level microphone with a built-in limiter is required. Frequency Response: 40 to 15,000 Hz. Output Impedance: 250 ohms actual (designed for use with 600-ohm or greater loads)

Model SM82 .....\$215.40

Model SM58 is a rugged unidirectional dynamic microphone; self-contained spherical filter to control explosive breath sounds and wind noise; unusually effective cardioid pickup pattern to minimize background noise and undesirable effects of studio and location acoustics. Rear and side rejection uniform to very low frequencies and completely symmetrical about microphone axis; bright, clean sound; cartridge shockmounted for protection and quiet operation; wind and "pop" filter readily removable for cleaning or replacement. Frequency response: 50 to 15,000 Hz

Model SM58 .....\$138.00

Model SM59 cardioid dynamic microphone. Essentially flat, wide response. 50 to 15,000 Hz. Patented Mechano-pneumatic shock mount system. Built in "pop" filter, and hum-bucking coil. Durable construction. Ideal for speech, vocal and instrument pick-up, for broadcast, recording and sound reinforcement uses.

Model SM59 . . . . . . . . . . . . . . . . . \$144.00

Model 50AC Telephone Acoustic Coupler, designed to acoustically couple recorded information into a telephone transmitter. May also be used in real-time broadcast applications. May also be used as a tape recorder microphone; its frequency response approximates that of a telephone. Is easily attached and removed from a telephone handset. The Model 50AC consists of a dynamic transducer cartridge in a small, lightweight molded rubber and plastic case. Frequency Response: 300 to 3,000 Hz.



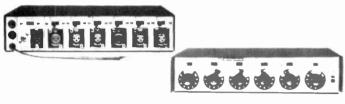
### MICROPHONES AND ELECTRONIC COMPONENTS

AREA CODE 312/328 9000 . CABLE: SHUPEMICRO



## **MODEL M67 PROFESSIONAL MICROPHONE MIXER**

The M67 features balanced 600 ohm line and microphone level outputs; an illuminated VU meter calibrated for +4 and + 10 dBm out; extremely low noise and RF susceptibility; wide, flat frequency response; two-level headphone monitor jack. AC or battery operation (see battery pack and other accessories on following page). Noiseless automatic switchover to battery if AC line fails. ..... \$232.80



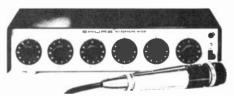
### **MODEL M677 ACCESSORY MIXER**

A transistorized, six input accessory mixer designed for use with Shure M67, M68, M63 or SE30. When used with either M67 or M68, it provides a low-cost and convenient means of adding six additional input channels (10 total). When used with M63, provides a six channel mixer with extremely flexible equalization, a 600-ohm output, a VU meter and a headphone monitor. With SE30, it converts the three-input mixer system to a nine-input system. Obtains power from associated Shure Miser or Battery Power Supply (A67B). Dimensions: 69.9mm H x 289mm W x 178mm D (234" x 11-3/8" x 7") Weight: 17 kg. (3% lbs.)

MODEL M677 - Requires 30 V.D.C. from Units such as M67 or 

MODEL M68 & M68FC

**MICROPHONE MIXERS** 



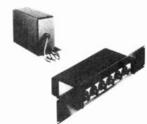
M68 & M68FC Microphone Inputs. The backs of the M68 and M68FC Mixers have four Cannon-type inputs. Model M68 has MALE Cannon XLR-3-14 input connectors (uses XLR-3-11C type mate). Model M68FC has FEMALE Cannon XLR-3-13 type (uses XLR-3-12C type mate). Each input accepts a dynamic or ribbon microphone (not recommended for crystal or ceramic microphones), either high or low impedance (balanced or unbalanced). Input impedance for each microphone is selected by a slide switch so that microphone types and impedances can be mixed. A fifth input, labeled "AUX," is high level and accepts a tape recorder or tuner signal. When used in conjunction with the A68P Phono Pre-Amp accessory, these mixers also accept a magnetic or ceramic phonograph signal.

......\$126.60 

**A67B Battery Power Supply** for M63, M67, M68RM, M68RM 2E, or M688 May be used as sole power source. On the M67 it may also be used as standby during AC opera tions providing noiseless switchover in case of AC failure

A68R Rack Panel Kit-Standard 19" x 31/2" audio equipment rack panel for use with all circuitry except M625 units. Gray Ham mertone finish.

A68R-BL Rack Panel Kit-Same as Model A68R (above), except black finish \$12.45



## Microphone Mixers



A new concept in economical total control of audio response. Can be used in production and transfer studios to equalize sound systems, correct room acoustics, produce special sound effects, reduce stand or stage noise, and for tape recording and duplication. Has two high-level inputs and five output provisions for the greatest response control and flexibility available. Effective, continuously variable high-pass and low-pass 6 db-per-octave filters, plus separate bass and treble (boost and cut) controls, can be combined for virtually unlimited response characteristics. Output VU meter. Five outputs: high impedance, high level, high impedance mic level, 600-ohm balanced line, and headphone. Two high-level high impedance inputs controlled by single input attenuator accept signal from virtually any high level source. For 108-132 Volts A.C., 50-60 Hz. .... \$147.60





### MODEL SE-30 GATED COMPRESSOR MIXER

High-quality, "hands-free" gain riding compressor in a single, portable unit. Makes output control in remote pickups, talk shows recording program line compression and professional sound reinforcement smoother, surer and more trouble-free than it's ever been before. Features, such as: feedback-type gain controls that automatically increase the input clipping level as the individual gain controls are turned down; a built-in low-distortion 1 kHz tone oscillator; three-function VU meter; stereo parallel jack, self-contained battery and AC power supply, with automatic switch-over to battery in case of AC failure; auxiliary meter light source for battery operation; removable AC line cord; disable switches for compressor and Gated Memory that convert the SE30 to a high quality linear mixer.

SE-30 ...... \$454.80 A100B Rack Panel 3½ x 19"..... \$16.20

## MODEL M625 **VOICEGATE**



Voice-activated microphone gain controller with response-shaped voice-frequency sensor. Blocks unwanted background noise. Adjustable to keep microphone "On" up to 30 seconds during conversation pauses. Professional three-pin audio connectors: Female input and Male output.

Model M625. For 120 volts AC + 10%, 50/50 Hz, and can also be powered by a 9- and 30-volt external DC source. . . . . . . . . \$137.40

Model M625AM is a "modular" unit which takes its power from the M625. (One M625 can power three M625 AM units for a total of 

## **PREAMPLIFIERS**



For 108-132 volts AC. 50/60 Hz. . . . . . **\$70.00** 

M64 SERIES STEREO Low-cost, versatile, compact, low distortion, and low noise stereo preamplifiers that provide gain, qualization, and choice of output impedances and levels. Can be used in a broad variety of preamplification and equalization applications: as a high-quality, low-cost magnetic phono preamplifier in broadcast applications; to provide 71/2 IPS NAB equalization for tape decks containing no electronics; to give nonequalized amplification wherever a boost in microphone output level is required. When used in conjunction with the A95 Series In-Line Transformers, an output of approximately 20 dbm is available.

## SMPTE Time Code Generators & Readers

## Time Code Generator TCG-80N Features:

- Full User Data facilities.
- Thumbwheels set Time and User Data.
- Full Frame or Drop Frame modes.
- High level output is capable of feeding multiple machines.
- Self-contained Video Character Generator (Option 003).
- Low power consumption: 5 watts.
- Unaffected by momentary power dropout.
- LED display with contrast filter.

## Time Code Generator TCG-70N Features:

- Same as TCG-80N except:
- Thumbwheels set Time in Hours & Minutes; Hours, Minutes & Seconds are displayed.
- User Data information can be accepted from an external source (Option 001).

## Time Code Reader TCR-80 Features:

- Displays Time and User Data, plus Drop Frame mode.
- Reads code from hand turn reel speed to 40 times play speed.
- Low level wide band head pre-amplifier, and wide dynamic range AGC.
- Digital decoding techniques.
- Retains and displays last code read when machine is stopped.
- Error detection and bypass.
- Self-contained Video Character Generator (Option 013).
- Low power consumption: 5 watts.
- LED display with contrast filter.





Specifications: TCG-80N & TCG-70N

Reference Input: Composite Video or Sync, loop thru.

Time Code Output: 1 ea. transformer isolated, balanced, +8dBm.

Power: 5 watts, 100-130VAC. 9 w. with Video Char Gen (TCG-80N only).

Size: Rack mount, 13/4" x 141/2".



TCR-80 \$2100

Specifications: TCR-80 High Level Code Input: - 10 to +8dBm, 600 Ohms, balanced.

Low Level Code Input: Direct connection to head, current mode input.

Power: 5 watts, 100-130VAC. 9 w. with Video Char Gen. Size: Rack mount, 13/4" x 141/2".

## Video Character Generator: Option 003 & 013 Features:

- Has integral kever that can simultaneously insert User Data and Time code in selected positions into the video of a work print or on a monitor. Is installed into, and powered by TCG-80N & TCR-80.
- Remote control panel is supplied for User Data &

### Time On/Off and Hold.

 Rear panel controls for Insert background and Character luminance level. Display position selector can be remoted.

Video Input: 1 Vp-p, loop thru. Video Output: 2 ea. at 1 Vp-p, source terminated, 75 Ohms.

## **Options**

TCG-80N TCG-70N TCR-80	
<ul> <li>— 001 — User Data Input Module to input Data from an external source. Data format: 32 bits parallel.</li> </ul>	\$270.
002 — — Data Input Module for External "Jam" Sync. Data format: Skotel byte serial.	\$135.
<ul> <li>— — 012 Data Output Module for External "Jam" Sync.</li> <li>Data format same as Option 002: Skotel byte serial.</li> </ul>	\$135.
003 — 013 Video Character Generator	\$750.
	No Charge

Notes: (1) All required mating connectors are supplied, except BNC's. (2) All options may be factory installed, or installed later on a plug in basis. (3) All prices are F.O.B. Destination, and in U.S. Funds.



### SKOTEL CORPORATION

1445 Provencher Brossard, Quebec. Canada J4W 1Z3 (514) 676-1813

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North: Mike Dyer (313) 478-2157

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### SMITH-VICTOR



Lake & Colfax Street Griffith, Indiana 46319 312-768-1025 219-924-6136

## **Professional Quartz Studio Lights**



Model 710/600 Watt PRO STUDIO LIGHT



Model 700 QUARTZ LIGHT



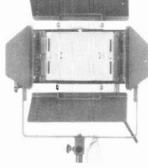
Model 740/650 Watt



Model 720/1000 PRO STUDIO LIGHT



Model 760 Quartz Fill STUDIO LIGHT 600 WATT



Model 750/1000 PRO STUDIO LIGHT





Model 770 QUARTZ BROAD STUDIO LIGHT 600 WATT

New Smith-Victor PRO Studio Lights in the 700 Series are the result of manufacturing lighting equipment for the amateur and professional photographer. These new studio lights are made to meet the needs of the most discriminating and demanding professional photographer. They are cool, strong and lightweight. They provide high quality lighting for photography or T.V. and are ideal for Key, Fill or Back Lighting.

Stock No.	Model		
401101	700	Quartz Light With DYH Lamp	\$39.50
620460	DYH	600 Watt Lamp, 3200°K, 120 Volt, Clear	19.45
401301	701	Barn Door for 700	27.50
401102	710	Pro Studio Light, 600 Watt (foc)	\$74.50
620460	DYH	600 Watt Lamp, 3200°K, 120 Volt, Clear	19.45
401307	711	Barn Door for 710	24.50
401312 .	712	Sgl. Scrim for 710, 760 & 770	7.95
401103	720	Pro Studio Light, 1000 Watt (foc)	\$94.50
620140	FBY	1000 Watt Lamp, 3200°K, 120 Volt, Frosted	26.75
401308	721	Barn Door for 720 Light	32.50
401316	722	Sgl. Scrim for 720 Light	10.95

These new Smith-Victor PRO Studio Lights are specially designed with a new unique high efficiency reflector. They provide broad flat illumination to fill large areas, and are made to meet the needs of the most discriminating and demanding professional. Large handle placed away from housing provides for cool adjustment of light. These lights are strong, light-weight and provide high quality lighting for photography or T.V. Permanently attached Barn Doors give full light control.

Stock No.	Model		
401104	740	Pro Studio Light, 650 Watt (n-foc) Fill	\$104.95
620050	FBX	650 Watt Lamp, 3200°K, 120 Volt, Frosted	19.00
401319	742	Sgl. Scrim for 740 Light	7.95
401105	750	Pro Studio Light, 1000 Watt (n-foc) Fill	\$109.95
620380	FHM	1000 Watt Lamp, 3200°K, 120 Volt, Frosted	25.50
401322	752	Sgl. Scrim for 750 Light	8.50

This new low cost quartz fill light for use with the 600 watt DYH lamp is ideal for photographic and T.V., key, fill and back lighting. It is of all aluminum construction for cool operation. Barn doors must be used to hold scrims. Safety wire included. Has 10 foot 3 wire cord with in-line switch.

Stock No.	Model		
401112	760	Studio Light, 600 Watt Fill (n-foc)	\$57.50
620460	DYH	600 Watt Lamp, 3200°K, 120 Volt, Clear	19.45
401325	771	Barn Door for 760 & 770 Lights	27.50
401312	712	Sgl. Scrim for 760 & 770 Lights	7.95
401113	770	Studio Light, 600 Watt Broad (n-foc)	\$52.50
620460	DYH	600 Watt Lamp, 3200°K, 120 Volt, Clear	19.45
401325	771	Barn Door for 760 & 770 Lights	27.50
401312	712	Sgl. Scrim for 760 & 770 Lights	7.95

SP/ A new professional lighting unit. A 6" focusing fresnel spotlight. Ideally suited for both key and fill applications, the SP1 spotlight accepts any medium bi-post lamp and features a rugged steel housing with oversized vents for maximum cooling. Swing-away rear door permits fast, easy relamping. The SP1 also features a ten foot 3 wire grounded cord for safety. Price \$189.50

Stock No.	Model		
661101	SP1	6" Fresnel Spotlight, 1000 Watt (foc)	\$189.50
621940	EGT	1000 Watt Lamp, 3200 K, 120 Volt, Clear	46.75
661103	BD6	4 Leaf Barn Door for SP1	29.95
661102	FH6	Gel Holder for SP1	7.95

Model SP1 1000 Watt FRESNEL SPOTLIGHT

## SMITH-VICTOR



Lake & Colfax Street Griffith, Indiana 46319 312-768-1025 219-924-6136



## ALUMINUM AND STEEL LIGHT STANDS

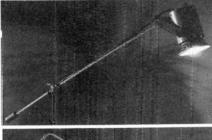
Sure-grip Lexan tocking collars. This unique design allows for finger-tight locking and release.

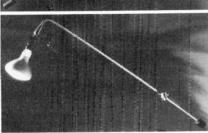
## STANDARD MODELS 401233 MODEL SA28

Extends to 8 feet ... \$39.95
40123 MODEL SA210
Extends to 10 feet ... \$39.95
401231 MODEL SA24
Very lightweight, Flat legs ... \$24.95
SUPER MODELS

Tubular legs, double braced for rigidity. Self locking nuts and leg braces are adjustable for wear. 3 popular models.

401232 MODEL SA8





## STEEL STANDS 401250 MODEL BR10

A new heavy-duty roller base studio light stand is now available from Smith-Victor. Specifically designed for studio usage, the BR10 features a 10 foot 5/8" mount steel upright which mounts on a steel base. Four square steel tubing legs with casters, two of which lock, allow for unlimited mobility in the studio, yet may be locked into position to prevent unwanted movement. Suggested list price on the BR10 is \$125.00

## LIGHTBOOMS 401224 MODEL BP4 LIGHT BOOM

This chrome plated light boom is 51 inches long and has a 2-pound counterweight. Fits any stand with 3/8" stud......\$39.95



## ALL PURPOSE STANDS 401228 MODEL S2

Extends to 8 feet with leg spread of 33 inches. Folds to 36 inches and weighs only 5 lbs., 11 oz. 3/8 inch stud . . . . . . . . \$21.95 401230 MODEL S4

Similar to the S3, but with a 5/8" top upright section for use with professional type 5/8" mount equipment.

..... \$24.50 401238 MODEL S6

## SMITH-VICTOR STUDIO KITS

## 401401 MODEL K2

(without barn doors)
This kit consists of 3 600 watt
700 DYH 3200° K Quartz
Lights, 3 S6 6½ ft. multi-purpose steel stands, 1 512
adapter for background stand
and 1 634L Case that holds
extension cords, spare lamps
and barn doors. Barn Doors
are available as an accessory.
\$199.50

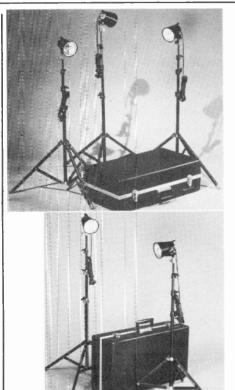
### 401420 MODEL K33

(with barn doors)
This kit consists of 3 600 watt
700 DYH 3200°K Quartz
Lights, 3 SA28 8 ft. black
aluminum stands, 3 701 barn
doors, and a 650 case that
has room for lights, stands,
extension cords, spare lamps
and barn doors. \$375.00

## 401417 MODEL K50

This kit has a total of 1,800 watts. Contains 1 760 fill light, 2 770 broad lights, 3 771 barn doors, 3 SA28 8 ft. black aluminum stands, 2 712 scrims, 3 DYH lamps and a 650 carrying case. . . . \$475.00





## K22 — Smith-Victor's new portable studio kit.

This kit features:

- 2 600 watt 700 Quartz lights, utilizing the
- 3200° K rated 75hr. DYH lamps.
- 2 S7 6½' steel light stands, and 1 handy Smith-Victor 650 carrying case . . . . . \$199.50

## K23 — The Smith-Victor K23 kit

## Features:

- 3 600 watt 700 Quartz lights
- 3 DYH lamps, 3200° K 75hr. life.
- 3 S7 steel stands
- 1 650 carrying case . \$259.50

Prices and Specifications Subject to Change Without Notice.

Circle (148) on Reader Service Card

## SMITH-VICTOR



Lake & Colfax Street Griffith, Indiana 46319 312-768-1025 219-924-6136

## K71 PRO FOCUSING QUARTZ STUDIO KIT

The K71 is a deluxe professional kit that consists of 3 lights with a total of 1800 watts, 3 10-foot black stands, 2 barn doors, 2 scrims and a convenient carrying case.

These lights provide high quality lighting for photography or T.V. and are ideal for Key, Fill or Punch Lighting.

The 3 710 HI-FI Quartz Lights, each with a 600 Watt DYH Lamp are rated at 3200° K, 75 hour life. Cable is 10 ft., 3 wire.

There are 3 SA10 aluminum stands that fold to 27½ inches and extend to 10 feet. Extensions are locked in, cannot be accidentally pulled apart. Extension thumb screws are locked in, cannot be dropped or lost. Entire stand is black to prevent reflections.

The entire unit is packed in a Model 671 case that has room for lights, stands and barn doors, plus extension cords, spare lamps.  $KIT - 29'' \times 16'' \times 7'' - Weight 34 lbs.$ 



## **K74 PRO QUARTZ STUDIO KIT**

The K74 deluxe kit is for the professional Cine and T.V. photographer and consists of 3 lights with a total of 3,000 watts, 3 8-foot black aluminum stands, 1 barn door, 2 scrims and a convenient carrying case.

There is a focusing 720 HI-FI Studio Light for Key Light with a FBY 1,000 watt lamp and 2 750 HI-FI Studio Lights, each with a FHM 1,000 watt lamp. The 750 lights provide broad flat illumination for Fill Light.

Permanently attached barn doors give full light control.

There are 3 SA48 black aluminum stands that fold to 27 ½ inches and extend to 8 ft. Extensions are locked in, cannot be accidentally pulled apart. Extension screws are locked in, cannot be dropped or lost.

The entire unit is packed in a Model 674 case that has room for lights, stands, barn door and scrims plus extension cords and spare lamps.

## Accessories



MOUNTS — These Smith-Victor light mounts are ideal for the professional photographer, movie studio or TV studio. Base plates are 4" x 6" steel with eight ¼" holes for easy mounting on wall or ceiling. Cold rolled steel studs are 5/8" in diameter and are available in 3", 6", 9" and 12" long. All mounts are painted matte black.







401216 MODEL C7 CLAMP \$18.95

661201 MODEL C3 3/8"
GAFFER GRIP......\$16.50
661202 MODEL C5 5/8"
GAFFER GRIP.....\$16.50

401346 MODEL FH1 FILTER & DIFFUSER HOLDER

Fits any light mounted on stand up to 12" diameter. . . . . . . . . \$27.50

## FILTER DIFFUSING AND EFFECT KITS FOR FILTER HOLDER

650009 12" For 10" & 12" Reflector Units Daylight correction....\$10.95 650010 12" Color Effect Pak .\$10.95 650011 12" Diffusion Pak ...\$10.95



## **K75 PRO QUARTZ STUDIO KIT**

The K75 is a deluxe kit that consists of 4 lights with a total of 2,500 watts, 48-foot black stands, 2 barn doors, 4 scrims and a convenient carrying case.

These lights provide excellent lighting for both studio or location use in photography or video, in color or black and white. Ideal for Key, Fill or Punch Lighting.

There are two 710 HI-FI Lights for accent lighting, each with a DYH 600 watt lamp, and two 740 HI-FI Lights for fill lighting, each with a FBX 650 watt lamp. A spare DYH and FBX lamp is included in kit. Cable is 10 ft., 3 wire.

There are 4 black aluminum stands that extend to 8 ft. and fold to 27 ½ inches. Extensions are locked in, cannot be accidentally pulled apart. Extension screws are locked in, cannot be dropped or lost.

The entire unit is packed in a Model 671 case that has room for lights, stands and barn doors plus extension cords and spare lamps

For foreign location work, 240 volt lamps are available.

KIT - 29" x 16" x 7" - Weight 49 lbs.

Stock No. 401421 Complete Outfit No. K75 . . . . . . . . . \$850.00

## **K76 PRO QUARTZ STUDIO KIT**

The K76 is a deluxe kit that consists of 4 lights with a total of 4,000 watts, 48-foot black stands, 2 barn doors, 4 scrims and a convenient carrying case.

These lights provide high quality lighting for photography or T.V. in color or black and white and are ideal for Key, Fill or Punch Lighting.

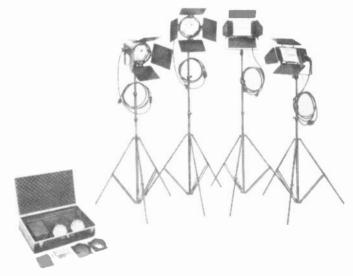
There are two 720 HI-FI Lights for accent lighting, each with a FBY 1,000 watt lamp, and two 750 HI-FI Lights for fill lighting, each with a FHM 1,000 watt lamp. A spare FBY and FHM lamp is included in kit. Cable is 10 ft., 3 wire.

There are 4 black aluminum stands that extend to 8 ft. and fold to 27½ inches. Extensions are locked in, cannot be accidentally pulled apart. Extension screws are locked in, cannot be dropped or lost

The entire unit is packed in a Model 674 case that has room for lights, stands and barn doors plus extension cords and spare lamps

For foreign location work, 240 volt lamps are available.

KIT - 29" x 18" x 8" - Weight 50 lbs.





## **K72 QUARTZ STUDIO KIT**

The K72 is a deluxe professional kit that consists of 3 lights with a total of 1900 watts, 3 8-foot black stands, 1 barn door, 2 scrims and a convenient carrying case.

These lights provide high quality lighting for photography or T.V. and are ideal for Key, Fill or Back Lighting and provide a broader beam than the K71 Kit

There is a 710 Pro Studio Light with a DYH 600 watt lamp and 2 740 Pro Studio Lights, each with a FBX 650 watt lamp. Cable is 10 ft., 3 wire.

Kit contains 3 SA48 aluminum stands that fold to 27 ½ inches and extend to 8 feet. Extensions are locked in, cannot be accidentally pulled apart. Extension thumb screws are locked in, cannot be dropped or lost. Entire stand is black to prevent reflections.

The entire unit is packed in a Model 671 case that has room for lights, stands and barn door plus extension cords and spare lamps.  $KIT = 29'' \times 16'' \times 7'' = Weight 32 lbs.$ 

Stock No.

401407 Complete Outfit No. K72 ......\$650.00

## sonar IIIIII radio

3000 Stirling Road • Hollywood, Florida 33021 • (305) 981-8800

## **VIDEORASER**

RE-USE VIDEOCASSETTES
WITH NO LOSS OF QUALITY!

Here's the electronic videocassette eraser for professional and home use. Erases 100 times better than the recorder's internal erase mechanism.

Easy to use.

Erases videocassettes clean . . . in seconds.

Saves wear on tape and video heads.

Powerful-magnetic flux of 1400 gauss at 1/4 inch.

Less powerful units will not erase as well.

Backed by Full One Year Warranty.

Contact us today and let us prove it's the most effective hand-held eraser available...out-performs comparable units selling at higher prices.

Your videocassette recorder needs VIDEORASER...the one the professionals use.

Dealers Inquiries Invited

## **SPECIFICATIONS**

Size 4¾" by 4½" high

Weight: 4½ lbs.

Power: 1200 watts (110-120 volts AC)

Magnetic Flux: Open field 1400 gauss at ¼ inch

Suggested Retail Price \$48.75

Model VX - 1401

represented nationally by:



## VIDEO COMPONENTS INC.

WE'RE KNOWN BY THE COMPANIES WE REP 601 south main street, spring valley, new york 10977

Prices and Specifications Subject to Change Without Notice.

World Radio History

Pitradio

(914)356-3700 telex 996534

## QUAD PANEL REFURBISHING SERVICE

Spin Physics will show you how and why our hot-pressed ferrite quad video heads with the 1000 hour warranty are your best buy.

OPERATIONS MANAGEMENT. ENGINEERING. FINANCE.

Everyone gains from the long life and low cost per hour of quad panel operation with Spin Physics' unique Manganese-Zinc hot-pressed ferrite heads. Our rapidly growing list of customers bears witness to our claims of superior quad panel performance — from 3 to 5 times longer than our competition. Even if you are getting higher than average life from ordinary heads, you can expect to save from 25 to 40 per cent of panel refurbishing costs with Spin Physics' high technology ferrite heads and upgraded panel components.

THE NON-PRORATED 1000 HOUR WARRANTY for each Mark X, Mark XV or RCA High Band quad panel spells out the story of savings. The compatible broadcast quality picture that maintains its crisp clarity throughout its dramatically extended life demonstrates superior performance. The combination illustrates Spin Physics' commitment to better service for the broadcast industry.

LET US SHOW YOU MORE at your own facility. tact our Field Engineer who serves your region, listed below. Intact Gene Long, National Sales Manager, or Forrest Watson, Video Products Manager, at our San Diego home office.



SPIN PHYSICS, INC.

A KODAK COMPANY

11633 Sorrento Valley Road, San Diego, California 92121 Telephone: 714-453-5410 Cable: SPINEX SANDIEGO TWX: 910-322-1737

EASTERN REGION Kent White 301-839-3218 SOUTHEAST Knowlton Harrell 205-582-6572

MIDWEST Ray Kundrot 312-325-1009 CENTRAL Leroy Koonsman 214-245-1816

PACIFIC Ken Thompson 415-961-7794 SOUTHWEST Ed Gehle 805-964-3316 NORTHWEST Dave Franssens 916-332-0885

FUROPE Bill Kroon, Putten, The Netherlands (03418) 3689 or Telex (844) 47589

## STEINBERG ELECTRONICS INC.

2520 NORTH BROAD STREET PHILADELPHIA, PA 19132 [215] 223-9400

## Specializing In The Following Parts

**ADMIRAL** ELECTRONIC PARTS — TV — RADIO — HI FI, ETC.

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**GE** TV PARTS ONLY

PANASONIC PARTS & ACCESSORIES: - VIDEO - TV - RADIO - STEREO

RCA PARTS & ACCESSORIES

**SONY** PARTS & ACCESSORIES: — VIDEO — TV — RADIO — HI FI — TAPE RECORDERS

**VIDICON & NEWVICON TUBES** 

## Antennas - Accessories

Alliance Rotors Blonder Tongue Rembrandt (All Channel) RCA

## **Batteries**

Culver-Video Eveready Panasonic Sony

## **Books** -- Manuals

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## Cable - Wire - Sleeving

Alpha Belden Coleflex Columbia Daburn

## Capacitors

Cornell Dubilier International Comp. Sprague Products

## Chemicals

Chemtronics G C Electronics

## Connectors

Amphenol AVA Cinch Kings Switchcraft UG-RF-MS

## Fuses - Holders

Bussman Littlefuse

### **Hardware**

Daburn G C Electronics Keystone H. H. Smith Mueller Electric

## Receiving — Transmitting Tubes

Amperex Eimac G E National Raytheon RCA Sylvania

## Recording Tape: - Video - Audio

Scotch 3M Sony TDK

## **Semiconductors**

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## Sound Equipment

Argos Products
Astatic
Atlas
Bogen
David Clark Co.
Electro Voice
Fanon
Pickering
Shure Bros.

Sony Soundolier Telex University

## **Switches**

Alco Arrow Hart Cutler Hammer JBT Linemaster

## **Test Equipment**

B & K Dynascan Eico Leader Non Linear Systems Simpson Electric VIZ (RCA)

## Tools — Accessories

Edsyn Inc. Kester Solder Panavise SGL Waber Elect. Ungar Weller Xcelite

## **Transformers**

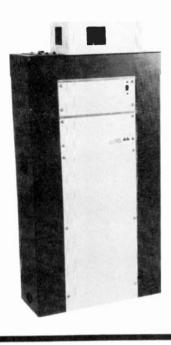
Stancor Thordarson Triad

## Video Parts & Accessories

Comprehensive Video Culver Batteries Hitachi Vidicons — Newvicons Panasonic Sony Vicon P.O. Box 15068, Salt Lake City, Utah 84115 (801) 972-8000, Telex: 388-352

## Multiplexers

## **TMM-205**

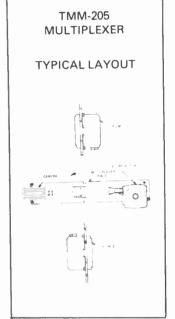


The TMM-205 can accommodate 8mm, 16mm, and 35mm film projectors and 35mm slide projectors for operation with a color or monochrome camera. Input selection is via motor-driven first-surface mirrors, providing a rapid optical wipe between sources.

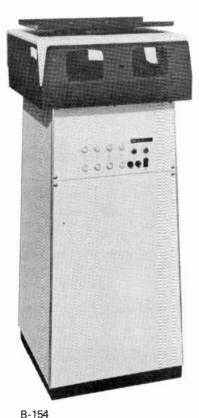
TMM-205	 	 										 		. \$995.6	00	
Remote Control	 	 										 		350.0	00	

## **Features**

- Three Inputs One Output
- Broadcast-Proven Quality
- Priced Below Competitive Units
- Transitions between Sources Exceed Broadcast Standards
- Accepts Wide Range of Cameras and Projectors



## **TMM-211**



## **Features**

- Four Projector Inputs Two Camera Outputs
- All Optics Factory Aligned No Field Adjustments Necessary
- 3" x 4" Image Format
- Flat Spectral Response Insures Optimum Color Operation
- All Optics Mounted on Single Rugged Casting
- Compatible with All Color Camera Chains
- Simultaneous use of Two Color Cameras Possible
- Time-Tested Mirror Mechanism Smooth Operation without Use of Clutches
- Full Remote Control Operation
- Rotating Monitor Shelf

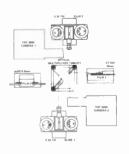
Prices and Specifications Subject to Change Without Notice.

## IM-211.....\$4195.00

## TMM-211 OPTICAL MULTIPLEXER

## TYPICAL LAYOUT

Four projector inputs Two camera outputs

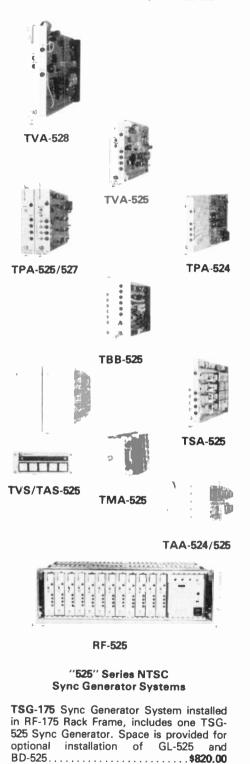


The AK-211 Alignment Kit is available as an accesory to allow considerable time saving in multiplexer system setup and alignment. The Kit includes a "Projecticon," a projection light source that is placed in the camera in place of the green tube, and two precision targets that are placed on the transfer assembly



P.O. Box 15068, Salt Lake City, Utah 84115 (801) 972-8000, Telex: 388-352

## "525" Series Modular Video/Pulse/Audio Distribution Amplifiers, Sync Generators and Terminal Equipment



TSG-176 Dual Sync Generator System, installed in RF-175 Rack Frame, includes two TSG-525 Sync Generators and one CO-525 Sync Changeover Module \$1675.00
Connecting Panels for "525" Sync Generator Systems
IP-1 Connecting Panel and Card Connector for mounting TSG-525 in RF-175 or RF-525 Rack Frames. Required only where TSG-525 is to be used without GL, CO, or BD accessories
IP-2 Connecting Panel and Motherboard for mounting TSG-525 and GL-525. Occupies two frame spaces
IP-3 Connecting Panel and Motherboard for mounting TSG-525, GL-525, and BD-525 in RF-525 Rack Frame. Occupies three frame spaces
IP-6 Connecting Panel and Motherboard for mounting one CO-525, two TSG-525's, two GL-525's and one BD-525 in RF-525 Rack Frame. Occupies six frame spaces \$225,00
"525" SERIES EQUIPMENT
TSG-525 Sync Generator, select appropriate connecting panel among IP-1, IP-2, IP-3, or IP-6
GL-525 Genlock Accessory, select IP-2, IP-3 or IP-6
CO-525 Sync Changeover Accessory, requires IP-6
BD-525 Bar Dot Accessory, to be used with IP-3 or IP-6 Connecting Panel configurations
TBB-525 Blackburst Generator\$640.00
TVA-524 Broadcast Video Distribution Amplifier
TVA-528 Broadcast Precision Video Distribution Amplifier, 6 Outputs\$335.00
TVA-525D Precision Video Distribution Amplifier with DL-525 Delay Plug-in Accessory
TVA-525E Precision Video Distribution Amplifier with EQ-525 Equalizer Plug-in Accessory
TVA-525DE Precision Video Distribution Amplifier with both DL-525 and EQ-525 Plug-in Accessories
TPA-524 Broadcast Pulse Distribution Amplifier

TPA-525 Amplifier .	Precision	Pulse	Distribution\$280.00			
TPA-527 Amplifier, v	Precision with individ	Pulse lual delay.	Distribution\$330.00			
with indivi	dual 370-	degree pl	on Amplifier, hase adjust- <b>\$415.00</b>			
	ACCES	SORIES				
	_		28 <b>\$285.00</b>			
<b>EQ-525</b> Equ TVA-528 .	ıalizer Pluç	g-in for	\$55.00			
TAA-524 A Amplifier	udio Distri	bution	\$280.00			
TAA-525	Audio D	istribution	Amplifier, <b>\$385.00</b>			
<b>TMA-525</b> 15 watt	Audio	Monitor	Amplifier, \$330.00			
TVS-525 5	x 1 Video	Switcher	\$430.00			
<b>TAS-525</b> 5 Module	x 1 Audio	Switcher	\$430.00			
ACCESSORIES FOR SWITCHER MODULES						
RC-5 5-pus mounts in R	hbutton Re P-203	emote Co	ntrol Panel, \$100.00			
CC-5/25 Co	nnecting C	able, 5 ft.	\$55.00			
CC-5/50 Co	nnecting C	able, 50 f	t <b>\$65.00</b>			
1	ACK FRA POWER S	<b>UPPLIES</b>				
installed.	comes v	vith a po	ower supply			
RF-525 5-7 and up to tw	4-in. Racı velve 1-in. ı	Frame modules.	for PS-525 <b>\$185.00</b>			
<b>PS-525</b> Pow	er Supply,	uninstalle	ed <b>\$240.00</b>			
<b>PS-525RK</b> Kit, uninst PS-525	talled, to	) be (	used with			
<b>RF-175</b> 1-¾ Supply	i-in. Rack	Frame	and Power <b>\$250.00</b>			
EX-526 Mod	ule Extend	er	\$100.00			
RP-203 Rac Modules, a modules	iccommod	ates up	to three			
BP-203 Blan	k Panel for	RP-203	\$20.00			

TSG-175GL Sync

Generator/Genlock

TVS/TAS-1000 Video/Audio Distribution Switching Systems

P.O. Box 15068, Salt Lake City, Utah 84115 (801) 972-8000, Telex: 388-352

### **TVS/TAS-1000 Matrix Configurations**

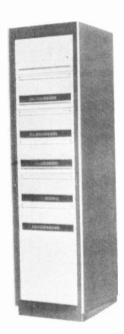
The TVS/TAS-1000 is offered in two standard configurations—type CAV and type MSO. It is also available under special order in numerous alternative configurations. The type CAV offers the most economical packaging while being limited to a maximum of 40 inputs, whereas the type MSO is more costly in a given configuration but permits expansion to matrix sizes of 100 x 100 and beyond.

## Type MSO — Multiple Chassis with Single Output Card In Each Chassis

Type MSO switchers are supplied with one card frame for each video output decade and a separate card frame for each audio output decade. They are available on initial order or for field expansion with matrices of up to 100 x 100.

## Type CAV Combined Audio and Video

In the CAV design, audio and video switchers are combined in a single 8%-in. card frame. Type CAV, limited to 40 inputs can be ordered with or expanded to 100 outputs.



40 x 50 AFV Switcher

## **FEATURES**

- Compact Up to 1000 Crosspoints per 8¾-inch Chassis
- Solid-State Crosspoints with Vertical Interval Switching
- Single-Coax "Party-Line" Control
   Wide Selection of Bus Controls and Status Monitors
- Plug-In Conversion to Phone Line or Computer Control
- Excellent Long- and Near-Term Transfer Characteristics
- Automatic Restoration After Power Failure, with Refresh Memory Option
- Dual Video Outputs
- Standard, Multiple-Sourced Components No Custom Hybrids
- Automatic System Testing of All Circuit Parameters Through All Possible Signal Paths — Hard Copy Results Supplied

## MATRIX MSO SERIES OPTIONS

### **ACCESSORIES**

EX-876 Module Extender, for servicing circuit cards or power supply \$145.00

BX-1001 Output Bus Extender for CAV Series, permits in-service maintenance of crosspoint and output cards, requires EX-876 ...110.00

PS-1000A Spare Power Supply \$595.00

PS-1000RK Power Supply Redundancy Kit ......\$80.00

TVU-175 Ventilation Unit, 117V ......\$210.00

TVU-176 Ventilation Unit for 234 V ......\$210.00

## DIGITAL CONTROL PANELS

### **BCD CONTROL PANELS**

NOTE: BCD Control Panel interface to switching matrix is via CM-1020 Control Multiplexer. All require CC-1010 cable.

CP-1004/1 Lever Switch Remote Control Panel, rackmount, requires CC-1010 Cable .....\$120.00 CP-1004/2 Dual Lever Switch Remote Control Panel, rackmount, reguires two CC-1010 Cables . \$250.00 CP-1011 Category number control panel with Take button . . . \$485.00 CP-1010 Category number control panel . . . . . . . . . . . . . . \$480.00 CP-1020 20 push-button control panel ......\$480.00 CP-1004/3 Triple Lever Switch Remote Control Panel, rackmount, requires three CC-1010 Cables .....\$340.00 CP-1005 Deskmount Lever Switch Remote Control, requires CC-1010 \$200.00

CM-1020 Control Multiplexer, for up to 6 buses \$685.00

CS-1004/1 Lever Switch Remote Control Panel with Bus Status Monitor, requires CC-1010 Cable \$385.00

CS-1004/2 Dual Lever Switch Remote Control Panel with Dual Bus Status Monitor, requires two CC-1010 Cables \$680.00

## **STATUS MONITORS**

 NOTE:
 All require
 RM-1001 in system

 SM-1000
 Full Matrix
 CRT Status

 Display Generator
 1895.00

 SM-1004/1
 Single-Bus
 Status

 Monitor
 \$370.00

 SM-1004/2
 Dual-Bus
 Status
 Monitor

 SM-1004/3
 Triple-Bus
 Status
 Monitor

 \$895.00

## COMPUTER AND DATAPHONE CONTROL ACCESSORIES

## 

## CARD FRAME/RACK SPACE REQUIREMENTS

(A) Type CAV Single 8%-in. card frame for both audio and video (B) TVU-175 Ventilation Unit — One 1%-in. exhaust blower is provided for each two 8%-in. card frames

## 12-Input Passive Switchers

TVS-12X1T 12 x 1 Terminating Switcher ......\$205.00



**CP-1001** 



CP-1002

MATRIX SIZE	VIDEO ONLY	AUDIO ONLY	COMBINED
INPUT OUTPUT	LIST	LIST	LIST
10 X 10	\$ 4,360.	\$ 3,940.	\$ 6,250.
20 X 10	6,040.	5,410.	9,400.
30 X 10	7,720.	6,880.	12,550.
40 X 10	9,400.	8,350.	15,700.
10 X 20	\$ 9,820.	\$ 7,930.	\$12,550.
20 X 20	13,180.	10,870.	18,850.
30 X 20	16,540.	13,810.	25,150.
40 X 20	19,900.	16,750.	31,450.
l			
10 X 30	\$15,280.	\$11,920.	\$18,850.
20 X 30	20,320.	16,330.	28,300.
30 X 30	25,360.	20,740.	37,750.
40 X 30	30,400.	25,150.	47,200.
1			
10 X 40	\$20,740.	\$15,910.	\$25,150.
20 X 40	27,460.	21,790.	37,750.
30 X 40	34,180.	27,670.	50,350.
40 X 40	40,900.	33,550.	62,950.
10 X 50	\$26,200.	\$19,900.	\$31,450.
20 X 50	34,600.	27,250.	47,200.
30 X 50	43,000.	34,600.	62,950.
40 X 50	51,400.	41,950.	78,700.

TVS/TAS-1000 VIDEO/AUDIO DISTRIBUTION SWITCHING SYSTEMS (CODE N)

MATRIX - CAV SERIES

NOTE: For switcher pricing with matrix larger than 40 x 50, the following per decade expansion pricing applies; maximum expansion is  $40 \times 100$ . Pricing for larger matrices adder for each additional 10 outputs beyond 50.

	VIDEO ONLY	AUDIO ONLY	COMBINED
	LIST	LIST	LIST
10 Inputs	\$ 5,460.	\$ 3,990.	\$ 6,300.
20 Inputs	7,140.	5,460.	9,450.
30 Inputs	8,820.	6,930.	12,600
40 Inputs	10,500.	8,400.	15,750.
Examples:			
10 X 80	(3x) 5,460.	(3x) 3,990.	(3x) 6,300
20 X 80	(3x) 7,140.	(3x) 5,460.	(3x) 9,450.
30 X 80	(3x) 8,820.	(3x) 6,930.	(3x) 12,600
40 X 80	(3-) 10 500	(3~) 8 400	(3v) 15 750

## TENTELOMETER -

## THE USER PROVEN TAPE TENSION GAGE FOR DIAGNOSING PROBLEMS IN YOUR TAPE TRANSPORT

## TENTEL'S HAND HELD TAPE TENSION GAGE (the TENTELOMETER) IS THE STANDARD OF THE INDUSTRY\*

## **SOME OF THE BENEFITS ARE:**

- Helps set proper tension on recorders and players for assured tape interchangeability.
- · Diagnose tension problems affecting horizontal stability.
- Measure tension to maintain video within time base corrector window of correction.
- Non-technical operator can detect machine versus tape problems so that service by an authorized repair station can be scheduled.
- Detect Audio Signal Distortion, Wow, and flutter.



The T2-H20-ML TENTELOMETER shown diagnosing an Audio wow and flutter problem.

an Addio wow and notter	problem.	
APPLICATION	MODEL	PRICE
<ul> <li>¼", ½", ¾"U, 1" Video</li> <li>2" Quad</li> <li>¼", ½", 1", 2" Audio</li> </ul>	T2-H15-UM T2-H20-2 T2-H20-ML	\$195.00 385.00 195.00

\* In use by and approved by virtually every foreign and domestic manufacturer of recording equipment.

Send for your FREE 8 page TENTELOMETER Instruction and application manual or call today.

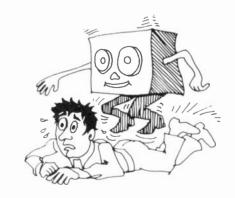
## TENTEL 50 Curtner Avenue Campbell, California 95008

(408) 377-6588



The T2-H15-UM TENTELOMETER shown measuring the critical supply tension on a SONY 2850. This tension determines the Horizontal stability of the video signal.

The entire 2850 can be set up using only the TENTELOMETER and a reel of tape. This alone will save many hundreds of dollars on special fixtures and allow preventive maintenance without disassembly of the machine.



CALL OR MAIL YOUR ORDER IN TODAY BEFORE THE TAPE "GREMLINS" SHUT YOU DOWN.

## TROMPETER



## **ELECTRONICS**

8936 Comanche Avenue (213) 882-1020

Chatsworth, California 91311 TWX: 910 - 494-1210

### INTRODUCTION

Trompeter Electronics designs and manufactures a wide variety of Video and Audio patch panels, patch cards, connectors, looping plugs, plugs and cable assemblies in Coax, Twinax and Triax. The coax series can be furnished in either 50 or 75 ohm. The entire line can be furnished in Western Electric miniature and miniature coax, twinax and triax.

## **BNC PLUG PL20-N**



This series is a fast 3-piece quick disconnect assembly accommodating 8218, 21-597, 8281 and other 75 ohm cables. The series is a propriatary Wrench Crimp design providing an all new coax cable attachment method. It can be assembled without the use

of special tools. It features a patented heat treated beryllium copper contact. A true 75 ohm

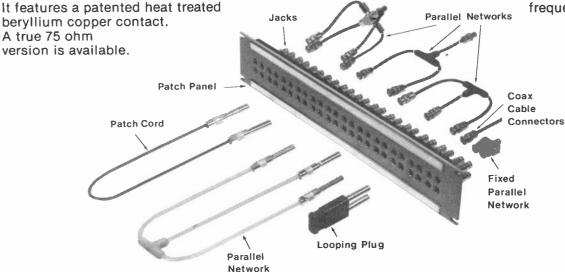
**PATCH JACK** (Normal thru) .090 pin (W.E.) J14W

The J14 series is a dual coax jack the purpose of which is to automatically provide a "normal thru" signal path without the use of looping plugs or patch cords. The normalling switch contacts utilize a unique self-wiping action for positive contact.

Standard, terminated and monitor types. M is monitor, T is terminated. Jacks are normally furnished with BNC (UG1094 type) connectors.

Signal degradation occurs

when used at frequencies above 30 MHz.





Rear mates with any BNC plug.

Circuit is terminated when patch plug is removed.

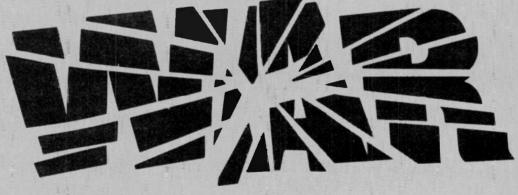


BNC-TNC TOOL RT1L (12") RT1S (6")

These tools greatly facilitate the installation of mating plugs to bulkhead or panel mounted jacks in high density areas.

SEND FOR YOUR FREE COMPLETE CATALOG

# From a cat's meow, to a lion's roarrr. From a pistol shot, to a world



SOUND EFFECTS LIBRARY The finest in Recorded Sound Effects, in one compact, versatile, easy-to-use collection of 21 Long Playing 33 1/3 RPM Discs. Major Records pioneered in the sound effects field and offers the greatest experience in selecting and recording sounds. In this series, Major Records now makes sound effects as easy to use as playing an LP record.

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- OVER 500 DIFFERENT EFFECTS ON 21 LPs
   ALL FOR \$147.00



THOMAS J. VALENTINO INC. 151 WEST 46TH ST , NEW YORK, N.Y. 10036 (212) 246-4675

## VAMCO ENGINEERING

11104 E. 56TH ST. • TULSA, OKLAHOMA 74145 918/252-5448



## model 775

VIDEO CASSETTE TAPE TIMER is an electronic digital timer designed to mount into the helical-type tape machines as a replacement to the original mechanical counter. The Model 775 no only gives accurate time in all modes of operation, but can be preset with a "fast-advance" switch for editing sessions where several cartridges are involved, without the need to rewind each one. The Model 775 consists of two p.c. boards. One contains all electronics except display, and mounts into the machine. The display board consists of pushbutton controls and mounts directly behind the panel in place of the original counter.

Easy to install with 10 electrical connections to the tape machine internally (without modification) and powered by the machine itself. The kit comes complete with all parts and instructions.



Installation: Installs in the field where old counter is removed on most video cassette machines. Installation time is 60 minutes, typical.

Note: Some machines may require optional control track adapter.

**Controls:** HOLD: "Freezes" display while timer continues operating. Display returns to real time when button is released.

Reset: Resets timer to zero count.

Set: "Fast advances" timer for finding tape locations without having to rewind cassettes everytime.

Display: Bright "calculator-type" display.

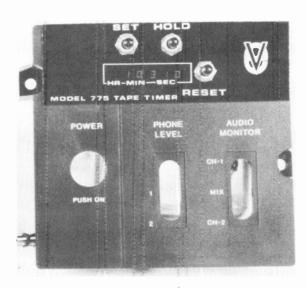
Maximum Time Displayed: 9 hours, 59 minutes, 59.9 seconds.

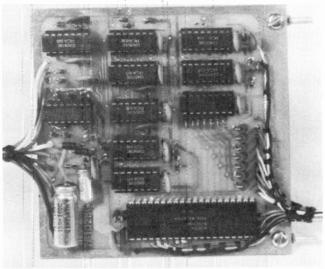
Accuracy: Utilizes control track for all timing except for 60Hz reference in record.

Power: 12 volts, D.C., 100 ma., typical. 5 or 6.5 volts, D.C., 28 ma., typical; derived

from tape machine.

Note: Specify machine type when ordering.







## model 749 & 749r

IVC TAPE TIMER is provided for quick installation on the IVC 800 and 900 series tape machines. This timer provides a resolution factor of 60:1 (to 1/10 second) over the original mechanical timer (6 seconds). This enhances program content timing and greater editing accuracy. The Model 749r is an optional rack-mounted display that will house up to two timers. For custom installations requiring additional timers specify number of timers per rack frame.

## VAMCO ENGINEERING

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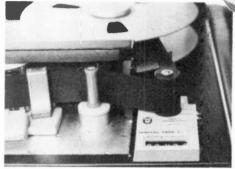


## model 734

**DIGITAL VIDEO TAPE TIMER,** provides at a reasonable cost, the ultimate in tape timing accuracy.

The VAMCO 734 eliminated the mechanical problems of the traditional timer by omitting the mechanical gears and linkages that produce friction to impair timing accuracy. The timer can be installed in minutes with one mounting nut. All circuitry except power supply is housed in the timer assembly, the power supply is a separate unit that is provided with each timer. The timer mounts without tape machine modification on all 2" Quad videotape machines and all 2" audio machines, Ampex Cartridge winders, and most other videotape machines. A remote display option is also available.







AMPEX VR-1200

AMPEX AVR-2

RCA TR-22

## **SPECIFICATIONS**

Installation: Mounts without tape machine modification on the following machine types:

macinio types.	
Ampex VR-1000 series	RCA TR-22 series
VR-1100 series	TR-50 series
VR-1200 series	TR-60 series
VR-2000 series	TR-61 series
AVR-2 series	TR-70 series
Cart Winder	Allen RB-1000 series
	RB-1200 series



Accuracy: ±0.14%

Display: 5 Hewlett Packard LED units

Maximum Time Display: 99 minutes, 59.9 seconds.

Controls: RESET: Resets all displays to zero.

Hold: "Freezes" display while tape is running. Counting circuitry continues

to run and is automatically displayed after button is released.

Accessories: Remote display. Editec-R recueing.

Power: 115V 60MHz, A.C., 6 watts, with power supply included.

## **model 771-2**

VIDEO CASSETTE TIMER is designed to provide production and engineering personnel with an accurate, reliable, high resolution, tape timer for the Sony VO-2850, VO-2850A, VO-2600\*, VO-2800\*, VO-2860, BVU-200, Panasonic NV9200, NV9500, JVC CR 8300U. The 771-2 offers accuracy to 1/10 second resolution for all cassettes. A "recue" button gives a programmable pre-roll cue for editing and ON AIR use.

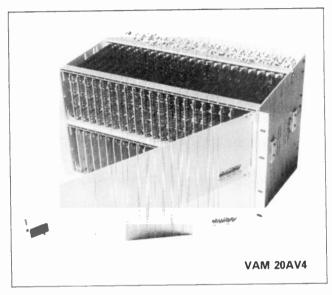
An available option is the Model 773 Preset unit. Designed to enter the time of a previously used cassette that was not rewound. The 773 can be added to the basic timer at a later date.

## VAMCO ENGINEERING

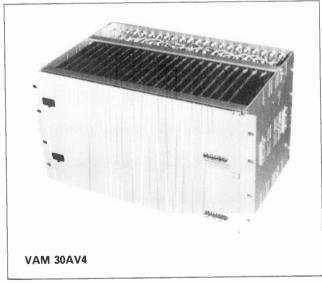
11104 E. 56TH ST. • TULSA, OKLAHOMA 74145 918/252-5448



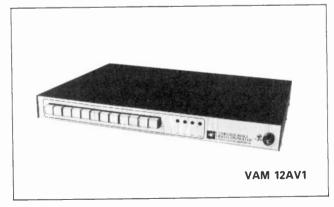
Modulized in a 20 input by 4 output format the VAM 20 AV4 offers the latest in state-of-the-art routing switchers. Each system matrix is designed for interface compatibility (stacked) of up to 12 units without DA's. Units are supplied with dual auto changeover power supplies for minimum downtime. Switching is in the Vertical Interval and reverts to random nature upon loss of vertical interval drive signal. Each video crosspoint board is a 1x4 with on-card switchpoint status and on-card switching for ease of maintenance. High quality bi-polar video switching is used for theoretical 100 db off-mode attenuation. Complementary bi-polar transistors throughout video stage virtually eliminates differential phase and gain errors. Each audio crosspoint board provides a 20x1 audio switching capability. To prevent impairing signal swing or response, no transformers are used. This system can be operated directly from a -24 volt power supply which is a natural for remote microwave relay installations.



The VAM 30AV4 system offers the same technical characteristics as the VAM 20AV4 except for expanded matrix, i.e. 30 inputs by 4 outputs. Both building block systems offer the following options: Dual Audio (Stereo), Remote control options are BCD parallel, Touch Tone, Two wire BCD serial, FSK tone, Two Wire "Party Line" and direct wire control. Remote panels can be fabricated to accommodate keyboard, individual pushbutton, thumbwheel or micro-computer control.



The VAM 12AV1 is a self contained unit providing a 12 input by 1 output format and can be stacked up to 15 units high without DA's. Each unit has a built in power supply allowing maximum isolation and ease of maintenance. Other features include: Vertical interval switching, Bi-polar video switching, short term memory protection, AFV, and CMOS audio switching. Available options are remote control and dual (stereo) audio.



## VIDEO AIDS from.

VIDEO AIDS corporation of colorado

325 EAST SEVENTH STREET, LOVELAND, COLORADO 80537 Phone (303) 667-3301



VIDEO AIDS corporation of colorado

## COLOR GENLOCK SYNC GENERATOR MODEL 5000

SPECIFICATIONS MODEL 5000 OPTION:01 (Helical) Model 5000 Helical tape recorder outputs have typically 1000 or more times the frequency variations of broadcast video. This more times the frequency variations of broadcast video. This new mode provides a very wide range genlock that is front panel selected to lock to helical recorder playbacks even with ± 1% speed variations, ± 10 microsecond skew and high amplitude head transition noise. Price: Model 5000 - \$1895.00

### **BLACK BURST GENERATOR KIT** MODEL BBG-1

Low-cost black burst generator for driving new color cameras and for users of video switchers who desire to fade to color

Price: \$89.00 F.O.B. Loveland, Colorado

## VIDEO ACTIVATED POWER SWITCH MODEL VPS-1

- Save electrical energy by using monitor only when video is
- present. Reduce color monitor maintenance when no drives are present.
- Eliminate distractions from free-running monitors.
  Eliminate special AC power lines or tall ladders to turn video monitors on and off in special locations. Price: \$65.00

## VIDEO D/A MODELS VDA-1, VDA-1P

The VACC Model VDA-1 is a video distribution amplifier which can be operated from any +12Vdc power supply capable of delivering 70 mA to the VDA-1.

The Mcdel VDA-1P has its own self-contained 12V power supply. No cabinet is included with the VDA-1 or VDA-1P. These video amplifiers have been designed in mind to install in the contained of the contained state. TBC's and other equipment where additional video outputs or

feeds are required.

Price: VDA-1 - \$79.50; VDA-1P - \$125.00

## PARTY LINE SYSTEM MODELS PLS-1, PL-1

### BENEF TS

- Individual volume control
- Model PLS-1 handles up to 10 headset units
- Low cost
- Small cabinet enables user to mount party line next to camera or to any convenient location.

## BURST-PHASE & H-PHASE METER MODELS BPM-1 & BPM-1 OPTION: 02

VACC's BPM-1 Option: 02 Burst-Phase Meter and H-Phase Meter is both a low-cost substitute or replacement for most vectroscope applications where burst-phase errors need to be observed and measured. Likewise, the unit is a low-cost substitute for an oscilloscope where H-Phase errors need to be

observed and measured.
Price: BPM-1 (cabinet) \$599.00, Option: 02 H-Phase add \$130.00

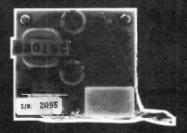
## ELECTRO OPTICAL ISOLATORS MODELS A-1, A-1A, D-1, D-1A, VL-1

Installing a VACC optical isolator circuit in your 12, 15, 17, 19, or 21 inch Sony Trinitron "color receiver converts it for use as a high quality color monitor and/or demodulator while still retaining the receiver function

Besides low cost, VACC's Video Line Isolator improves overall performance of your video system by providing Letter power-line isolation (80 dB) than traditional differential amplifiers. Price: Specify Model # - \$171.00; VL-1 - \$250.00



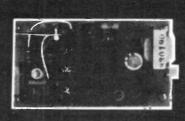










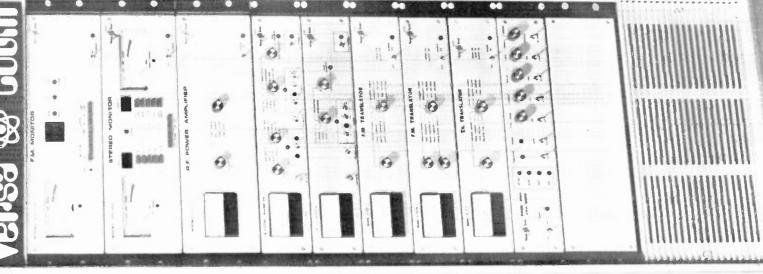




LIGHTED

METER

## Versa 🕸 Count



## Versa • Count

## **NEW FOR 1979**

## FM MODULATION MONITOR MM-440

A new super accurate design with crystal controlled calibration circuits. Extended range of noise measurements down to -80 db. Optional digital frequency meter available. Suitable for driving remote readout panels. LED peak level indicators set at 100 %, plus adjustable peak indicators showing peaks above or below 100%.

## STEREO MONITOR SM-460

New and important quadrature error measurement. Accurately measures the phase relationship between the 38 KHz sub carrier and the 19 KHz pilot. This measurement gives you the information needed to properly adjust or check the pilot phase of any stereo generator without the use of external measuring equipment.

## 150 WATT R.F. POWER AMP LA-150

Unique built-in true power reflectometers sample and regulate the R.F. output power within 1% for 10% change in line voltage. Only 8 watts of R.F. drive power required for 150 watt output. Special circuits maintain constant output with variations in R.F. drive power of up to 25%.

## TV TRANSLATOR VHF 1 & 10 WATT V-213 & 214

Designed for high reliability and stable operation. Versa-Count experience and reputation in the FM Translator field is all brought together in this new product. Highly selective cascode MOS-FET front end with dual gate mixing provides high overload capability, excellent cross modulation and image rejection.

## **NEW IN 1978**

## 10 WATT FM EXCITER/TRANSMITTER V-322

The V-322 is now on the air in more than 75 stations in both the USA and South America. Several commercial stations have found that the V-322 is as good or better than exciters costing more than twice as much. The clean sound comes from very low S/N ratio, in fact lower than most monitors can measure.

## FM TRANSLATORS 1&10 WATT V-316 & 317

These FM Translators were formerly made under the Robert Jones FCC type acceptance and are on the air in hundreds of locations throughout the world. Unquestionably the most reliable and stable of any FM Translator operating today. FCC type accepted 1978.

For further information, Write or Phone: 312-593-0208

Versa • Count

553 LIVELY BOULEVARD ELK GROVE VILLAGE ILLINOIS 60007



## **VMU-44**

The VMU-44 is an add-on audio and video kit which expands a standard JVC 4400, Panasonic NV9400, and Hitachi SV340 to full broadcast features.

## **FEATURES INCLUDE:**

- External Sync
- External Subcarrier
- Individual gain pots for each each audio channel
- Microphone/Line switch for each channel
- XLR Connectors
- Balanced Audio/Low Impedance
- Will accept RF Converter



The kit comes complete with wire harness, transformers and is pre-wired and ready to install on any JVC 4400 or equivalent  $\frac{3}{4}$ " portable VTR. The entire conversion takes a technician approximately two hours and adds  $2\frac{1}{2}$  lbs. in weight and 2" in overall machine height.



## **VM95U**

250 North Wolfe Road, Sunnyvale, CA 94086 408/733-6500



The NV950U/VM95U represents the first practical approach to low cost editing while maintaining all the features presently available on any ¾" editing console. It also has one big advantage over the competition — it requires no mechanical modifications to the VTR's.

The NV950U/VM95U is available for interface to the Panasonic NV 9200, NV 9500, and Sony VO 2860. By eliminating mechanical modification to the VTR's, factory warranty is still valid (a big plus). Also, since we do not force the VTR into unnatural functions, they don't "eat" tape. If you have edited any length of time on a competitive editor, you know the heartbreak of having your master tape "eaten."

Check the comparison table below for features of the NV950U/VM95U as compared to a well known editing system and then check the price. There is no comparison.

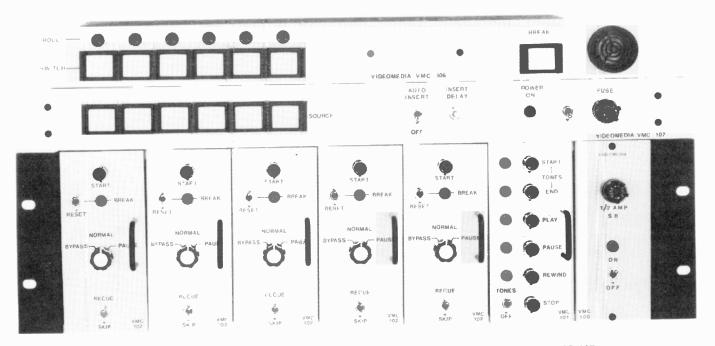
## NV950U/VM95U with T 95 Tape Timer vs. Competitor with Tape Timer and Keyboard Computer

	Joystick Control Bi-directional	Random Search	Preview of Insert Start & End	Mechanical Interface Required	Full Remote Control of Both VTR's	Dual Tape Timer	Return to Edit	Auto Assemble
COMP.	X	X	X	X	X	X	NO	NO
NV950U/ VM95U	X	X	X	NO	X	X	Х	X

The T 95 tape timer search module and NV950U/VM95U are available as an add on and are field installable.



## the VMC-100



VMC-100 with VMC-107 Vertical Interval Switcher and VMC-106 Remote Control for VMC-107 Switcher.

### **GENERAL DESCRIPTION**

The Videomedia VMC-100 sequencing system was designed specifically as a professional approach to sequencing %" video tape machines in a broadcast situation.

The versatile VMC-100 sequencer is a rugged, dependable, low cost control system that interfaces to any capstan servoed helical-scan video cassette machine for precise cueing and vertical interval switching of program material.

The system derives its accuracy from counting control track pulses on standard, unmodified video tapes, obviating the need for expensive time codes.

The sequencer features individual control cards for each videotape machine for utmost dependability. In the event of a failure, either mechanical or electronic, the by-pass function allows the sequencing system to route control signals around the defective machine or control card.

The VMC-100 is the best system available for low cost sequencing of broadcast commercials. An analysis of broadcast users of video cart machines has indicated a typical loss of between \$5,000.00 to \$8,000.00 in revenues for the average down time of a cart machine.

Because of the individual control card-to-machine design of the VMC-100, with its by-pass capability, loss of commercial revenues is minimized.

Additionally, the cost of a turn key six machine system including switchers, time base corrector, waveform monitors, etc. is approximately 1/5th the cost of a quad video cart machine.

## **APPLICATIONS**

The VMC-100 sequencing system design is flexible for adaptation to the following typical uses:

- Commercial spot play systems
- · Standby or back-up for quad video cart machines
- Network delay with commercial inserts
- ENG news playback
- Automatic programming for cable television
- Hotel/motel movie sequencing (can handle three separate movie channels)
- Training tape repetition
- Can be used for continuous recording (infinite number of hours)



## the VMC-100

## **FEATURES**

- · Automatic recue or program segment advance
- Automatic tape slack (machines may be left in cue position with tape loaded, without fear of head clog)
- · Full remote control of vertical interval audio follow-video switcher
- Unit will automatically switch to and from external signals if required
- Pause/restart feature allows remote break to be made during any sequence of operation
- · Remote status panel indicates which VTR is up
- Separate bridging switcher for monitoring, cueing and engineering checks
- Two-tone PLL system for positive precise tone cueing and indexing, up/down counters assure exact tone placement on tape
- · Each control card has a by-pass, normal or pause mode function
- Warning beep tone at remote panel provides five (5) second count down to switcher operator indicating the machine is entering a pause condition. Operator has time to roll film, take network, etc.

The tone encoder back space control unit allows precise cueing of the program material. Upon selection of the switch point the control unit automatically, by counting control track pulses, applies the required tones exactly five (5) seconds prior to program start or end.

A single system consists of two to six machines and is expandable by cascading additional controllers and machines indefinitely.

Due to the card rack frame construction the user need buy only as many control cards as is immediately required, with complete assurance that the system can be expanded in the future. Trouble shooting is simplified since in the event of one card/machine failure, the entire sequencer control does not need to be replaced.

### **SPECIFICATIONS**

General

Power
Size:       Width       19" (48.26 cm)         Height       5.25" (13.35 cm)         Depth       11.5" (29.21 cm)
Weight
Ambient Temperature
VMC-101 Tone Encoder Backspace Control
Audio Output
Start Tone
Enc Tone
Cue Placement
VMC-102 VTR Control Card
Audio Input
Input Impedance
Input Activating Frequencies: Pause
Program Switch

225.00

## VMC 100 SYSTEM

Model	Modules	User Net
VMC-100 VMC-101 VMC-102 VMC-103 VMC-105 VMC-106	Power supply and frame .  Tone encoder and backspace control unit .  VTR control card, one required per VTR used (price does not include VTR modification kit) .  Card extender .  Stand alone power supply/frame (houses two units) .  Remote control for VMC-107 switcher (sequence "break" control, warn buss and audio alarm) .	690.00 560.00 35.00 500.00 575.00
	Vertical interval switcher 6X1 with auto-insert function, audio follow video (including VMC-100 interface mods)	
Panasonic N\	/ 9200 Kit/ 9500 Kit	

### **CABLES FOR VMC-100 SYSTEM**

Sony VO 2860 Kit.....

RM-100	75' remote control cable for vertical interval switcher	180.00
RM-100J	Junction for utilizing two VMC-106 remote controls	140.00
RM-95J	Connects 105 with editing system	250.00

## VTR CONTROL CABLES

(Included with VTR	modification	kite at	t no charge	١

(IIIciaaea wi	til VIII modification kits at no charge,	
CC8P CC8S	10' control cable (Panasonic)	60.00 60.00



## Z6 EDITING SYSTEM



The Z-6 microprocessor based control editing system represents the largest breakthrough in technology since the original inception of video tape editing itself. The system offers frame accurate editing and a 99 event memory with "micro-loc\*".

"Micro-loc\*" obviates the need for SMPTE time code. It is absolutely "dead lock" accurate and does not require expensive readers and generators. "Micro-loc" does not require an audio track to operate and if necessary can co-exist with SMPTE time code.

The Z-6 system has a Z-80 microprocessor "heart of gold". It won't break your pocket-book, resides on the industry standard S-100 buss; and its use, with total accuracy, is made possible for the first time by "micro-loc\*". Here's why:

In order for an editing system to be frame accurate, each and every frame must have a way of being identified as unique. SMPTE time code fills this need, as does "micro-loc\*". But SMPTE code requires complex data handling of an 80-bit word which becomes increasingly difficult in fast forward and rewind modes of the VTR. In that case, a 16-bit processor is an absolute necessity, hence a much more costly system (by a factor of 5X or more). The Z-6 however can cruise sweetly with "micro-loc\*" and sample correctly at any speed forward or reverse with time to spare, hence the first 8-bit system in the world with frame accurate editing.

The operating program resides in a software package making this a system that will not obsolete itself. Any new features or options can be implemented by simply changing the software. A Z-6 purchased today will have the option of doing all the things a Z-6 of tomorrow can do, (whatever happened to "planned obsolescence"?).

\*Patent Pending

## **OPERATING FEATURES**

The Z-6 is the fastest, most flexible, most practical, most innovative, most reliable, most lovable editing system that has ever been touched by a video producer's hands. Editing the way it should be and never was. A tool to be loved, not feared. A unit easy to master, not to be conquered by. Most of all, a system with the power to be really creative without being a graduate engineer. Put your mind on your creation and forget all the technicalities. The Z-6 has a simple screen layout that doesn't take a genius to figure out. And you don't need numbers, only the computer does. You can edit an entire program and never mess with numbers, (people edit pictures, not numbers).



## A Microprocessor Based Editing Control System for

## CREATIVE FREEDOM

## Standard Z6 features include:

- Play and record joystick shuttle arms for bi-directional search.
- · Programmable pre-roll and post roll times.
- · Programmable in, out and duration of each VTR.
- Auto search (with "sense enough" to know how far to go and what speed to get there).
- Single glide ballistics (3X play speed to stop with no overshoot, automatically controlled and varied).
- · Select edits on the fly.
- Tag entries (for animation, multiple event execution etc.).
- Calculate mode.
- Convert (converts entire display from "micro-code" to minute; second; frame format and vice versa).
- · Cruise control.
- · Full function VTR remote control.
- · Return to "in" edit point.

- Return to "out" edit point.
- · Go to search function.
- · Rehearse edit (ingoing and outgoing).
- · Perform edit.
- Review edit.
- · Auto select of "micro-loc\* or not"
- "Micro-loc\*" recalibrate features auto offset.
- · Consecutive event non stop mode change execution.
- Foolproof error messages and keyboard lockout (won't let you make a mistake).
- Prompting for proper entries.
- · AB monitor select with auto lockout functions.
- S-100 buss.
- · Abort function.
  - \*Patent Pending

## **SPECIFICATIONS**

The Z-6 system is sold and serviced by authorized Videomedia Dealers throughout the United States and Canada with a strong commitment from Videomedia to provide ongoing software development to increase the personality of your powerful Z-6 system.

## **Dimensions**

	Height	Width	Depth
Electronics Chassis	7''	19"	13''
Keyboard	4''	19''	10′′

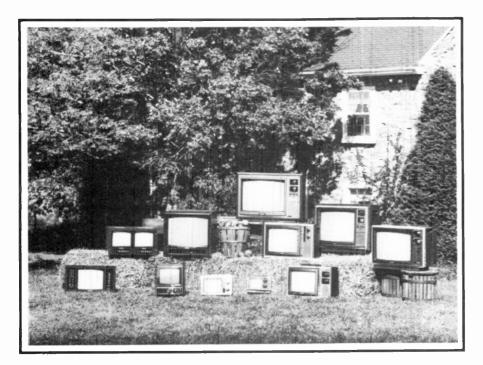
Power requirements 110/220 VAC 50/60 Hz 65 watts Video output display IV pp at 75 ohms

Z-6 software is copyrighted and is supplied subject to the following restrictions:

It shall not be reproduced, copied, altered or changed without express written permission from Videomedia.

Because of the high degree of technology involved in a Z-6 system, hardware interfaces must be performed by an authorized videomedia Z-6 dealer or a waiver for said installation must be submitted by the dealer to Videomedia to maintain Warranty Status.

0 4:2 3:1 2 IN POINT	T 0 T A L	0 5:4 1:1 2 OUT POINT
PLAY VIR		RECORD VTR
	I N	
0 4:2 4:1 5,	0 U T	0 5:4 1:1 2
00:0000	.D U R A T I O N	0 0:0 1:0 3
	VIEW AN UN-PERFORMED EI MEAN (R E H E A R S E)	
TAPE # : 0 1	INSERT V : A2	EVENT # : 0 2
PRE-ROLL :0 5	PROGRAM LENGTH	0 0:0 5:1 2
POST-ROLL:0 3	WITH THIS EVENT	0 0:0 6:1 5



## VIDEOTEK PRESENTS...

## PROFESSIONAL COLOR MONITORS FOR BROADCAST ENG CCTV

Designed by the Professionals for the the Professionals

Protured left to right bottom row VM-12 PRO\_RM 9H\_RM 8\_RM 5\_RM-12 top row VM 8 PRO\_VM-19 PR\_RM-21\_RM-12\_RM-19\_RM-17

## **PROFESSIONAL COLOR MONITORS**

Videotek professional color monitors are designed and manufactured with expert workmanship to assure the durability and performance needed in today's "On The Move" broadcasting. "State Of The Art" circuitry complemented by the Trinitron Plus. CRT brings high reliability, stability, and superior picture quality in all Videotek monitors. And the entire series (8, 12, and 19 inch) is designed for mounting in any standard 19 inch equipment rack.

The latest additions to the line include 8 inch portable units, Studio 12 and VM-15PRO, ideal for all Broadcast applications.

cast applications.
VM-8PT — 8" Professional Portable AC/DC
Colar Monitor
VM-8PR — 8" Professional Rackmount
Color Monitor
VM-8PRW — 8" Professional Rackmount Color
Monitor with space for 528 Waveform Moni-
tor1095.00
VM-8PRD — Dual 8" Professional Rackmount
Color Monitors
VM-8PRA — 8" Professional Rackmount Color
Monitor with speaker cabinet
VM-12PR — 12" Professional Rackmount
Color Monitors
VM-12PRO — 12" Professional Rackmount
Color Monitor with all Options
STUDIO 12 - 12" Professional Rackmount
Color Monitor
VM-15PRO - 15" Professional Rackmount
Color Monitor
VM-19PR - 19" Professional Rackmount
Color Monitor
DM-4R — Rackmount Demodulator 550.00

## **CCTV COLOR MONITORS**

Al. Videotek CCTV monitors and monitor/receivers are available with optional equipment making the entire series desirable for broadcast use. The complete line is totally compatible with all portable recording and eciting equipment. One hundred percent solid state circuitry, complemented by the Trinitron Plus<sup>®</sup> CRT, insures maximum stability and reliability.

VM-9 - 9" Portable Trinitron® Color Moni-....\$740.00 . 725.00 RM-12 - 12" Portable Trinitron® Color Receiver/ Monitor ...... VM-12R — 12" Trinitron © Color Monitor (Rackmount) . . . . . . . . . . RM-12R — 12" Trinitron<sup>®</sup> Color Receiver/ Wonitor (Rackmount)...
V:M-15 — 15" Trinitron ® Color Monitor ....
RIM-15 — 15" Trinitron ® Color Receiver/ .790.00 RM-17 — 17" Trinitron® Color Receiver/ Monitor 935.00 VM-19 — 19" Trinitron® Color Monitor . . . . . 970.00 RM-19 - 19" Trinitron® Color Receiver/ Monitor .: VM-21 — 21" Trinitron® Color Monitor. . . . . . 1105.00 RM-21 - 21" Trinitron® Color Receiver/ 

## **AC/DC COLOR MONITORS**

Complete your ENG Color System with the exciting new series of 5, 8, and 9 inch AC/DC Color Monitors by Videotek. The durable, lightweight Monitor and Monitor/Receivers take the guesswork out of setting up color cameras and taping color programming on remote locations. The entire series is also ideal for use with all editing systems.

VM-5 — 5" AC/DC Portable Trinitron® Color Monitor
OPTIONS
Service Manual
Battery Pack for 9H
Battery Pack for 5"
Battery Pack for 8"
AB Selection (Not Available on RM-8,
RM-5, VM-5)
Blue Gun

TV Line VTR Selection (Standard on RM-8) . . . . 60.00

Carrying Case for 8" (Holds monitor &



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Write for our brochure for more information on standard and optional features.

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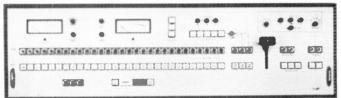
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3700 N.E. 53rd Ave. Gainesville, Florida, USA 32601 (904) 377-8900

Where Professional Standards are Required—Price range of \$12,000.00 to \$48,000.00

## Model 730 Master Control System



The 730 Series Master Control System has been designed to permit a single master control operator to flawlessly air complex on-air programs and station breaks.

By combining Video, Audio, and Complete Machine Control functions into Preset and Take Operation, the ON AIR programming can be Smooth and continuous. Preset the next on air segment and relax until air time and just depress a SINGLE pushbutton — the 730 DIGITAL logic will do the Starting, Rolling, Flipping Mirrors, Switching Audio and Video, Key, Matte, Mix or Fade automatically and on time.

Modern technological advances in hardware and operational design permit hardware reliability with operational ease. Digital electronics are used throughout for superb linearity, stability and reliability, with an economical price.

## **FEATURES**

- 16, 20, or 24 Audio follow Video inputs (including color blk and color background)
- 5 Audio Only Sources

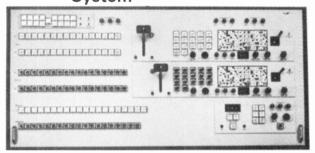
## • 3 Switching Buses: Audio Breakaway, Program and Preset

- Automatic or optional Manual Video and Audio Mixer/Fader.
- Full over-under Audio Controller.
- Over-Under Ratio Control.
- 2 VU Meters and remotely operated Audio Level Controls.
- 5 input Audio Monitor Switch.
- Output Color Burst Defeat.
- Ready wired for computer interface.
- One-man operation of Audio, Video and Machine control.
- Full one-event preset and take system.
- Automatic Revert to Normal Selection (AFV Full, Cut and Key out)

### **OPTIONS**

- Downstream Kever with 4 key inputs and color matte, with auto preset controls for cut or dissolve in and out.
- Analog Key Border and Edge System with Drop Shadow and outline for the Downstream Keyer.
- Pre-roll system and automatic preset machine start and mirror flip system.
- Machine control for a complete film island (2 projectors and one slide) (4 island max:).
- Machine Control for a VTR or Video Cart.
- Audio Preset Level System.
- Additional 16 x 1, 20 x 1, or 24 x 1 AFV Switching Bus with 5 Audio Only Inputs, complete with 1.75 x 19 control panel. This system can be used as a second master control outlet.
- Micromax-32 Microprocessor Preset Control System.
- Micromax-200 Microprocessor Automatic System.
- Vimax-200 Computer Control System.
- 6 x 1 Audio Follow Video Bypass Switcher.

## Model 702 Video Production Switching System

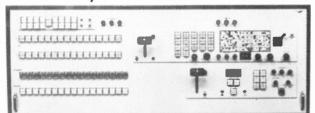


The Model 702 is a Digitally Controlled Video Switching System for use in Television Studios, Production Centers and other TV applications where professional standards are required. The 702 is available in NTSC, PAL, or PAL-M standards. The ease of operation and the outstanding features, combined with technical excellence, makes the 700 series a trend setter. Human engineered panel allows for full utilization of all features.

- 16 or 24 Inputs including Color Black and Color Background.
  6 Output Buses: Mix/Effect 1 A and B, Mix/Effect 2 A and B, Program, and Preview.
- 2 Linear Shadow Keyer with 4 inputs and VARI-KEY.
- 2 Mix/Effect systems, each with color matte, modulated positioner, 60 pattern effect (Including Heart, Star, Binocular, Sequential, pointer and many other wipe patterns) Soft and Border wipe, spotlite, and preset patterns for Key into Wipe into Mix or Wipe.
- Synchronous or non-synchronous operation and inhibit.
- On Air tally system.
- Self contained Color Black and Color Background Generator.
- Vertical Interval Switching.

- Shadow Chroma Key Both RGB & Encoded.
- Downstream Keyer with automatic Key Cut or dissolve.
- Key Edge & Bordering with Edge, Shadow, and Outline.
- Digital, Quad Split and input selector.
- Frame Programmable Auto transition System.
- Rotary & Clock wipes.
- Computer Editor Access and Audio System.
- Auxiliary Switching Matrix.

## Model 700 Video Production Switching **System**



The Model 700 is a Digitally Controlled Video Switching System for use in Television Studios, Production Centers and other TV applications where professional standards are required. The 700 is available in NTSC, PAL, or PAL-M standards. The ease of operation and the outstanding features, combined with technical excellence, makes the 700 series a trend setter.

· 16 inputs, including color black and color background.

- 4 output buses: mix/effects A & B, program and preview.
- Linear shadow keyer with 4 inputs and VARIKEY
- Synchronous or non-synchronous operation and inhibit.
- On air tally system.
- Mixer/fader between program and preview buses.
- Mix/effects system with color matte, modulated patterns. 60 pattern effect (including heart, star, binocular, sequential, pointer and many other wipe patterns) soft and border wipe, spotlite and preset patterns for key into wipe into mix or wipe.
- Self contained color black and color background generation.
- Vertical interval switching.

- Shadow chroma Key Both RGB & Encoded. Downstream keyer with automatic key cut or dissolve.
- Key edge & bordering with edge, shadow and outline.
- Digital Quadsplit and input selector.
- Frame programmable auto transition system.
- Rotary & clock wipes.
- Computer editor access and audio system.
- Auxiliary switching matrix.

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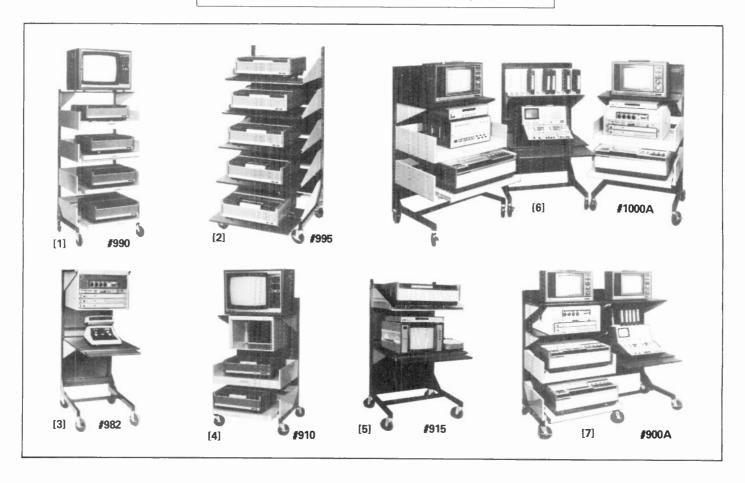
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## EDITING, DUBBING AND POST-PRODUCTION CONSOLES

With strength, mobility and safety, here's new flexibility in working arrangements for ENG/EFP — without costly, clumsy fixed wooden installations. Caster-mounted steel construction lets you place these compact Winsted units virtually anywhere in your teleproduction facilities — or even roll a unit into a van to create a mobile setup. Modular components can easily be rearranged . . . whenever your needs change.

Separate "L" frame modules can be bolted together. All shelves and drawers have 1" adjustments. All VTR units have a pullout sliding shelf with 12" safety stop. A pullout work surface gives added space to the editor shelf. Removable rear panels reveal a handy 2" x 28" raceway for cords and cables.

Extended frames allow you to create the ideal setup for %" video-cassette duplicating. Consoles hold up to 5 VTR units.

[2] MODEL 995: Extended "L" frame with 5" casters (2 locking) and five #950 VTR shelves. 72"H x 26"D x 30"W. (Wt. 202 lbs.) . . \$649.00

 [4] MODEL 910: Complete "L" frame with 5" casters (2 locking), two all steel #960 VTR drawers, one #930 monitor shelf and one #986 rack mount cabinet. 56"H x 26"D x 30"W. (Wt. 183 lbs.) . . . . \$505.00

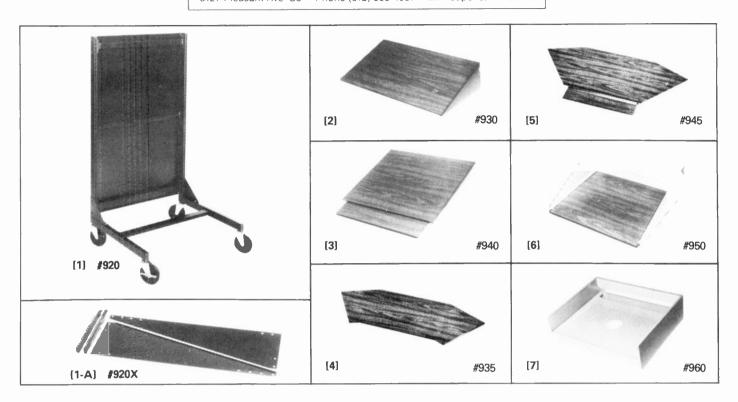
[7] MODEL 900A: Two sets of complete "L" frames with 5" swivel casters (4 locking), three monitor shelves, editor shelf and two all steel #960 VTR drawers. Shown assembled as "in-line" console — overall dimensions 56"H x 28"D x 60"W. (Wt. 280 lbs.) . . . . . \$785.00 MODEL 900B: (not shown) Same as above except two low profile #950 VTR shelves in place of two #960 VTR drawers. . . . . . . \$755.00

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## DESIGN A CONSOLE TO FIT YOUR VIDEO NEEDS

Now you can create the ideal setup for any 34" cassette editing -ENG, EFP, industrial, educational or production house. Winsted gives you the exact combination of shelves and drawers you need; they all lock at 1" increments, at exactly the working height you like best.

[1] BASIC FRAME: Rugged black enamel 1" x 2" steel channel "L" frame is slotted to accept shelves and drawer units at 1" increments. Removable back panels for full rear access. Heavy duty 5" swivel casters (2 locking). Specifications: 56"H x 26"D x 30"W. MODEL 9200 (Wt. 42 lbs.) Same frame without removable back

[1-A] BASIC FRAME EXTENSION KIT: Two 16" extension and two side support gussets.

[2] FLAT MONITOR SHELF: Made of 5/8" particle board with walnut woodgrain laminate top; will safely hold TV monitors. Specifications: 18"D x 29 34"W. Beige steel brackets. 

[3] FLAT EDITOR SHELF: Accommodates all sizes of editors; made of 5/8" particle board with walnut woodgrain finish. Pullout adds 12" of working surface. Specifications: 26"D x 2934"W (38"D with pullout extended.) Beige steel brackets.

[4] EXTENDED MONITOR SHELF: Adds shelf space when you're using single modules or angled frame layouts. Wings extend 15" beyond frame on each side. Same construction as Model 930. Specifications: 19 ½"D x 60"W.

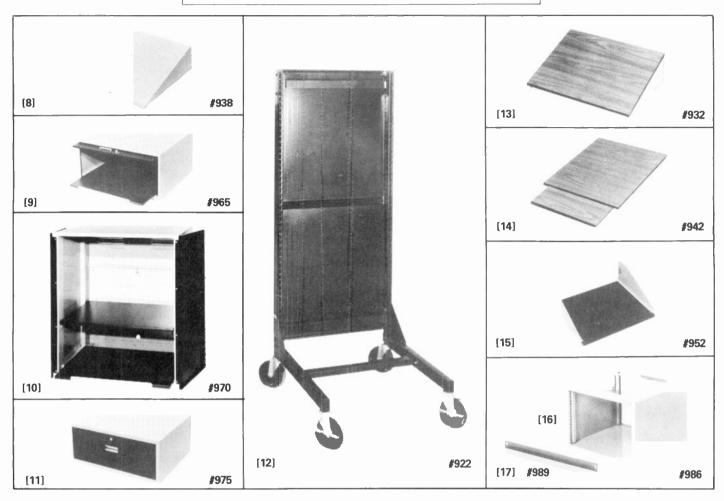
[5] EXTENDED EDITOR SHELF: Angled shelf extends 15" beyond frame on each side. Use with angled layout or individual module arrangement. Same construction as Model 940, including 12" pullout shelf. Specifications: 26"D x 60"W (38"D with pullout extended). 

[6] LOW PROFILE VTR SHELF: Holds all sizes of videotape recorder/players. Low profile design increases space for other equipment. Pullout sliding shelf with 12" safety stop. Steel tabs lock shelf to frame at any height in 1" increments. Specifications: Made of 5/8" particle board with walnut woodgrain laminate top. Brackets of beige steel. 73/4"H x 24"D x 29"W.

[7] VTR DRAWER: Beige steel unit holds any size videotape recorder/player, has a pullout shelf with 12" safety stop. Drawer bottom is punched for installation of muffin fan where heat buildup is a problem. Specifications: 8"H x 24"D x 29 %"W.

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[8] ANGLED MONITOR SHELF: Holds up to a 25 monitor, is tilted for glare-free viewing, adjusts up or down in 1" increments. Specifications: 29"W x 22"D. Beige enameled steel.

[9] VTR CABINET: Tip-up door locks for security. Pullout shelf with 12" safety stop for easy access to VTR. Locking ventilated rear panel is removable for full access. Specifications: 14½"H x 24"D x 29"W. Beige and black enameled steel.

[11] STORAGE DRAWER: Locking cabinet stores plenty of supplies and equipment. Specifications: 12"H x 24"D x 29"W. Beige and black enameled steel.

**NEW SPACE SAVING MODULE:** This compact unit is only 22" wide, yet has all of the features of the standard editing modules. Ideal for the new smaller editors, monitors, and rack mount equipment.

[12] BASIC FRAME: Compact 1" x 2" steel "L" frame has same rugged construction as Model 920 frame. Specifications: 56"H x 26"D x 22"W.

[13] FLAT MONITOR SHELF: Sturdy shelf with same rugged construction as the Model 930 will safely hold TV monitor or other teleproduction equipment. Specifications: 18"D x 21%"W.

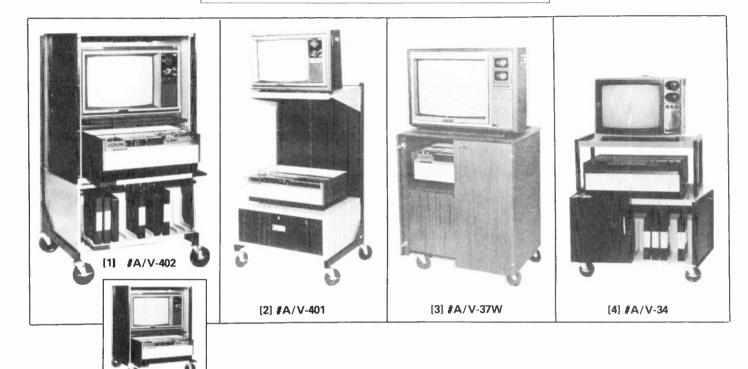
[14] FLAT EDITOR SHELF: Accommodates the new smaller editors. Pullout adds 12" of working surface. Same features as Model 940 shelf. Specifications: 26"D x 22"W.

[15] COMPACT VTR SHELF: Accommodates any %" Betamax or VHS machine. Same features as Model #950. Specifications: 7%"H x 18"D x 21"W.

[17] EXTRA SUPPORT BRACKETS: For installations requiring more than the single pair of brackets included with [15]. Specifications:  $1\,\%'' \times 1\,\%'' \times 15\,\%''$ .

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# 34" VIDEO CENTERS/CONSOLES

**DELUXE VIDEO CABINET:** Upper section accepts most 19" monitors and VTR units. Adjustable monitor shelf can be angled 5° for glare-free viewing. Pullout VTR shelf with 12" safety stop. Ventilated locking rear panel access to cords, cables and adjustments. Locking swing-away doors.

#A/V-405

Low section has locking tip-up door. Provides ample storage space; ideal for multiple VTR units. Ventilated locking rear panel for easy access to video equipment. Specifications: Overall size: 56"H x 26"D x 30"W.

[1] MODEL A/V-402 complete with #920 Frame, #970 TV/VTR Cabinet, #965 VTR Cabinet. (Wt. 220 lbs.)
MODEL A/V-405 Low Profile Unit #970 TV/VTR cabinet with 5" swivel casters. (Wt. 115 lbs.)
TV AND VTR CONSOLES: Complete video center with ample capacity — up to 25" monitor plus the largest of videocassette recorder/players. Monitor shelf is angled for glare-free viewing, adjusts up or down on 1" increments. Locking drawer for supplies

recorder/players. Monitor shelf is angled for glare-free viewing, adjusts up or down on 1" increments. Locking drawer for supplies and equipment. Removable rear panel access to power cords and cables. Unit is extremely stable; rolls easily even with full load. Specifications: Overall size: 56"H x 26"D x 30"W. Monitor shelf 29"W x 22"D. VTR Cabinet 14½"H x 24"D x 29"W. Drawer 12"H x 24"D x 29"W. Heavy gauge steel in beige and black enamel.

 MODEL A/V-401C (not shown) is designed for extra security. All features of A/V-401 plus locking VTR Cabinet. Complete with #920 Frame, #938 Monitor Shelf, #965 VTR Cabinet and #975 Storage Drawer.

[3] **EXECUTIVE VIDEO CONSOLE** of rich walnut wood grain laminate holds any ¾" VTR machine and monitor of up to 25" size. Ideal for executive conference rooms and offices. Storage shelf holds tapes and other video accessories. Pullout VTR shelf.

Locking cabinet doors provide extra security, swing back out of way a full 270°. Rear opening provides access to cords, cables and control adjustments. Large 4" industrial type casters. Shipped assembled. Specifications: 35"H x 22"D x 29"W.

use. Monitor shelf is set back slightly to permit easier access to VTR shelf. Specifications: 34"H x 20"D x 30"W. Top shelf 15"D x 28"W. Cabinet 13"H x 20"D x 29 %"W.

**Optional Accessories:** 

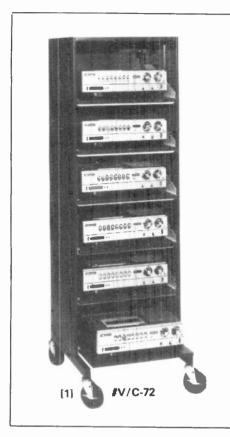
MODEL 130: Two-outlet Electrical Assembly with 20' three-wire cord and cord winder bracket.

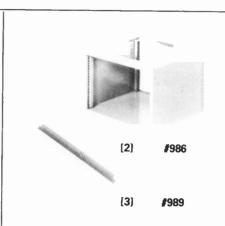
MODEL UCS-12 Molded plastic divider holds 12 videocassettes. (Wt. 3 lbs.) \$12.00

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# 1/2 " VIDEO CENTERS and STORAGE SYSTEMS

A versatile ½" videocassette tape duplicating center. Console holds up to six VTR units — or one rack mount cabinet and five VTR shelves. Pullout sliding VTR shelf, with full 21" width, accommodates any size ½" videocassette machine. All shelves adjustable up or down on 1" increments. Caster mounted steel construction. Removable back panels for full rear access. Separate "L" frames can be bolted together.

[1] TAPE DUPLICATING CONSOLE: Complete extended "L" frame with 5" casters (2 locking), six #952 VTR shelves, top canopy and side panels. Specifications: 72"H x 20"D x 22"W. Black frame. Chocolate brown top and side panels. Walnut wood grain laminate VTR shelf with beige brackets.

MODEL V/C-72 (Wt. 245 lbs.)	
Individual Components:	
922X Extended Frame (Wt. 61 lbs.)	
922BP Back Panels (set of 2) (Wt. 20 lbs.)	

922BP Back Panels (set of 2) (Wt. 20 lbs.)	35.00
922C 5" Casters (set of 4) (Wt. 4 lbs.)	24.00
922TC Top Canopy (Wt. 10 lbs.)	55.00
922XS Side Panels (set of 2) (Wt. 30 lbs.)	84.00
952 VTR Shelf (Wt. 20 lbs.)	85.00
986 Rack Mount Cabinet (Wt. 23 lbs.)	74.00

[3] EXTRA SUPPORT BRACKETS: For installations requiring more

than the single pair of brackets included with above cabinet. Specifications: 1¼"H x 1¼"D x 15½"W.

[4] CASSETTE HOLDER: Holds 25 tapes of any ½" videocassette format. Pressure-sensitive tape on bottom assures positive, easy installation. Specifications: 4-3/8"H x 5"D x 33"W. Molded high-impact polystyrene plastic, beige color.

 MODEL VCS-25 Carton of 5 (Wt. 11 lbs.)
 \$35.00

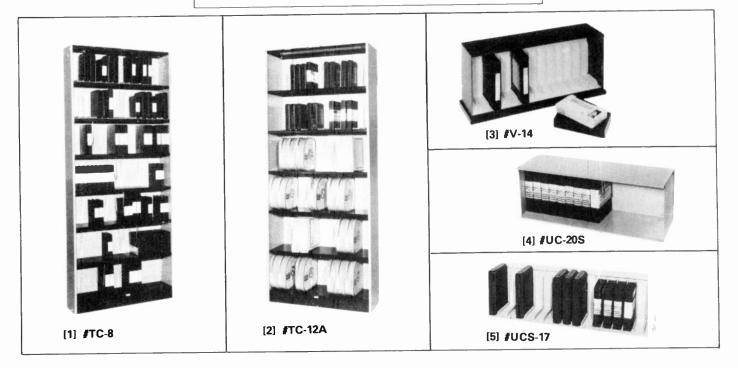
 Individual Dividers (Wt. 2 lbs.)
 \$10.00

[5] EXECUTIVE VIDEO CABINET: Holds any ½" Betamax or VHS machine. Spacious storage drawer and lower shelf holds tapes, camera or other valuable video equipment. Locking doors swing back a full 270°, provide cabinet security. Rear opening provides access to cords, cables and adjustments. Large 4" swivel casters make unit easy to move. Shipped assembled. Specifications: 35"H x 22"D x 24"W. Rich walnut wood grain laminate cabinet.

MODEL V/C-36W (Wt. 95 lbs.) \$259.00

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# **OPEN SHELF STORAGE SYSTEMS**

Heavy gauge steel cabinets help you organize your tapes for quick access and proper filing. Shelves bolt in place, adjust up or down in 1" increments. Sliding wire supports hold tapes upright. "Add-on" cabinets bolt on side-to-side or back-to-back. Beige and black baked enamel finish.

SPACE SAVING, SLIDING LATERAL CABINETS AVAILABLE FOR SUPER DENSITY STORAGE ... CALL OR WRITE FOR DETAILS.

[1] VIDEO TAPE STORAGE SYSTEM: Has 8" cabinet depth, ideal for %" U-Matic videocassettes and 5" - 7" helical tape. Order molded plastic dividers for videocassettes separately. (Model UCS-17A, item 5). Seven shelves. Specifications: 88"H x 8"D x 36"W (inside width 34½", inside height 83").

 MODEL TC-8 (Wt. 120 lbs.)
 \$295.00

 Add-On Unit TC-8X Specify side-to-side or back-to-back installation when ordering. (Wt. 105 lbs.)
 \$275.00

 MODEL TC-8S Extra Shelf. (Wt. 4 lbs.)
 \$14.00

# VIDEOCASSETTE STORAGE SYSTEMS

[3] OPEN-FRONT CASE. Holds 14 cased ¾" U-Matic video-cassettes; any size of ¾" format. Units interlock, can be set on table, wall hung or stacked five high. Specifications: 13"H x 8"D x 30"W. Steel frame in black enamel with woodgrain end panels, molded vinyl dividers.

[4] TAPE STORETTE Welded steel cabinet holds 16 mini-size (20-minute) %" U-Matic videocassettes. Creates an orderly, efficient ENG/EFP station, library or storage area. Can be set on a table, wall hung or stacked four high. Sliding wire support holds tapes upright. Specifications: 9%"H x 8"D x 25"W. Beige enamel finish.

[5] HOLDER/DIVIDER: Holds 17 cased ¾" U-Matic videocassettes of all sizes, can be installed on standard 3' wide shelving. Pressure-sensitive tape on bottom assures positive, easy installation. Index label area on front. Specifications: 10-1/8"H x 7½"D x 35¼"W. Molded high-impact polystyrene plastic, beige color.

 MODEL UCS-17 Carton of 5 (Wt. 12 lbs.)
 \$50.00

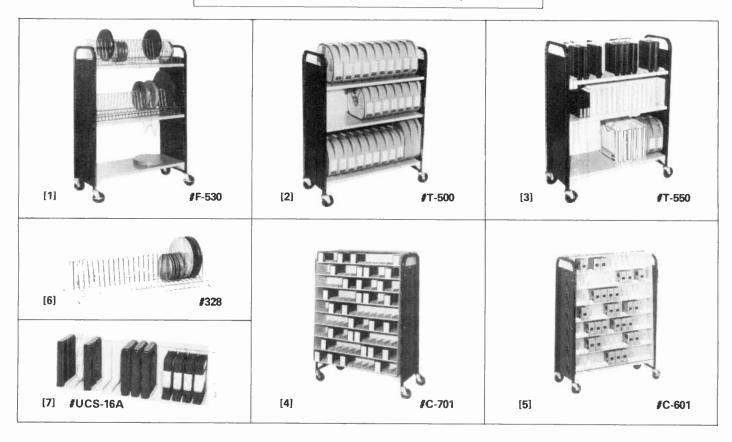
 Individual Dividers (Wt. 3 lbs.)
 12.00

 MODEL UCS-17A. For use in TC-8 or TC-12A cabinets. Carton of 7 (Wt. 16 lbs.)
 \$70.00

 Individual Dividers (Wt. 3 lbs.)
 12.00

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# TAPE AND FILM TRUCKS

These heavy trucks have metal end frames welded to heavy gauge square steel tubing. Shelves adjust to fit transport needs; each has a 3" steel backstop, removable for access to both sides of the shelf. Sliding supports hold tapes upright. Industrial 4" ball bearing casters allow safe effortless movement of heavy loads. Specifications: 50"H x 15"D x 36"W. Beige and black enamel finish. Inside shelf width 15"D x 34-1/8"W.

[1] FILM TRUCK: Holds 54 reels of 16mm film in 1-1/16" wide wire supports. Open bottom shelf holds additional films or equipment.

MODEL F-530 (Wt. 68 lbs.) \$239.00

[2] VIDEO TAPE TRUCK: Includes shelf backstops and sliding supports to hold tapes securely upright.

MODEL T-500 (Wt. 64 lbs.) \$193.00

[3] VIDEOCASSETTE/TAPE TRUCK: Includes two plastic molded dividers for %" U-Matic videocassettes.

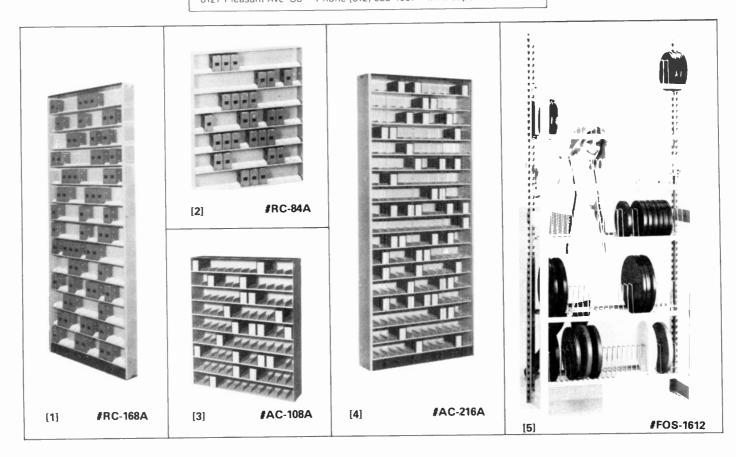
MODEL T-550 (Wt. 70 lbs.) \$208.00

# PROGRAMMING TRUCKS

Helps you set up your daily spot programming schedule quickly, efficiently. Full access from both sides of truck. Cartridge shelves are tilted rearward for safe transport of tapes. Heavy duty truck rolls easily fully loaded on 4" industrual ball bearing casters. Specifications: 50"H x 15"D x 36"W. Black and Beige.

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# TAPE AND FILM STORAGE SYSTEMS

Sturdy tape cabinets of beige and black enameled steel store your RCA TCR-100 or Ampex ACR-25 cartridges safely, conveniently. Double side walls give added strength. Extra units bolt on side-to-side or back-to-back.

Exclusive "Pik-Quik" feature — just tip back adjoining cartridges to grasp and remove any desired tape.

[1] TAPE STORAGE SYSTEM (RCA TCR-100 type) holds 168 tape cartridges. Specifications: 88"H x 4½"D x 36"W.

MODEL RC-168A (Wt. 120 lbs.) . . . . . . . . . . . . . . . . \$309.00

[2] MINI TAPE STORAGE UNIT (RCA TCR-100 type) holds 84 tape cartridges in minimum space. Cabinet is easily wall hung. Specifications: 42"H x 4½"D x 34"W.

[3] MINI TAPE STORAGE UNIT: (Ampex ACR-25 type) holds 108 tape cartridges in minimum space. Can easily be wall hung. Specifications:  $42^{\circ}H \times 7\%^{\circ}D \times 34^{\circ}W$ .

SPACE SAVING, SLIDING LATERAL CABINETS AVAILABLE FOR SUPER DENSITY STORAGE — Call or Write for Details . . . . . . . . . .

[5] FILM STORAGE UNIT: Open-shelf for quick access, filing of 16mm film. Shelves adjust on 2" increments. Unit assembles without tools. Specifications: Beige enameled steel with chrome-plated reel racks. 88" H x 36"W.

ADD-ON AND ENCLOSED CABINET UNITS AVAILABLE. CALL OR WRITE FOR FULL DETAILS.

FOR MORE INFORMATION ... CALL TOLL FREE NUMBER (800) 328-2962

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Nationwide Electronic Systems Inc.  SGL Waber	Farinon Electric	Leitch Video Ltd.
Switchcraft Inc.	Grass Valley Group Inc. Harris Corp. Broadcast Products Division	Lenco Inc.,
Topaz Electronics	Holland Electronics	Electronics Division B91-B103
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McIntire Co.	M.M.S. Inc. MPC Educational Systems Inc.	Quick-Set Inc
Wichtife Co.	Roger Mayer Electronics Inc.	RCA Broadcast Systems Richmond Hill Laboratories Ltd.
ALADMO ACIDO	Micro-Trak Corp	Roh Corp.
ALARMS, AC/DC	Microwave Associates Inc.	Rohde and Schwarz Scientific-Atlanta Inc.
MONITOR/CONTROL	Modular Audio Products B117	Shintron Co. Inc.
B and I Electronics Inc.	Rupert Neve Inc.	Sigma Electronics Inc.
Dranetz Engineering Laboratories Inc.	Opamp Labs Inc	TelemationB154-B156
ALADRAC AUDIO	Orange County Electronics Inc.	3M Co. — Mincom Division
ALARMS, AUDIO	Panasonic Co	Vamco
MONITOR/CONTROL	Pulse Dynamics Mfg. Corp. (PDMC)	Engineering Inc B160-B162
Atlas Sound	QRK Electronic Products B131 RCA Broadcast Systems	Video Aids of ColoradoB163
B and I Electronics Inc.	Ramko Research Inc B140, B141	Video Components Inc.
	Richmond Sound Design Ltd.	Viscount Industries Inc.
ALARMS, RF	Robins Broadcast and Sound Equipment Corp.	Vitex Co
MONITOR CONTROL	Hoh Corp.	
B and I Electronics Inc.	Scientific Systems Inc. Shintron Co. Inc.	ANIMATION FOLUBATION
Bird Electronics Corp.	Sigma Electronics Inc.	ANIMATION EQUIPMENT
GTE Lenkurt Inc.	Singer Education Products	Alan Gordon Enterprises Inc. Fax Inc.
AL ABA40	Spectra Sonics	Image Devices Inc
ALARMS, TELETYPE RECEIVER	Superscope Inc.	Leedal Inc.
B and I Electronics Inc.	Telemation	Starex Inc. TSC Development
	Tri-Tronics Professional Electronics	. To bottlophish
ALIGNMENT TAPES	United Research Laboratory Corp.	ABITECHIA
AGFA-Gevaert Inc.	Val-Tronics Inc.	ANTENNA AND TOWER
Broadcast	Vamco	INSTALLATION AND SERVICES
Electronics IncB22-B27	Engineering Inc B160-B162	AEL Inc.
Fidelipac	Versa-Count	Advance Industries Andrew Corp.
	Engineering B164-B165	
AM ANTENNA PHASING	Vital Industries Inc.	CCA Electronics Corp
AND MATCHING EQUIPMENT	Ward-Beck Systems Ltd. Westlake Audio	Fisher Burke Professional Audio
AGFA-Gevaert Inc.	Wilkinson Electronics Inc.	Fort Worth Tower Co. Inc.
Continental Electronics Mfg. Co.		Harris Corp., Broadcast Products Division McMartin Industries Inc.
Val-tronics Inc.	AMPLIFIERS,	Micro Communications Inc. Grenier Field
	VIDEO DISTRIBUTION	Microflect Co. Inc.
AM DUMMY LOAD		Fred A. Nudd Corp B119
Continental Electronics Mfg. Co.	American Data	Marconi Communication Systems Ltd. Philadelphia Resins Corp.
Rex Rheostat and Co. Inc.	Applied Video Electronics Inc.	Prodelin Inc.
	ASACA Corp. of America B17-B19	R.F. Systems Inc.
AMPLIFIERS,	Beaveronics IncB20 BETA Technology Inc.	Soll Inc. Swager Tower Corp.
AUDIO DISTRIBUTION	Broadcast Video	Tiner Communications Service Inc
Altec Lansing		Unarco-Rohn, Division of Unarco Industries Inc. Utility Tower Co.
American Data B12	Systems Ltd	Val-Tronics Inc.
Audio Designs and Mfg. Co.		Van Ladder Inc.
Automated Processes Inc.	Central Dynamics Ltd B41 Channelmatic Electronics Inc.	
BGW Systems Bayly Engineering Ltd.	Cohu Inc., Electronics Division	ANTENNA ACCESSORIES
Beaveronics Inc	Communications Technology Inc.	Andrew Corp.
Bell Audio Systems Inc.	Dage — MTI Inc. Datatek Corp.	The Finney Co.
BETA Technology Inc.	Diamond Electronics, Division of Arvin Systems Inc.	RCA Distributor and Special Products Division
Bogen Division/Lear Siegler Inc. Boston Sound and Power Systems	Di-Tech Inc	
Social Sound and Fower Systems	Dyma Engineering Inc	ANTENNA HARDWARE

B-183

**ANTENNA HARDWARE** 

Andrew Corp.

Dyma Engineering Inc. Dynair Electronics Inc.

Broadcast Electronics.... B22-B27

The Finney Co.	Turner Division of Conrac Corp.	Bird Electronic Corp.  CCA Electronics Corp
Fred A. Nudd Corp B119	Utility Tower Co.	Cetec Broadcast GRoup
RCA Distributor and Special Products Division	ANTENNAS, MATV AND CATV	Duncan Electronics Inc.
	CADCO	Gotham Audio Corp. Harris Corp., Broadcast Products Division
ANTENNA HEATER	The Finney Co.	Kay Elemetrics Corp.
CONTROL SYSTEMS	Sitco Antennas	King Electronics Co. Inc. Marconi Instruments, Div. of Marconi Electronics Inc.
CCA Electronics Corp B29	ANTENING DUMMAY LOAD	Orange County Electronics International Inc.
Cetec Broadcast Group  Micro-Trak Corp	ANTENNAS, DUMMY LOAD	Potomac Instruments Inc. Quad-Eight Electronics
Val-Tronics Inc.	Bird Electronic Corp. Coaxial Dynamics Inc.	ROH Corp. Richmond Sound Design Ltd.
var-frontes trie.	Continental Electronics Mfg. Co. Union Connectors Co. Inc.	Robins Broadcast and Sound Equipment Corp.
ANTENNA MONITORS	Onion Connectors Co. Inc.	Rohde and Schwarz Shallco Inc.
Delta Electronics Inc.	ANTENNAS, MICROWAVE	Shure Brothers Inc B144, B145
Electro Impulse Laboratory Inc. Gorman Redlich Mfg. Co.	Andrew Corp.	Spectra Sonics
McMartin Industries Inc.	Cablewave Systems Inc.	Tech Laboratories Inc. Texscan Corp.
	Gabriel Electronics Inc.  Marti Electronics Inc B110, B111	Waters Mfg. Inc. Weinschel Engineering Co.
ANTENNA SYSTEMS	Maury Microwave Corp.	Westlake Audio
Alford Mfg. Co. Andrew Corp.	Nurad Inc. Prodelin Inc.	
Anixter-Mark	Rohde and Schwarz	AUDIO ALC AND
Applied Video Electronics Inc. Bogner Broadcast Equipment Corp.	Scala Radio Corp. Electronic Manufacturers TerraCom, Division of Conic Corp.	AGC AMPLIFIERS
CCA Electronics Corp	Terracom, Division of Come Corp.	Automated Processes Inc.
C.S.P. Inc.	ANTENNA POLES	Broadcast P22 P27
Cablewave Systems Inc. CADCO	Fred A. Nudd Corp B119	Electronics Inc
Canadian General Electric Co. Ltd.	Fred A. Nada Corp	Elcom Engineering Co
Cetec Broadcast Group Continental Electronics Mfg. Co.	ANTENNA	ITI Flectronics Inc.
D.H.V. Inc.	ANTENNA	Inovonics Inc
Delta Electronics Inc. Dielectric Communications, A Unit of General Signal	POSITIONING SYSTEM	International Microwave Corp. KEL Corp.
Electronics, Missles and Communications Inc.	Pelco	McCurdy Radio Industries Inc.
Evenview Television Systems The Finney Co.	Van Ladder Inc.	Marti Electronics Inc B110, B111
G.C. Electronics Geleco Electronics Ltd.	ANTENNA PREAMPLIFIERS	Roger Mayer Electronics Inc. Roh Corp.
Harris Corp., Broadcast Products Division	CADCO	Sescom Inc.
Heath Co. McMartin Industries Inc.	The Finney Co.	Sontec Electronics Corp.
Marconi Communication Systems Ltd.	Sitco Antennas	Thomson-CSF Laboratories Wilkinson Electronics Inc.
Micro Communications Inc. Grenier Field Micro Control Associates Inc.	ANITENIA DELL	villandon and and and
Microwave Associates Inc.	ANTENNA RTH	AUDIO
Multronics Inc. Nurad Inc.	RELAY TILT HEAD	<b>AUTOMATION EQUIPMENT</b>
Phelps Dodge Communications Co. Prodelin Inc.	Quick-Set IncB132-B137	Allison Research Inc.
RCA Broadcast Systems		Autogram Corp. Automated Processes Inc.
R.F. Systems Co. — PA R.F. Systems Co. — FL	ANTENNAS, SATELLITE	Broadcast
Rohde and Schwarz Sales Co.	Andrew Corp.	Electronics IncB22-B27
Scala Radio Corp. Electronic Manufacturers Shively Laboratories Inc.	Microdyne Corp.	Delta Electronics Inc. — VA
Singer Products Co. Inc.		Elcom Engineering Co
Sitco Antennas Swager Tower Corp.	ANTENNAS, TV	McMartin Industries Inc.
Tayburn Electronics Inc.	CADCO Canadian General Electric Co. Ltd.	MCI Inc.
Toner Cable Equipment Inc. Winegard Television Systems	Cetec Jampro	QRK Electronic Products IncB131
Willegard Television Systems	Comark Industries Inc. Electronics, Missiles and Communications Inc.	Quad-Eight Electronics
ANTENNAS, AM	The Finney Co.	Richmond Sound Design Ltd.
Atlantic Research Corp.	Heath Co. Micro Communications Inc.	Tape Athon Corp.
Barker and Williamson Inc.	Microdyne Corp.	AUDIO AUTOMATION
Cetec Jampro D.H.V. Inc.	RCA Broadcast Systems RCA Distributor and Special Products Division	PROGRAMMING
Harris Broadcast Products	R.F. Systems Co. — PA Scala Radio Corp. Electronic Manufacturers	Concept Productions
McMartin Industries Inc. RCA Broadcast Systems	Sitco Antennas	Electronic Engineering Co. of California (EECO)
Rohde and Schwarz	Toner Cable Equipment Inc.	
Scala Radio Corp. Electronic Manufacturers Turner Division of Conrac Corp.	ADT CERVICE	<b>AUDIO CASSETTE COPIERS</b>
Utility Tower Co.	ART SERVICE	International Audio Inc.
ANTENNAC CAS	Image Devices Inc. W.A. Palmer Films Inc.	Recordex
ANTENNAS, FM		Telex Communications Inc.
CADCO Canadian General Electric Co. Ltd.	ASSEMBLIES, CAMERA CABLE	AUDIO COMPRESSOR/
Cetec Jampro	Anton/Bauer Inc	LIMITERS, AM
Comark Industries Inc. The Finney Co.	Boston Insulated Wire and Cable Co.	Automated Processes Inc.
Harris Broadcast Products		Bogen Division, Lear Siegler Inc.
McMartin Industries Inc.	ATTENUATORS	Broadcast Electronics IncB22-B27
Micro Communications Inc.		FIGOREONICS INC 51/-52/
Phelps Dodge Communications Co.	Allen Avionics	Caringella Electronics Inc
Phelps Dodge Communications Co. RCA Broadcast Systems RCA Distributor and Special Products Division	Allen Avionics	Caringella Electronics Inc.
Phelps Dodge Communications Co. RCA Broadcast Systems		Caringella Electronics Inc.  Elcom Engineering Co

International Electro Magnetics	KLM Associates	AUDIO ENHANCERS
LPB Inc.	Listec Television	EDCO Products Inc. Kahn Communications Inc.
McCurdy Radio Industries Inc. McMartin Industries Inc.	Equipment Corp B104-B107	Roger Mayer Electronics Inc.
Marti Electronics Inc B110, B111	Logitek Electronic Systems Roger Mayer Electronics Inc.	Richmond Sound Design Ltd. Thomson-CSF Laboratories
Roger Mayer Electronics Inc. Rupert Neve Inc.	McCurdy Radio Industries Inc.	
Orange County Electronics Corp. Ltd. Quad-Eight Electronics	McMartin Industries Inc. MCI Inc.	AUDIO EQUALIZATION
Ramko Research Inc B140, B141	MPC Educational Systems Inc.	ANALYZER SYSTEMS
Robins Broadcast and Sound Equipment Corp.	Micro-Trak Corp	Amber Electro Design Ltd. Comark Industries Inc.
Shure Brothers Inc B144, B145	Modular Audio Products B117	Shure Brothers Inc B144, B145
Sontec Electronics Corp. Spectra Sonics	Opamp LabsB123  QRK Electronic	
Thomson-CSF Laboratories VIF International	Products IncB131	AUDIO EQUALIZERS
Wilkinson Electronics Inc.	Quad-Eight Electronics	Altec Lansing
	Quantum Audio Labs Inc. RCA Broadcast Systems	Audio Design and Mfg. Inc. Bogen Division/Lear Siegler Inc.
AUDIO	Ramko Research Inc B140, B141	Crown International Inc.
COMPRESSOR/LIMITERS, FM	Richmond Sound Design Ltd. Robins Broadcast and Sound Equipment Corp.	Gotham Audio Corp. Heath Co.
Allison Research Inc. Audio Designs and Mfg. Inc.	Rockwell International-Collins Broadcast Products	ITI Electronics Inc. International Electro Magnetics
Automated Processes Inc. Barker and Williamson Inc.	Rupert Neve Inc. Shure Brothers Inc B144, B145	Kahn Communications Inc.
Bogen Division, Lear Siegler Inc.	Sphere Electronics Inc.	McCurdy Radio Industries Inc.  Micro-Trak Corp
Broadcast	Sontec Electronics Corp. Spectra Sonics	Modular Audio Products B117
Electronics Inc	Superscope Inc.	Opamp Labs
Elcom Engineering CoB49 Gotham Audio Corp.	2005 AD Inc. Tangent Systems Inc.	Orange County Electronics Corp. Ltd.
Inovonics Inc	Technical Audio Products Corp. (TAPCO) Ultra Audio Pixtec	Precision Electronics Inc. Pulse Techniques Inc.
International Electro Magnetics	VIF International Val-Tronics Inc.	Quad-Eight Electronics
LPB Inc. McCurdy Radio Industries Inc.	Wilkinson Electronics Inc.	Ramko Research Inc B140, B141 Richmond Sound Design Ltd.
McMartin Industries Inc.		Robins Broadcast and Sound Equipment Corp.
Marti Electronics Inc B110, B111 Roger Mayer Electronics Inc.	AUDIO CONTROLS	Roh Corp.  Sescom Inc.
Moseley Associates Inc.	Automated Processes Inc.	Shure Brothers Inc B144, B145
Orange County Electronics Corp. Ltd. Rupert Neve Inc.	Broadcast	Sontec Electronics Corp.
Shure Brothers Inc B144, B145	Electronics IncB22-B27	Spectra Sonics Spectrum Instruments Inc.
Sontec Electronics Corp. Spectra Sonics	Crown International Delta Electronics Inc., Div. of Long Engineering Co.	Sphere Electronics Inc.
Thomson-CSF Laboratories	ITI Electronics Inc. McCurdy Radio Industries Inc.	TT Electronics Inc. Technical Audio Products Corp. (TAPCO)
VIF International Wilkinson Electronics Inc.	Shallco Inc.	2005 AD Inc. VIF International
	Spectra Sonics Tech Laboratories Inc.	
AUDIO CONNECTORS	2005 AD Inc. Val-Tronics Inc.	AUDIO
Broadcast	Waters Mfg. Inc.	FEEDBACK CONTROLLERS
Electronics Inc		Altec Lansing Roger Mayer Electronics Inc.
Ercona Corp.	AUDIO DELAY LINES	Shure Brothers Inc B144, B145
MPC Educational Systems Inc. Neutrik Products	ESC Electronics Corp.	, 2
Switchcraft Inc.	Eventide Clockworks Inc. Gotham Audio Corp.	AUDIO FILTERS
Trompeter Electronics B158	McCurdy Radio Industries Inc. Neutrik Products	Altec Lansing
	Quad-Eight Electronics	Crown International Inc. ESC Electronics Corp.
AUDIO CONSOLE KITS	Ramko Research Inc B140, B141	Gotham Audio Corp.
Automated Processes Inc.		Heath Co. McCurdy Radio Industries Inc.
Broadcast	AUDIO DISC	Marti Electronics Inc B110, B111
Electronics Inc	CUTTING EQUIPMENT	Roger Mayer Electronics Inc. Pulse Techniques Inc.
Modular Audio Products B117	Gotham Audio Corp.	Quad-Eight Electronics
Opamp Labs	Sontec Electronics Corp. Sphere Electronics Inc.	Sescom Inc.
Quad-Eight Electronics		Shure Brothers Inc B144, B145 Spectra Sonics
Robins Broadcast and Sound Equipment Corp.	AUDIO DISC	Spectrum Instruments Inc.
AUDIO CONSOLES	PLAYING EQUIPMENT	TT Electronics Inc. 2005 AD Inc.
Altec Lansing	Broadcast	
Amco Engineering Co.	Electronics Inc B22-B27	AUDIO GENERATORS
Ampro Broadcasting Inc. Audio Designs and Mfg. Inc.	Gotham Audio Corp. MPC Educational Systems Inc.	Amber Electro Design Ltd.
Autogram Corp. Automated Processes Inc.	Newcomb Audio Products Co.	Automated Processes Inc. Barker and Williamson Inc.
Broadcast	QRK Electronic	Gaw Co. Inc.
Electronics IncB22-B27	Products Inc	Heath Co. Leader Instruments Corp.
Bud Industries Inc. Cetec Audio	Superscope Inc.	McMartin Industries Inc. Quad-Eight Electronics
Custom Audio Electronics		Radiometer U.S. Corp.
Delta Electronics, Division of Long Engineering Co. Harris Broadcast Products	AUDIO DICCO	Rohde and Schwarz
	AUDIO DISCS —	Sound Technology
Industrial Sciences Inc.	BLANK LAQUERS	Sound Technology Spectra Sonics
Industrial Sciences Inc. International Nuclear Corp.		Sound Technology

AUDIO HEADS,	KLM Associates	AUDIO OPAMPS_
RECORDER REPLACEMENT	LPB Inc. McCurdy Radio Industries Inc.	Modular Audio Products B117
Broadcast	McMartin Industries Inc.	Opamp LabsB123
Electronics Inc B22-B27	Roger Mayer Electronics Inc.  Micro-Trak Corp	
International Electro Magnetics	Modular Audio Products B117	AUDIO PATCH
Minneapolis P116	Opamp LabsB123	PANELS AND CABLES
Magnetics Inc	Panasonic Co	Audio Accessories Inc.
United Research Laboratory Corp.	Paso Sound Products Inc.	Audio Designs and Mfg. Inc. <b>Broadcast</b>
VIF International	Precision Electronics Inc.	Electronics IncB22-B27
AUDIO LEADER TAPE	QRK Electronic Products Inc	California Switch and Signal
AGFA-Gevaert Inc.	Quad-Eight Electronics	D'San Corp. McCurdy Radio Industries Inc.
7.3.7.	RTS Systems IncB139	ORK Electronic
AUDIO LINE AMPLIFIERS	Ramko Research Inc B140, B141	Products IncB131
Altec Lansing	Richmond Sound Design Ltd. Robins Broadcast and Sound Equipment Corp.	Switchcraft Inc.  Trompeter Electronics B158
American Data	Sansui Electronics Corp. Scientific Systems Inc.	Trompeter Electronics Disc
Audionics of Oregon	Shure Brothers Inc B144, B145	AUDIO PEAK
Automated Processes Inc. BGW Systems Inc.	Sontec Electronics Corp.	POWER INDICATOR
Bogen Division/Lear Siegler Inc. Crown International Inc.	Spectra Sonics Sphere Electronics Inc.	Lec Tro Tech Inc.
Delta Electronics Inc., Div. of Long Engineering Co.	Superscope Inc.	Let 110 Tech me.
Frezzolini	Switchcraft Inc. Tangent Systems Inc.	AUDIO PHASERS
Electronics Inc	Technical Audio Products Corp. (TAPCO) Telex Communications Inc.	Automated Processes Inc.
ITI Electronics Inc. International Nuclear Corp.	Transist-O-Sound Inc.	Eventide Clockworks Inc. Gotham Audio Corp.
Kahn Communications Inc. McCurdy Radio Industries Inc.	2005 AD Inc. Ultra Audio Pixtec	Gottlam Addio Corp.
McMartin Industries Inc. Roger Mayer Electronics Inc.	VIF International	<b>AUDIO POWER AMPLIFIERS</b>
Micro-Trak Corp	ALLENO MACHITOD AMERICAN	Altec Lansing
Modular Audio Products B117	AUDIO MONITOR AMPLIFIERS	Audionics of Oregon Automated Processes Inc.
Rupert Neve Inc.	Altec Lansing American Data	BGW Systems Inc. Bogen Division/Lear Siegler Inc.
Opamp Labs	Audio Designs and Mfg. Inc.	Broadcast
Quad-Eight Electronics	Audionics of Oregon Autogram Corp.	Electronics Inc B22-B27
Ramko Research Inc B140, B141	Automated Processes Inc.	Crown International Inc. Delta Electronics Inc., Div. of Long Engineering Co.
Richmond Sound Design Ltd. Robins Broadcast and Sound Equipment Corp.	BGW Systems Inc.  Beaveronics Inc	Dynair Electronics Inc.
Roh Corp.	Bogen Division/Lear Siegler Inc.	EDCOR Heath Co.
Sescom Inc.	Broadcast	ITI Electronics Inc. International Microwave Corp.
Shure Brothers Inc B144, B145 Sontec Electronics Corp.	Electronics Inc	International Nuclear Corp.
Spectra Sonics	Crown International Inc. Delta Electronics Inc., Div. of Long Engineering Co.	McCurdy Radio Industries Inc. McMartin Industries Inc.
Sphere Electronics Inc. 2005 AD Inc.	Di-Tech Inc	Micro-Trak Corp
Vamco	Frezzolini	Modular Audio Products B117
Engineering Inc B160-B162	Electronics Inc	Newcomb Audio Products Co.  Opamp Labs
	International Nuclear Corp.	Orange County Electronics Corp. Ltd.
AUDIOMETERS	McCurdy Radio Industries Inc. McMartin Industries Inc.	Osawa and Co. USA Inc. Precision Electronics Inc.
Eckstein Brothers Inc.	Marti Electronics Inc B110, B111	Quad-Eight Electronics
AUDIO MODIU ATORS	Micro-Trak Corp	Ramko Research Inc B140, B141
AUDIO MODULATORS	Modular Audio Products B117	Robins Broadcast and Sound Equipment Corp. Roh Corp.
Catel, Division of United Scientific Corp. Roger Mayer Electronics Inc.	Opamp Labs	Sansui Electronics Corp.
Spectra Sonics Varian Electron Device Group	QRK Electronic	Scientific Systems Inc. H.H. Scott Inc.
Farian Electron Sovice Group	Products Inc	Sescom Inc.
AUDIO	Quad-Eight Electronics  Ramko Research Inc B140, B141	Shure Brothers Inc B144, B145
MIXER/PREAMPLIFIERS	Roh Corp.	Superscope Inc. Technical Audio Products Corp. (TAPCO)
Altec Lansing	Sansui Electronics Corp. Scientific Systems Inc.	Ultra Audio Pixtec
Ampro Broadcasting Inc.	Sescom Inc.	Varian Electron Device Group
Audio Designs and Mfg. Inc. Audionics of Oregon	Spectra Sonics	ALIDIO DDEAMDI IEIEDS
Autogram Corp. Automated Processes Inc.	Superscope Inc. Telex Communications Inc.	AUDIO PREAMPLIFIERS  Altec Lansing
Bogen Division/Lear Siegler Inc.	Ultra Audio Pixtec	Audionics of Oregon
Broadcast	AUDIO NOICE	Autogram Corp. Automated Processes Inc.
Electronics IncB22-B27	AUDIO NOISE	BGW Systems Inc.
Crosspoint Latch CorpB46 Crown International Inc.	REDUCTION SYSTEMS	Bogen Division/Lear Siegler Inc. <b>Broadcast</b>
Dage - MTI Inc.	Allison Research Inc. Audio Designs and Mfg. Inc.	Electronics IncB22-B27
Delta Electronics Inc., Div. of Long Engineering Co. EDCOR	Dolby Laboratories Gotham Audio Corp.	Crown International Inc.
Heath Co.	ITI Electronics Inc.	Delta Electronics Inc., Div. of Long Engineering Co. Dynair Electronics Inc.
ITI Electronics Inc. Image Devices Inc.	Inovonics Inc B73	Frezzolini
International Microwave Corp. International Nuclear Corp.	Kahn Communications Inc. Roger Mayer Electronics Inc.	Electronics Inc
KEL Corp.	Quad-Eight Electronics	Heath Co.

ITI Electronics Inc.	Di-Tech Inc	Martel Electronics
International Microwave Corp. International Nuclear Corp.	Dynair Electronics Inc. Dytek Industries Inc.	Superscope Inc. Telectro Systems Corp.
LPB Inc. Logitek Electronic Systems	International Nuclear Corp.	Telex Communications Inc. United Research Laboratory Corp.
McCurdy Radio Industries Inc. McMartin Industries Inc.	Lenco Inc.,	VIF International
Roger Mayer Electronics Inc.	Electronics Div	AUDIO TARE GAGGETTE
Micro-Trak Corp	Roger Mayer Electronics Inc.	AUDIO TAPE CASSETTE PLAYER/RECORDERS
Opamp Labs	Modular Audio Products B117 Opamp Labs	Amilon Corp.
Orange County Electronics Corp. Ltd.	Richmond Sound Design Ltd.	Ampro Broadcasting Inc. Avid Corp.
Osawa and Co. USA Inc. Paso Sound Products Inc.	Roh Corp. Utah Scientific Inc.	Broadcast
Precision Electronics Inc. <b>QRK Electronic</b>	Vamco	Electronics Inc
Products Inc	Engineering Inc B160-B162 Vitex Co	EDCOR Products Inc.
Quad-Eight Electronics  RTS Systems Inc	VIII 00	Hamilton Electronics Corp. Heath Co.
Ramko Research Inc B140, B141	AUDIO SEARCH CONTROL	MPC Educational Systems Inc.
Richmond Sound Design Ltd.	Electronic Engineering Co. of California (EECO)	Mincom Division, 3M Co. Newcomb Audio Products Co.
Roh Corp. Sansui Electronics Corp.	Sony	Radmar Inc. Sansui Electronics Corp.
H.H. Scott Inc. Sescom Inc.		H.H. Scott Inc.
Shure Brothers Inc B144, B145	AUDIO SLIDE/SYNC	Sharp Electronics Corp. — Professional Products
Sontec Electronics Corp. Spectra Sonics	RECORDERS AND PLAYERS  MacKenzie Laboratories Inc.	Superscope Inc.
Sphere Electronics Inc.	Telex Communications Inc.	Telectro Systems Corp. Telex Communications Inc.
Superscope Inc. Telex Communications Inc.	ALIDIO CDI ICINIC TADE	Uher Corp. United Research Laboratory Corp.
2005 AD Inc.	AUDIO SPLICING TAPE AGFA-Gevaert Inc.	Times visible
AUDIO PROGRAMMING	Broadcast	AUDIO TAPE DUPLICATION
Blue Hill Educational Systems Inc.	Electronics IncB22-B27	Ray Jacobs Audio Inc.
AUDIO PUBLIC		MPC Educational Systems Inc. Mincom Division, 3M Co.
ADDRESS AMPLIFIERS	AUDIO SYNCHRONIZATION	Playback Conference Recording Ltd. Radmar Inc.
Altec Lansing	EQUIPMENT	Recortec Inc.
Automated Processes Inc. BGW Systems Inc.	Ampex Corp.	Superscope Inc. TapeAthon Corp.
Bogen Division/Lear Siegler Inc. Crown International Inc.	Automated Processes Inc. Electronic Engineering Co. of California (EECO)	Telectro Systems Corp. United Research Laboratory Corp.
EDCOR Heath Co.	Martel Electronics Mincom Division, 3M Co.	
McCurdy Radio Industries Inc.	Telectro Systems Corp.	AUDIO TAPE DUPLICATORS
McMartin Industries Inc. MPC Educational Systems Inc.	AUDIO TAPE ACCESSORIES	Cetec Audio
Newcomb Audio Products Co. Paso Sound Products Inc.	AGFA-Gevaert Inc.	International Audio Inc.
Perma Power Electronics Inc. Precision Electronics Inc.	A-V Tape Sales Corp. Ampro Broadcasting Inc.	Ray Jacobs Audio Inc. MPC Educational Systems Inc.
Shure Brothers Inc B144, B145	Broadcast	Mincom Division, 3M Co. Radmar Inc.
Spectra Sonics Telectro Systems Corp.	Electronics Inc	Recordex Corp. Recortec Inc.
	Fidelipar Heath Co.	Superscope Inc. Telex Communications Inc.
AUDIO PUBLIC	Ray Jacobs Audio Inc. LPB Inc.	United Research Laboratory Corp.
ADDRESS SYSTEMS	MPC Educational Systems Inc. Magnesonics Mfg. and Sales Co.	
Altec Lansing Bogen Division/Lear Siegler Inc.	Maxell Corp. of America	AUDIO TAPE
Hamilton	Micro-Trak Corp	EDITING EQUIPMENT
Electronics Corp. Precision Electronics Inc.	Nortronics Co. Inc. Schuessler Case Co. Inc.	Automated Processes Inc. <b>Broadcast</b>
Richmond Sound Design Ltd.	Superscope Inc. TDK Electronics Corp.	Electronics Inc
AUDIO REVERB UNITS	United Research Laboratory Corp.	Electronic Engineering Co. of California (EECO) Fidelipac
AKG Acoustics B7. B8	Vamco Engineering Co B160-B162	Nagy Research Products Nortronics Co. Inc.
Eventide Clockworks Inc.	Vulcan Binder and Cover	7.5.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5.1.1.5
Gotham Audio Corp. Logitek Electronic Systems		AUDIO TAPE HEADS
Quad-Eight Electronics Robins Broadcast and Sound Equipment Corp.	AUDIO TAPE CARTRIDGE	Ampro Broadcasting Inc.
Sansui Electronics Corp. Technical Audio Products Corp. (TAPCO)	PLAYER/RECORDERS	Broadcast B22 B23
VIF International	Amilon Corp. Ampro Broadcasting Inc.	Electronics Inc
AUDIO ROUTING SWITCHERS	Audi-Cord Corp. Beacon-Camera Audio Visual Co. Inc.	Frezzolini
Audio Designs and Mfg. Inc.	Broadcast	Electronics Inc
Automated Processes Inc.  Beaveronics Inc	Electronics Inc	Minneapolis
Beta Technology Inc.	Harris Broadcast Products Heath Co.	Magnetics Inc B116
Broadcast Books Books	International Electro Magnetics	Nortronics Co. Inc. Taber Mfg. and Eng. Co.
Electronics Inc	LPB Inc. MPC Educational Systems Inc.	United Research Laboratory Corp. VIF International
Contrar Dynamics Ltu B41	MacKenzie Laboratories Inc.	Vikron

AUDIO TAPE HEAD AND TAPE ERASERS	TDK Electronics Corp. United Research Laboratory Corp.	AUTOMATIC TRANSMISSION SYSTEMS
		The Widget Works Inc.
R.B. Annis Co.	TO DEEL TO DEEL	THE Widget Works inc.
Broadcast	AUDIO TAPE REEL TO REEL	AUTOMATION SYSTEMS, TV
Electronics IncB22-B27	PLAYER/RECORDERS	
Chyron	Ampex Corp.	Central Dynamics Ltd B41 Chrono-Log Corp.
Ercona Corp.	Broadcast	Grass Valley Group Inc.
Garner Industries Inc	Electronics Inc B22-B27	Programmable Systems Inc.
Magnesonics Mfg. and Sales Co.	Ray Jacobs Audio Inc. MCI Inc.	Vitex Co
Microtran B115	MPC Educational Systems Inc.	
Nortronics Co. Inc.	Martel Electronics Mincom Division, 3M Co.	AV PRODUCTION SERVICES
Taber Mfg. and Eng. Co.	Scully Recording Instruments	AIDS, A Damon Co.
VIF International	Superscope Inc.	KAPCO Communications
AUDIO TADE MACNETIC PULL	TapeAthon Corp. Telectro Systems Corp.	Multi Media Forum
AUDIO TAPE MAGNETIC, BULK	Telex Communications Inc.	Webb Telemedia
AGFA-Gevaert Inc. Audio Magnetics Corp.	Uher Corp. United Research Laboratory Corp.	
Broadcast Cartridge Service	VIF International	AV TRAINING TAPES_
Broadcast		Visual Learning Inc.
Electronics Inc B22-B27	AUDIO TAPE REELS AND BOXES	
Capitol Magnetic Products, Div. of Capitol Records DAK Industries Inc.	Plastic Reel Corp. of America	AUDIO/VIDEO EDITING DUPLICATION AND TRANSFER
Fidelipac	AUDIO TAPE SPLICERS	KAPCO Communications
International Audio Inc. Irish Magnetic Recording Tape	Broadcast	Multi Media Forum B122
Ray Jacobs Audio Inc.	Electronics IncB22-B27	Webb Telemedia
MPC Educational Systems Inc.	Nagy Research Products	
Superscope Inc. TDK Electronics Corp.	Robins Broadcast and Sound Equipment Corp.	
United Research Laboratory Corp.		D
	AUDIO TAPE STORAGE	В
AUDIO TAPE	Broadcast	
MAGNETIC, CASSETTE	Cartridge Service	BALUMS
A-V Tape Sales Corp.	Broadcast	The Finney Co.
Ampex Corp. Audio Magnetics Corp.	Electronics Inc B22-B27	North Hills Electronics Inc.
Capitol Magnetic Products, Div. of Capitol Records	Display Media Inc.	
DAK Industries Inc.	Harwald Co.	BANDPASS FILTERS
Fuji Photo Film USA Inc. Irish Magnetic Recording Tape	Ray Jacobs Audio Inc. MPC Educational Systems Inc.	Bird Electronic Corp.
International Audio Inc.	Micro-Trak Corp	Cadco Catel, Division of United Scientific Corp.
Ray Jacobs Audio Inc.	Neumade Products Corp.	Coaxial Dynamics Inc.
MPC Educational Systems Inc. Maxell Corp. of America	Robins Broadcast and Sound Equipment Corp. Reliance Plastics and Packaging Division	Comark Industries Inc.
Superscope Inc.	Storeel Corp.	The Finney Co. Wide Band Engineering Co. Inc.
TDK Electronics Corp. United Research Laboratory Corp.	TDK Electronics Corp.	
United Research Laboratory Corp.	Univex International Vulcan Binder and Cover	BAR GRAPH
AUDIO TAPE	Validati Sittadi. dirid deret	Colorado Video Inc B31-B38
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	AUDIO TEST SET	Colorado Video IIIC
MAGNETIC, CARTRIDGE	Delta Electronics Inc., Div. of Long Engineering Co.	
Ampex Corp. Ampro Broadcasting Inc.	Delta clectronics mai, piv. or cong engineering	BASE INSULATORS AM/FM
Audio Magnetics Corp.	AUDIO TAPE TIMERS	Utility Tower Co.
Broadcast Cartridge Service		
Broadcast	Ampex Corp. <b>Broadcast</b>	BATTERIES
Electronics Inc	Electronics IncB22-B27	Alexander Mfg. Co
Capitol Magnetic Products, Div. of Capitol Records	Liectionics mc	Anton Bauer
Fidelipac Fuji Photo Film USA Inc.		Belden Communications Inc.
International Audio Inc.	AUDIO TRANSFORMERS	Cine 60 Inc
Irish Magnetic Recording Tape	Altec Lansing	Control Technology Inc.
Ray Jacobs Audio Inc.	Automated Processes Inc. Crown International Inc.	Duracell Products Co.
MPC Educational Systems Inc. Maxell Corp. of America	Delta Electronics Inc., Div. of Long Engineering Co.	Frezzolini
Superscope Inc.	Gotham Audio Corp. Roger Mayer Electronics Inc.	Electronics Inc
TDK Electronics Corp.	Microtran B115	Alan Gordon Enterprises Inc. Image Devices Inc.
	Modular Audio Products B117	MPC Educational Systems Inc.
AUDIO TAPE MAGNETIC,		Samigon Division/Argraph Corp.
REEL TO REEL	Opamp LabsB123	Sanyo Electric Inc.
AGFA-Gevaert Inc.	Sescom Inc.	Sony
A-V Tape Sales Corp.	Shure Brothers Inc B144, B145	Video Components Inc.
Ampex Corp. Audio Magnetics Corp.		
Broadcast	<b>AUDIO VISUAL PLANNING AIDS</b>	BATTERY PACKS
Electronics IncB22-B27	Heindl Masks 'N' Mounts	
DAK Industries Inc.		Alexander Mfg. Co
Fuji Photo Film USA Inc.	AV TRAINING AND	Anton Bauer B13-B16
Irish Magnetic Recording Tape Ray Jacobs Audio Inc.	EDUCATION PROGRAMS	Belden Communications Inc. Christie Electric Corp.
MPC Educational Systems Inc.	Motorola Teleprograms Inc.	Cinecraft International Inc.
Maxell Corp. of America Superscope Inc.	Thompson-Mitchell and Associates	Cine 60 Inc
eapoiscope iiio.		

Control Technology Inc.	B - 1K1 1	
Data Precision Corp.	B and K Instruments Inc. Bogen Division/Lear Siegler Inc.	Cetec Broadcast Group Comark Industries Inc.
Frezzolini	Broadcast	Diamond Electronics, Div. of Arvin Systems
Electronics Inc	Electronics Inc	Dyma Engineering Inc.
Alan Gordon Enterprises Inc.	Bud Industries Inc.	Dynatech Data Systems The Finney Co.
Harris Corp., Broadcast Products Div. Ikegami Electronics (USA) Inc.	Communications Distribution Inc.	GBC Closed Circuit TV Corp.
Image Devices Inc.	Crown International Inc. Display Media Inc.	G.C. Electronics General Cable Corp.
Panasonic Co	Emcor Products/GF Business Equipment Inc.	Harris Corp., Broadcast Products Division
Perrott Engineering	Enclosure Corp.	Image Devices Inc.
Labs Inc	GBC Closed Circuit TV Corp. Harwald Co.	Javelin Electronics Maury Microwave Corp.
	Lyon Metal Products Inc.	Micro Control Associates Inc.
Sony Superscope Inc.	McCurdy Radio Industries Inc. M.M.S. Inc.	Nurad Inc.
Television Products Co. Inc.	Micro-Trak Corp	Phelps Dodge Communications Co. Prodelin Inc.
Topaz Electronics	Multiplex Display Fixture Co.	Saxton Products Inc.
Video Components Inc.	T.R. Pitts Co.	Singer Products Co. Inc.
Yardney Electric Corp.	Plastic Reel Corp. of America	Sony
	Quad-Eight Electronics	Steinberg
BATTERY PACK CHARGERS	Quick-Set Inc	Studer Revox America
Alexander Mfg. Co	Research Technology Inc.	Times Wire and Cable Co.
Anton Bauer B13-B16	Sansui Electronics Corp.	Toner Cable Equipment Co.
Belden Communications Inc.	Shintron Co. Inc. Smith System Mfg.	<b>Trompeter Electronics B158</b> Utility Tower Co.
Cine 60 Inc	Storeel Corp.	Video Components Inc.
Control Technology Inc.	Superscope Inc.	Wilkinson Electronics Inc.
Frezzolini	Toner Cable Equipment Inc. Topaz Electronics	Winegard Television Systems
Electronics Inc	Vent-Rak, Div. of General Devices Co. Inc.	- ,
Alan Gordon Enterprises Inc.	WinstedB175-B182	CABLE, CONTROL
Image Devices Inc.		Boston Insulated Wire and Cable Co.
Perrott Engineering	CABLE AND	Brand-Rex Co.
Labs Inc		Diamond Electronics, Div. of Arvin Systems Inc.
Superscope Inc.	EMERGING TECHNOLOGY	GBC Closed Circuit TV Corp. Nurad Inc.
Video Components Inc.	INFORMATION SERVICE	Troited me,
	Communication Commission,	CABLE, DIRECT BURIAL
BATTERY POWERED LIGHTS	National Council of Churches	
		AEL Inc. Belden Corp.
Cine 60 Inc	CABLE LOCATERS	Brand-Rex Co.
	Aqua-Tronics Inc.	CCA Electronics Corp B29
BATTERY TEST		Cablewave Systems Inc.
GAUGES/CONDITIONERS	CABLE, AUDIO	J I Case Davis Div. Comm/Scope Co.
Television Products Inc.	Boston Insulated Wire and Cable Co.	General Cable Corp.
relevision Froducts Inc.	Brand-Rex Co.	Times Wire and Cable
DENCUES STEEL	Gotham Audio Corp. Osawa and Co. USA Inc.	
BENCHES, STEEL	Sansui Electronics Corp.	CABLE, MICROPHONE
Equipto Storage Systems	Saxton Products Inc.	
	Sescom Inc.	AKG Acoustics B7, B8
BLOWERS AND FANS	Switchcraft Inc.	Belden Corp. Boston Insulated Wire and Cable Co.
Amco Engineering Co.	Trompeter Electronics B158	_
		Kroadcast
Bud Industries Inc.		Broadcast P22 P27
Javelin Electronics Optima Enclosures	CARLE CAMERA	Electronics Inc
Javelin Electronics	CABLE, CAMERA	Electronics Inc
Javelin Electronics Optima Enclosures	Anton Bauer B13-B16	Electronics Inc
Javelin Electronics Optima Enclosures	Anton Bauer	Electronics Inc
Javelin Electronics Optima Enclosures Stantron	Anton Bauer	Electronics Inc
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION	Anton Bauer	Electronics Inc
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp.	Anton Bauer	Electronics Inc
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast	Anton Bauer	Electronics Inc
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp.  Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp.  Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc.
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc.
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc.
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc.
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer B13-B16 Belden Corp. Boston Insulated Wire and Cable Corp. Brand-Rex Co. Diamond Electronics, Div. of Arvin Systems Corp. Fernseh Group, Robert Bosch Corp. GBC Closed Circuit TV Corp. Harris Corp., Broadcast Products Division  Hitachi-Denshi America Ltd. B65-B72 Ikegami Electronics (USA) Inc. Image Devices Inc.  JVC Industries B75-B82 Panasonic Co. B124-B129 Sony	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio Whirlwind Music
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio
BROADCAST MODIFICATION Broadcast Products Division Broadcast Modification Sadelco Inc. Val-Tronics Inc.	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio Whirlwind Music Wilkinson Electronics
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio Whirlwind Music Wilkinson Electronics  CABLE
BROADCAST MODIFICATION Broadcast Products Division Broadcast Modification Sadelco Inc. Val-Tronics Inc.	Anton Bauer B13-B16  Belden Corp. Boston Insulated Wire and Cable Corp. Brand-Rex Co. Diamond Electronics, Div. of Arvin Systems Corp. Fernseh Group, Robert Bosch Corp. GBC Closed Circuit TV Corp. Harris Corp., Broadcast Products Division  Hitachi-Denshi America Ltd. B65-B72  Ikegami Electronics (USA) Inc. Image Devices Inc.  JVC Industries B75-B82  Panasonic Co. B124-B129  Sony  CABLE, COAXIAL  AEL Inc. Andrew Corp. Belden Corp. Belden Corp. Blonder-Tongue Labs Boston Insulated Wire and Cable Co. Brand-Rex Co.	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio Whirlwind Music Wilkinson Electronics  CABLE PRESSURIZATION EQUIPMENT
BROADCAST MODIFICATION Broadcast Products Division Broadcast Modification Sadelco Inc. Val-Tronics Inc.	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio Whirlwind Audio Whirlwind Music Wilkinson Electronics  CABLE PRESSURIZATION EQUIPMENT Andrew Corp.
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp.  Broadcast Electronics Inc	Anton Bauer B13-B16  Belden Corp. Boston Insulated Wire and Cable Corp. Brand-Rex Co. Diamond Electronics, Div. of Arvin Systems Corp. Fernseh Group, Robert Bosch Corp. GBC Closed Circuit TV Corp. Harris Corp., Broadcast Products Division  Hitachi-Denshi America Ltd. B65-B72  Ikegami Electronics (USA) Inc. Image Devices Inc.  JVC Industries B75-B82  Panasonic Co. B124-B129  Sony  CABLE, COAXIAL  AEL Inc. Andrew Corp. Belden Corp. Belden Corp. Blonder-Tongue Labs Boston Insulated Wire and Cable Co. Brand-Rex Co.	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio Whirlwind Music Wilkinson Electronics  CABLE PRESSURIZATION EQUIPMENT
BROADCAST MODIFICATION Broadcast Products Division Broadcast Modification Sadelco Inc. Val-Tronics Inc.	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio Whirlwind Audio Whirlwind Music Wilkinson Electronics  CABLE PRESSURIZATION EQUIPMENT Andrew Corp. McIntire Co.
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp.  Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio Whirlwind Audio Whirlwind Music Wilkinson Electronics  CABLE PRESSURIZATION EQUIPMENT Andrew Corp. McIntire Co.  CABLE TESTER
Javelin Electronics Optima Enclosures Stantron  BROADCASTING AUTOMATION Bias/Data Communications Corp. Broadcast Electronics Inc	Anton Bauer	Electronics Inc. B22-B27 CCA Electronics Inc. B29 California Switch and Signal Corp. Dyma Engineering Inc. Electro-Voice Inc. B50, B51 G.C. Electronics Gotham Audio Corp. Harris Corp., Broadcast Products Division Image Devices Inc. Nagra Magnetic Recorders Inc. Neutrik Panasonic Co. B124-B129 Saxton Products Inc. Sescom Inc. Singer Products Co. Inc. Sony Studer Revox America Switchcraft Inc. Times Wire and Cable Co. Whirlwind Audio Whirlwind Audio Whirlwind Music Wilkinson Electronics  CABLE PRESSURIZATION EQUIPMENT Andrew Corp. McIntire Co.

#### Canon USA Inc. Ceco Communications Inc. CALIBRATION SERVICES Dage - MTI Inc. Eastman Kodak Co. Alford Mfg. Co. Levit Electronics B and K Instruments Inc. Thomson-CSF Electron Tubes Frezzolini Bird Electronic Corp. Commercial Radio Monitoring Co. Inc. CAMERAS, CCTV Alan Gordon Enterprises Inc. Harris Corp., Broadcast Products Division Image Devices Inc. Leasametric **BLACK AND WHITE** Karl Heitz Inc. National Electrolab Ltd. Photo Research Div. of Kollmorgen Corp. Image Devices Inc. ASACA Corp. of America B17-B19 Potomac Instruments Inc. L-W International Canadian General Electric Co. Ltd. Sadelco Inc. Minolta Corp. Cohu Inc., Electronics Division Dage — MTI Inc. RCA Broadcast Systems Sencore Inc Super 8 Sound Inc. Tektronix Inc. Diamond Electronics, Div. of Arvin Systems Inc. GBC Closed Circuit TV Corp. Teledyne Camera Systems Video Components Inc. General Electrodynamics Corp. CALIBRATORS Hitachi-Denshi Sadelco Inc. lkegami CAMERAS, FILM STILL Javelin Electronics **CAMERA CRANES** Levit Electronics Canon USA Inc., Optics Division Image Devices Inc. NEC America Inc. Comquip Inc. Listec TV Eastman Kodak Co. Equipment Corp. . . . . B104-B107 QSI Systems Inc. Karl Heitz Inc. RCA Electro Optics and Devices R.F. Systems Co. — PA Image Devices Inc. Minolta Corp. CAMERA HOUSINGS. Sanvo Electric Inc. Radmar Inc. Sickles Inc. **ENVIRONMENTAL** Sharp Electronics Corp. — **Professional Products** ASACA Corp. of America B17-B19 Cohu Inc., Electronics Division Sony Dage - MTI Inc. CAMERAS, SURVEILLANCE Video Optics Inc. Electro and Optical Systems Ltd. GBC Closed Circuit TV Corp. Alan Gordon Enterprises Inc. ASACA Corp. of America B17-B19 CAMERAS, CCTV COLOR Ikegami Electronics (USA) Inc. Canadian General Electric Co. Ltd. ASACA Corp. of America B17-B19 Image Devices Inc. Cohu Inc., Electronics Division Comquip Inc. Javelin Electronics Canadian General Electric Co. Ltd. Cohu Inc., Electronics Division Dage -- MTI Inc. Diamond Electronics, Div. of Arvin Systems Inc. Hitachi-Denshi Dyma Engineering Inc RCA Electro Optics and Devices Eastman Kodak Co. Ikegami Technovations General Electric Co. JVC ..... B75-B82 Video Components Inc. General Electrodynamics Corp. Levit Electronics Karl Heitz Inc. Hitachi-Denshi **CAMERA Philips** MOUNTING EQUIPMENT Sanyo Electric Inc. Ikegami Cleveland/Price Inc. Image Devices Inc. Javelin Electronics Sharp Electronics Corp. — Davis and Sanford Co. Inc. **Professional Products** L-W International Fax Co. Lenzar Optics Corp. Marconi Communication Systems Ltd. GBC Closed Circuit TV Corp. Sonv Image Devices Inc. **NEC America** Javelin Electronics CAMERAS, DUMMY Panasonic Co. . . . . . . . . B124-B129 Power-Ontics Inc. Canadian General Electric Co. Ltd. QSI Systems Inc. Dage - MTI Inc. Listec Telelvision GBC Closed Circuit TV Corp. RCA Electro Optics and Devices Equipment Corp. . . . . B104, B107 R.F. Systems Co. - PA .....B124-B129 Panasonic Co.... Miller Professional Equipment Sanyo Electric Inc. RCA Electro Optics and Devices R.F. Systems Co. — PA O'Connor Sharp Electronics Corp. — Engineering Labs.... B120, B121 Sanyo Electric Inc. **Professional Products** Panasonic Co..... B124-B129 Sony CAMERAS, FILM CHAIN Technovations RCA Electro Optics and Devices Teledyne Camera Systems C.R.V. Systems Cohu Inc., Electronics Division Sony Commercial Electronics Inc. . . B30 Video Cinema Industries Telescript Inc. Comquip Inc. Teltron Inc. Video Components Inc. Fernseh Group, Robert Bosch Corp. GBC Closed Circuit TV Corp. Harris Corp., Broadcast Products Division H. Wilson Corp. Hitachi-Denshi CAMERAS, TV BLACK **CAMERA PICKUP TUBES** AND WHITE PORTABLE Amperex Electronic Corp. Ikegami Electronics (USA) Inc. Ceco Communications Inc. Marconi Communication Systems Ltd. ASACA Corp. of America B17-B19 Dage - MTI Inc. Panasonic Co..... B124-B129 Diamond Electronics, Div. of Arvin Systems Inc. Dage - MTI Inc. Diamond Electronics, Div. of Arvin Systems Inc. GBC Closed Circuit TV Corp. EEV Inc. **Philips** General Electrodynamics Corp.

# CAMERA TUBES

GBC Closed Circuit TV Corp.
Levit Electronics

RCA Electro Optics and Devices

Steinberg .....

Video Components Inc.

Amperex Electronic Corp.

CAMERAS, FILM CINE Arriflex Co. of America

Sharp Electronics Corp.

RCA Broadcast Systems

Thomson-CSF Laboratories Videodetics Corp.

Sony

B-190

RCA Distributor and Special Products Division

Hitachi-Denshi

Sanyo Electric Inc.

Image Devices Inc.

Javelin Electronics

Levit Electronics

Ikegami

Sonv

Panasonic Co..... B124-B129

CAMERAS, BLACK AND WHITE	Sony	EEG Enterprises Inc.
STUDIO BROADCAST	Thomson-CSF Laboratories	Hunt-Pierce Corp. International Nuclear Corp.
ASACA Corp. of America B17-B19		Jackson Communications Corp.
Dage — MTI Inc.	CAMERAS, TV HAND HELD	Lightning Elimination Associates Inc. Magnavox CATV System Inc.
Image Devices Inc.	Ampex Corp.	Microdyne Corp.
Levit Electronics	ASACA Corp. of America B17-B19	Microwave Filter Co. Inc.
Panasonic Co	Commercial Electronics Inc B30	T.R. Pitts Co. TOCOM Inc.
Philips	Custom Films Inc.	Toner Cable Equipment Inc.
Video Optics Inc.	Frezzolini	
	Electronics Inc	CATV PAYMENT SYSTEMS
CAMERAS,	GBC Closed Circuit TV Corp.	T.R. Pitts Co.
TV COLOR PORTABLE	Hitachi-Denshi	,
Ampex Corp.	America Ltd	CATV REPLACEMENT
ASACA Corp. of America B17-B19	Image Devices Inc.	
Frezzolini	Javelin Electronics Levit Electronics	COMPONENTS
Electronics Inc	Panasonic Co	Broadband Engineering Inc.
GBC Closed Circuit TV Corp.	Philips	0114555555555555
Hitachi-Denshi	RCA Broadcast Systems	CHART RECORDERS
America Ltd	RCA Electro Optics and Devices	Fax Co.
Image Devices Inc.	Sanyo Electric Inc.	Heath Co. Toner Cable Equipment Inc.
JVC	Sharp Electronics Corp. —	Total dable equipment me.
Levit Electronics	Professional Products	CHECQUE VISION —
Panasonic Co B124-B129	Sony	CCTV SYSTEM
Philips	Thomson-CSF Laboratories	
Sharp Electronics Corp. —		GBC Closed Circuit TV Corp.
Professional Products	CARRELS, STUDY	
Sony	MPC Educational Systems Inc.	CHROMA DECODER
· · · · · · · · · · · · · · · · · · ·	W o Eddottonal Gystems Inc.	Broadcast Video
04445040 71/00/00	CARTRIDGE LABELS	Systems Ltd
CAMERAS, TV COLOR		Lenco Inc.,
PORTABLE BROADCAST	Broadcast	Electronics Div B91-B103
Ampex Corp.	Electronics IncB22-B27	Vitex Co
ASACA Corp. of America B17-B19	Fidelipac	vnex co
Commercial Electronics Inc B30	Image Devices Inc.	
Custom Films Inc.	CARTRIDOF	CHROMA KEY SYNCHRONIZED
Frezzolini	CARTRIDGE	BACKGROUND EQUIPMENT
Electronics Inc	RECORDING SERVICES	Power Optics
GBC Closed Circuit TV Corp.	AIDS, A Damon Corp.	
Hitachi-Denshi	Broadcast Component Dist. Pentagon Industries Inc.	CHROMA KEYERS
America Ltd	TapeAthon Corp.	
Image Devices Inc.		American Data
JVC B75-B82	CARTRIDGES, PHONO	Beaveronics IncB20
Levit Electronics	AKG Acoustics B7, B8	Broadcast Video
NEC America Inc.		Systems Ltd
Panasonic Co B124-B129	Broadcast	Central Dynamics Ltd
Philips	Electronics IncB22-B27	Crosspoint Latch Corp B46
RCA Broadcast Systems	Ercona Corp. Gotham Audio Corp.	Dyma Engineering Inc.
Sharp Electronics Corp. —	LPB Inc.	Dynasciences Div. Whitaker Corp.
Professional Products	Osawa and Co. USA Inc.	Industrial Sciences Inc.
Sony	_	International Nuclear Corp.
Thomson-CSF Laboratories	CASSETTE CLEANERS	J and D International
	Chyron CorpB42	Panasonic Co
CAMERAS, TV COLOR	,	Thomson-CSF Laboratories
STUDIO BROADCAST	CATALOG BEGIGN	3M Co. — Mincom Division
All Mobile Video Inc.	CATALOG DESIGN	Vital Industries Inc.  Vitex Co
Ampex Corp.	The Bill Daniels Co. Inc B55, B74,	VILEX CO
CCA Electronics Corp B29	B91, B109, B112, B174	
C.R.V. Systems Inc.	CATALOGS	CHURCH FILM AND
Commercial Electronics Inc B30	CATALOGS,	VIDEO INFORMATION
Dyma Engineering Inc. Fernseh Group, Robert Bosch Corp.	SPECIFICATION SHEETS,	
GBC Closed Circuit TV Corp.	BROCHURES	Communication Commission, National Council of Churches
Harris Corp., Broadcast Products Division	Altec Lansing	reaction of officines
Hitachi-Denshi	Communication Commission, National Council of Churches	CLOCKS DIGITAL
America Ltd	The Bill Daniels Co. Inc B55, B74,	
Ikegami Image Devices Inc.	B91, B109, B112, B174	AND DIGITAL DRIVER
International Video Corp.	Heath Co.	Automated Broadcast Controls
Levit Electronics	MPC Educational Systems Inc.	Beaveronics IncB20
Marconi Communication Systems Ltd. Marconi Electronics Inc.	Charles Mayer Studios Inc. RCA Distributor and Special Products Division	Broadcast Aids Inc.
Panasonic Co	Smith System Mfg.	Broadcast Placetronias Inc. B22 B27
Philips		Electronics Inc
RCA Broadcast Systems	CATV CONSTRUCTION	Channelmatic Electronics Inc.
Sharp Electronics Corp. —	ACCESSORIES	Chrono-Log Corp.
Professional Products	Burnup and Sims Inc.	Digital Concepts Corp.
	comes and caris inc.	E.S.E B56, B57

Harris Corp., Broadcast Products Division	COLOR TEMPERATURE METERS	Audio Interface Inc. Auditronics Inc.
Heath Co.  Industrial Sciences Inc.	Photo Research Div. Kollmorgen Corp.	Autogram Corp.
McCurdy Radio Industries Inc.	COMPINEDO	Automated Processes Inc. Bayly Engineering Ltd.
Nationwide Electronic Systems Inc.  ORK Electronic	COMBINERS Comark Industries Inc.	Broadcast D22 B27
Products IncB131	Continental Electronics Mfg. Co.	Electronics Inc
QSI Systems Inc.  Ramko Research Inc B140, B141	The Finney Co. Micro Communications Inc.	CCA Electronics Corp B29 Cetec Audio
Rohde and Schwarz	COMMUNICATION SYSTEMS,	Cetec Broadcast Corp.
Singer Products Co. Inc.	LAND — MOBILE	Contel Mfg. Custom Audio Electronics
Superscope Inc. Vamco	Altec Lansing	Dyma Engineering Inc. Harris Corp., Broadcast Products Division
Engineering Inc B160-B162	Atlantic Research Corp. David Clark Co. Inc.	Industrial Sciences Inc.
Westlake Audio	Coastcom	International Communications and Control Corp.  J and D International
	Comark Industries Inc. Dynair Electronics Inc.	LPB Inc.
CLOCKS,	GTE Lenkurt Inc. Image Devices Inc.	Listec Television Equipment Co
STATION MASTER CONTROL	International Microwave Corp. KEL Corp.	Logitek Electronic Systems
Beta Technology Inc. Channelmatic Electronics Inc.	Leasametric	McCurdy Radio Industries Inc. McMartin Industries Inc.
Chrono-Log Corp. Datametrics Inc.	McMartin Industries Inc.  Marti Electronics Inc B110, B111	Roger Mayer Electronics Inc.
Di tel Consesso Cons	Paso Sound Products Inc.	Micro-Trak Corp
E.S.E	Raytheon Data Systems TOCOM Inc.	Modular Audio Products B117 Rupert Neve Inc.
Kaitronics Corp. Laird Telemedia Inc.	Turner Division of Conrac Corp.	Opamp Labs Inc B123
Leitch Video Ltd. Nationwide Electronic Systems Inc.	COMMUNICATIONS	Pacific Recorders and Engineering Corp.
QSI Systems Inc. Singer Products Co. Inc.	SERVICE MONITORS	QRK Electronic Products IncB131
Sono-Mag Corp.	GTE Lenkurt Inc.	Quad-Eight Electronics
Vamco Engineering Inc B160-B162	Lampkin Laboratories	Quantum Audio Labs Inc. RCA Broadcast Systems
Video Devices Co.	COMMUNICATIONS	Ramko Research Inc B140, B141
	SYSTEMS	Richmond Sound Design Ltd. Robins Broadcast and Sound Equipment Corp.
CLOCKS AND TIME SYSTEMS	RENTAL — LEASE	Rockwell International-Collins Broadcast Products
Beaveronics IncB20	Leasametric	Russco Electronics Mfg. Inc.  Shure Brothers Inc B144, B145
Broadcast		Singer Products Co. Inc.
Electronics IncB22-B27	COMPARATOR, TIME CODE	Sontec Electronics Corp. Spectra Sonics
Caringella Electronics Inc. Channelmatic Electronics Inc.	E.S.E B56, B57	Studer Revox America
Chrono-Log Corp.	Skotel CorpB146	Superscope Inc. Tangent Systems Inc.
Digital Concepts Corp. D'San Corp.		Tri-Tronics Professional Electronics UMC Electronics Co., Broadcast Products Division
E.S.E	COMPUTER BUSINESS SERVICES	Ultra Audio Pixtec United Recording Electronics Industries
Harwood Mfg. Co.	Bias/Data Communications Corp.	Val-Tronics Ward-Beck Systems Ltd.
Heath Co. Leitch Video Ltd.	Columbine Systems Inc.	Wilkinson Electronics Inc.
Logical Products Co. McCurdy Radio Industries Inc.	Paperwork Systems Inc. Raytheon Data Systems	Yamaha International Corp.
Nationwide Electronic Systems Inc. QSI Systems Inc.	Toner Cable Equipment Inc.	CONSOLES, AUDIO FM
Vamco	COMPUTER/DATA	Accurate Sound Co.
Engineering Inc B160-B162	PROCESSING	Amco Engineering Co.
Video Components Inc.	Kapco Communications	Ampro Broadcast Inc. Audio Designs and Mfg. Co.
		Audio Interface Inc. Auditronics Inc.
CLOSED CIRCUIT	COMPUTER EQUIPMENT	Autogram Corp. Automated Processes Inc.
INTERCOM SYSTEMS	Ampex Corp. Bristol Division of Acco	Bayly Engineering Ltd.
Bogen Division/Lear Siegler Inc. Catel, Division of United Scientific Corp.	Columbine Systems Inc. Heath Co.	Broadcast Electronics Inc
Clear-Com Image Devices Inc.	Moseley Associates Inc.	Bud Industries Inc.
Video Aids of ColoradoB163	Nationwide Electronic Systems Inc. Raytheon Data Systems	CCA Electronics Corp B29
	Eric Small and Associates Inc. Toner Cable Equipment Inc.	Cetec Audio Cetec Broadcast Group
COLOR ANALYZER,		Contel Mfg. Custom Audio Electronics
ELECTRONIC	CONDUIT PLASTIC	Dyma Engineering Inc.
Power Optics	CONDUIT, PLASTIC Wipco	Harris Corp., Broadcast Products Division Holland Electronics
	VVIDEO	Industrial Sciences Inc.
COLOR CORRECTORS	CONNECTORS, CAMERA CABLE	International Communications and Control Corp.  J and D International
BJA Systems Inc.	Boston Insulated Wire and Cable Co.	LPB Inc.
Broadcast Video Systems Ltd	Image Devices Inc.	Listec Television Equipment Corp B104-B107
Systems Ltu	CONSOLES, AUDIO AM	Logitek Electronic Systems
COLOR MEDIA FILTERS	Accurate Sound Co.	McCurdy Radio Industries Inc. McMartin Industries Inc.
Belden Communications Inc.	Amco Engineering Co. Ampro Broadcasting Inc.	Roger Mayer Electronics Inc.
Image Devices Inc.	Audio Designs and Mfg. Inc.	Micro-Trak Corp

Modular Audio Products B117	Val-Tronics Co.	Marconi Electronics Corp.
Rupert Neve Inc.	Ward-Beck Systems Ltd. Westlake Audio	Roger Mayer Electronics Inc.
Opamp Labs Inc	Yamaha International Corp.	Micro-Trak Corp
Pulse Dynamics Mfg. Corp.		Modular Audio Products B117 Rupert Neve Inc.
QRK Electronic	CONSOLES, AUDIO RECORDING	Opamp Labs Inc
Products Inc	Accurate Sound Co. Altec Lansing	Panasonic Co
Quad-Eight Electronics Quantum Audio Labs Inc.	Amco Engineering Co.	Philips
RCA Broadcast Systems	Ampro Broadcasting Inc. Audio and Design Recording Co.	QRK Electronic
Ramko Research Inc B140, B141	Audio Designs and Mfg. Inc.	Products Inc
Richmond Sound Design Ltd. Robins Broadcast and Sound Equipment Corp.	Audio Interface Inc. Auditronics Inc.	Quad-Eight Electronics
Rockwell International-Collins Broadcast Products	Automated Processes Inc.	Quantum Audio Labs Inc. RCA Broadcast Systems
Roh Corp. Russco Electronics Mfg. Inc.	BSC Inc.  Broadcast	Ramko Research Inc B140, B141
Shure Brothers Inc B144, B145	Electronics IncB22-B27	Richmond Sound Design Ltd.
Singer Products Co. Inc.	Bud Industries Inc.	Abbins Broadcast and Sound Equipment Corp.  Singer Products Co. Inc.
Sontec Electronics Corp.	Cetec Audio Cetec Broadcast Group	Sontec Electronics Corp.
Spectra Sonics Studer Revox Inc.	Custom Audio Electronics Inc.	Spectra Sonics
Superscope Inc.	Delta Electronics Inc., Div. of Long Engineering Corp.  Dyma Engineering Inc.	Summit Cinevideo Corp. 2005 AD Inc.
Tangent Systems Inc. Tri-Tronics Professional Electronics	Harris Corp., Broadcast Products Division	Ultra Audio Pixtec
UMC Electronics Co., Broadcast Products Division Ultra Audio Pixtec	Holland Electronics	Val-Tronics Inc. Ward-Beck Systems Ltd.
United Recording Electronics Industries	Industrial Sciences Inc. International Communications and Control Corp.	Yamaha International Corp.
Val-Tronics Inc. Ward-Beck Systems Ltd.	J and D International	00100150 075050
Yamaha International Corp.	LPB Inc.  Listec Television	CONSOLES, STEREO
	Equipment Corp B104-B107	Amco Engineering Co. Ampro Broadcasting Inc.
CONSOLES, AUDIO PORTABLE	Logitek Electronic Systems	Audio Designs and Mfg. Inc.
Altec Lansing	McCurdy Radio Industries Inc. McMartin Industries Inc.	Audio Interface Inc. Auditronics Inc.
Amco Engineering Co. Audio Design and Recording Inc.	MCI Inc.	Autogram Corp.
Auditronics Audio Designs and Mfg. Inc.	Magna-Tech Electronic Co. Inc. Roger Mayer Electronics Inc.	Automated Processes Inc. BSC Inc.
Automated Processes Inc.	Micro-Trak Corp	Broadcast
BSC Inc. Bayly Engineering Ltd.	Modular Audio Products B117	Electronics IncB22-B27
Boston Sound and Power Corp.	Rupert Neve Inc.	Bud Industries Inc.
Broadcast	Opamp Labs IncB123	CCA Electronics Corp B29 Cetec Audio
Electronics IncB22-B27	Quad-Eight Electronics Quantum Audio Labs Inc.	Cetec Broadcast Group
Bud Industries Inc.	Ramko Research Inc B140, B141	Custom Audio Electronics Delta Electronics Inc., Div. of Long Engineering Co.
CCA Electronics Corp	Richmond Sound Design Ltd.	Dyma Engineering Inc.
Central Dynamics CorpB41 Cetec Broadcast Group	Robins Broadcast and Sound Equipment Corp	Electrohome LtdB52, B53
Collins Television Services	Shure Brothers Inc B144, B145	Harris Corp., Broadcast Products Division Industrial Sciences Inc.
Custom Audio Electronics Delta Electronics Inc., Div. of Long Engineering Co.	Singer Products Co. Inc. Sontec Electronics Corp.	International Communications and Control Corp.
Dyma Engineering Inc.	Spectra Sonics	J and D International
Harris Corp., Broadcast Products Division  Industrial Sciences Inc.	Sphere Electronics Inc. Superscope Inc.	LPB Inc.  Listec Television
International Communications and Control Corp.	Tangent Systems Inc.	Equipment Corp B104-B107
J and D International LPB Inc.	Technical Audio Products Corp. (TAPCO) 2005 AD Inc.	Logitek Electronic Systems
Listec Television	VIF International	McCurdy Radio Industries Inc. McMartin Industries Inc.
Equipment Corp B104-B107		Roger Mayer Electronics Inc.
McCurdy Radio Industries Inc.	CONSOLES, AUDIO TV	Micro-Trak IncB114
McMartin Industries Inc. Roger Mayer Electronics Inc.	Amco Engineering Co.	Modular Audio Products B117
Micro-Trak Corp B114	Ampro Broadcast Inc.	Rupert Neve Inc.
Modular Audio Products B117	Audio Designs and Mfg. Inc. Auditronics Inc.	Opamp Labs Inc
Moseley Associates Inc.	Automated Processes Inc. BSC Inc.	QRK Electronic
Rupert Neve Inc.  Opamp Labs Inc	Broadcast	Products Inc
Pulse Dynamics Mfg. Corp.	Electronics IncB22-B27	Quantum Audio Labs Inc.
QRK Electronic	Bud Industries Inc.	RCA Broadcast Systems  Ramko Research Inc B140, B141
Products Inc	Central Dynamics Corp B41	Richmond Sound Design Ltd.
Quad-Eight Electronics	Cetec Audio Collins Television Services	Robins Broadcast and Sound Equipment Corp.
Quantum Audio Labs Inc. RCA Broadcast Systems	Communications Systems, Division of	Russco Electronics Mfg. Inc.  Singer Products Co. Inc.
Ramko Research Inc B140, B141	Powell Tool Supply Inc.  Delta Electronics Inc., Div. of Long Engineering Co.	Sontec Electronics Corp.
Richmond Sound Design Ltd.	Dyma Engineering Inc.	Spectra Sonics
Robins Broadcast and Sound Equipment Corp.  Shure Brothers Inc B144, B145	Dytek Industries Inc. Harris Corp., Broadcast Products Division	Sphere Electronics Inc. Superscope Inc.
Sontec Electronics Corp.	Holland Electronics	Tangent Systems Inc. Technical Audio Products Corp. (TAPCO)
Spectra Sonics	Industrial Sciences Inc.	2005 AD Inc.
Sphere Electronics Inc. Studer Revox America	International Communications and Control Corp. International Nuclear Corp.	Val-Tronics Inc. Ward-Beck Systems Ltd.
Superscope Inc. TEAC Corp. of America	J and D International LPB Inc.	Westlake Audio
Tangent Systems Inc.	Listec Television	Wilkinson Electronics Inc.
Technical Audio Products Corp. (TAPCO) Tri-Tronics Professional Electronics	Equipment Corp B104-B107	CONSOLES, VIDEO PORTABLE
2005 AD Inc.	Logitek Electronic Systems	
UMC Electronics Co., Broadcast Products Division Ultra Audio Pixtec	McCurdy Radio Industries Inc. McMartin Industries Inc.	American Data
		CITICO ETIGITICOTRIU CO.

Broadcast Video	COPY STAND,	DATA TRANSMITTER
Systems Ltd	TRANSPARENCY	American Modem Corp.
Bud Industries Inc.	PREPARATION	Catel, Division of United Scientific Corp. Coastcom
C.R.V. Systems Inc.	Impact Communications Inc.	GTE Lenkurt Inc.
Crosspoint Latch CorpB46	Leedal Inc.	Moseley Associates Inc. Nationwide Electronics Systems Inc.
Dage — MTI Inc. Dyma Engineering Inc.		Raytheon Data Systems
Dytek Industries Inc.	CRYSTALS	
Evenview Television Systems GBC Closed Circuit TV Corp.	Image Devices Inc.	DECODERS, TONE
Industrial Sciences Inc.	Marti Electronics Inc B110, B111	American Microsignal Co.
nternational Nuclear Corp.		Ampro Broadcasting Inc.
J and D International	CUSTOM CASES	Bayly Engineering Ltd. Channelmatic Electronics Inc.
Listec Television	Image Devices Inc.	Coastcom
Equipment Corp B104-B107 RCA Broadcast Systems	Lowenthal Mfg.	Di-Tech Inc
Richmond Hill Laboratories Ltd.	Lumitrol Ltd. Theatre Lighting	Dyma Engineering Inc.
Ross Video Ltd.		Elcom Engineering CoB49 Gorman Redlich Mfg. Co.
Sony Corp. of America	CUSTOM CONTROL	IGM Div. of Northwestern Tech.
Victor Duncan Inc.	LIGHTING SYSTEMS	International Nuclear Corp.
Video Components Inc. Videodetics Inc.	Electronics Diversified Inc B54	Marti Electronics Inc B110, B111
Vital Industries Inc.	Kliegl Brothers	Monroe Electronics Inc B118
Weather Scan Inc.	Skirpan Lighting Control Corp.	Rivers Associates Inc. Time and Frequency Technology Inc.
Winsted CorpB175-B182	Strand Century Inc.	Toner Cable Equipment Inc. UMC Electronics Co., Broadcast Products Division
	OUGTON CONTROL CYCTEMS	Val-Tronics Inc.
CONCOLES VIDEO STUDIO	CUSTOM CONTROL SYSTEMS	Vega Electronics
CONSOLES, VIDEO STUDIO	Audio Visual Contractors  Erskine-Shapiro Theatre Technology Inc.	
American DataB12	Industrial Sciences Inc.	DEMAGNETIZERS, TAPE
Amco Engineering Co.	McCurdy Radio Industries Inc.	R.B. Annis Co.
Broadcast Video Systems Ltd	Moseley Associates Inc. Nationwide Electronic Systems Inc.	Broadcast
Bud Industries Inc.	Quad-Eight Electronics	Electronics Inc
C.R.V. Systems Inc.	Richmond Sound Design Ltd. Summit Cinevideo Corp.	CCA Electronics Corp B29
Central Dynamics Corp B41	TOCOM Inc.	Cetec Broadcast Group
Crosspoint Latch Corp B46		Chyron
Dage — MTI Inc. Dyma Engineering Inc.	CUTTING ROOMS	Fidelipac
Dytek Industries Inc.	Color Stock Library Inc. and Lem Bailey Prod.	G.C. Electronics  Garner Industries Inc
GBC Closed Circuit TV Corp. Grass Valley Group	Image Devices Inc.	Harris Corp., Broadcast Products Division
Industrial Sciences Inc.	0.000 0.00 4.444	International Tapetronics Corp.
International Nuclear Corp.	CYCLORAMA,	J and R Film Co. —
J and D International Laird Telemedia Inc.	STUDIO DRAPERY	Goldberg/Compco
Listec Television	Automatic Devices Co. The Janson Industries	MPC Educational Systems Inc. Magnasync/Moviola Corp.
Equipment Corp B104-B107	Lumitrol Ltd.	Magnesonics Mfg. and Sales Co.
Marconi Electronics Corp.		Microtran Co. Inc
Panasonic Co		Nortronics Co. Inc. Optek
Philips		Pentagon Industries Inc.
RCA Broadcast Systems	<b>D</b>	Robins Broadcast and Sound Equipment Corp. TEAC Corp. of America
Richmond Hill Laboratories Inc. Ross Video Ltd.	U	TDK Electronics Corp.
Shintron Co. Inc.		Taber Mfg. and Eng. Co. UMC Electronics Co., Broadcast Products Div.
Sony Corp. of America	DARKROOM EQUIPMENT	United Research Laboratory
Video Components Inc.	Leedal Inc.	Val-Tronics Inc. Wide Range Electronics Corp.
Videodetics Inc. Vital Industries Inc.		·
Weather Scan Inc.	DATA CAMERA	DEMODULATORS
Winsted CorpB175-B182	Colorado Video Inc B31-B38	Catel, Division of United Scientific Corp. Comark Industries Inc.
	Colorado Video Me	Rohde and Schwarz
	DATA INSERTION GENERATOR	<b>DEMODULATORS, OPTICAL</b>
CONSULTANTS, AV FACILITIES	Colorado Video IncB31-B38	Radiation Devices Co. Inc.
Audio Visual Contractors		Telemet a Geotel Co.
	DATA LOGGING	Video Aids Corp. of ColoradoB163
CONVERTERS, FREQUENCY		Of Colorado
AEL Inc.	Broadcast B22 B27	
California Instruments	Electronics Inc	DIAMETER ANALYZER
Catel, Division of United Scientific Corp.	INDUSTRALIE LIEUTOTIIU JYSTETTIS ITTU.	Colorado Video Inc B31-B38
Communication Modifications Inc		Colorado Video IIIC
Communication Modifications Inc. The Finney Co.		Colorado Video IIIC
The Finney Co. Marconi Electronics Inc.	DATA RECEIVERS	
The Finney Co.	DATA RECEIVERS  American Modem Corp. Catel, Division of United Scientific Corp.	DIGITAL AND
The Finney Co. Marconi Electronics Inc. Motorola SPI Mu-Del Electronics Inc. North Hills Electronics Inc.	DATA RECEIVERS  American Modem Corp. Catel, Division of United Scientific Corp. Coastcom	DIGITAL AND ANALOG EQUIPMENT
The Finney Co. Marconi Electronics Inc. Motorola SPI Mu-Del Electronics Inc. North Hills Electronics Inc. Oak Industries Inc.	DATA RECEIVERS  American Modem Corp. Catel, Division of United Scientific Corp.	DIGITAL AND ANALOG EQUIPMENT Bristol Division of Acco
The Finney Co. Marconi Electronics Inc. Motorola SPI Mu-Del Electronics Inc. North Hills Electronics Inc. Oak Industries Inc.  Philips Test and Measuring	DATA RECEIVERS  American Modem Corp. Catel, Division of United Scientific Corp. Coastcom GTE Lenkurt Inc. Leasametric Microdyne Corp.	DIGITAL AND ANALOG EQUIPMENT Bristol Division of Acco Lenco Inc.,
The Finney Co. Marconi Electronics Inc. Motorola SPI Mu-Del Electronics Inc. North Hills Electronics Inc. Oak Industries Inc.	DATA RECEIVERS  American Modem Corp. Catel, Division of United Scientific Corp. Coastcom GTE Lenkurt Inc. Leasametric	DIGITAL AND ANALOG EQUIPMENT Bristol Division of Acco

DIGITAL FRAME	DISTORTION	ELECTRONIC
SYNCHRONIZER	MEASUREMENT SET	<b>EDUCATIONAL PROGRAMS</b>
ADDA CorpB6	Amber Electro Design Ltd.  ASACA Corp. of America B17-B19	Electronic University
DIGITAL HEAD	Hewlett PackardB64	ELECTRONIC
REFURBISHING	BIOTRIBUTOR	FIELD PRODUCTION
Minneapolis Magnetics Inc B116	DISTRIBUTOR, EDUCATIONAL FILMS	Webb Telemedia Corp.
DIGITAL METERS	Color Stock Library Inc. and Lem Bailey Prod.	<b>ELECTRONIC MANUFACTURING</b>
DIGITAL METERS Amber Electro Design Ltd.	DDAFTING OFFICE	Bogen Division/Lear Siegler Inc. Custom Audio Electronics
Dranetz Engineering Laboratories Inc. Nationwide Electronic Systems Inc.	DRAFTING SERVICES TV AND RADIO FACILITIES	EEG Enterprises Inc. Gorman-Redlich Mfg. Co.
Photo Research, Division Kollmorgen Corp.	Beaveronics Inc	Lenco Inc.,
DIGITAL MULTIMETERS		Electronics Div
California Instruments Data Precision Corp.	DROPOUT COMPENSATORS	EMEDOENCY DOMED
Dranetz Engineering Laboratories Inc.	Ampex Corp. Digital Video Systems	EMERGENCY POWER Communications Distribution Inc.
DIGITAL PRODUCTION TIMERS		Control Technology Inc. Onan Division — Onan Corp.
E.S.E		Sawyer Industries Inc. Tech Laboratories Inc.
Vamco		Toner Cable Equipment Inc.  Versa-Count
Engineering Inc B160-B162	E	Engineering B164-B165
DIGITAL CTORWATOLICO	EARTH STATION	ENCLOCUEEC
DIGITAL STOPWATCHES E.S.E	EARTH STATION FREQUENCY COORDINATION	ENCLOSURES Altec Lansing
Image Devices Inc.	Compucon Inc.	Cases IncB40
Nationwide Electronic Systems Inc.	EASELS AND ACCESSORIES	Optima Division, Scientific — Atlanta Inc.
DIGITAL TIMERS	Oravisual Co. Inc.	ENCODERS, COLOR
Chrono-Log Corp. Digital Concepts Corp.	E.B.C. TWO TONE OVOTERS	Broadcast Video
E.S.E	E.B.S. TWO TONE SYSTEM  Broadcast	Systems Ltd
Nationwide Electronic Systems Inc.	Electronics IncB22-B27	Lenco Inc., Electronics Div
DIPLEXERS, AM	Channelmatic Electronics Inc. E.S.E	Electronics Div B91-B103
Comark Industries Inc.	Elcom Engineering Co	ENCODERS, TONE
Continental Electronics Mfg. Co.	Gorman Redlich Mfg. Co. International Nuclear Corp.	Bogen Division/Lear Siegler Inc. Channelmatic Electronics Inc.
DIPLEXERS, FM	Logitek Electronic Systems McMartin Industries Inc.	Coastcom <i>Di-Tech Inc.</i>
Cetec Jampro	Time and Frequency Technology Inc.	EEG Enterprises Inc.
DIPLEXERS, TV	EDITING CONSOLES	Elcom Engineering Co B49 Gorman Redlich Mfg. Co.
Cetec Jampro	Consolidated Video Systems . B39 Datatron Inc.	McMartin Industries Inc.  Marti Electronics Inc B110. B111
Comark Industries Inc.	Image Devices Inc.	Time and Frequency Technology Inc.
DIRECTIONAL COUPLERS	The Winsted Corp B175-B182	Vega Electronics
Coaxial Dynamics Inc. Comark Industries Inc.	EDITING SERVICES	ENG BRACES
Wide Band Engineering Co. Inc.	Color Stock Library Inc. and Lem Bailey Prod.	Cine 60 Inc
DISCO LIGHTING EFFECTS	ELECTRICAL GAVEL	Frezzolini
Oregon Sound and Lights	CA Compton Inc.	Electronics Inc
51005	ELECTRO OPTICAL ISOLATORS	Image Devices Inc.  K and H Products Ltd.
DISCREET SECURITY ENCLOSURES	Video Aids of Colorado B163	Video Cinema Industries Inc.
Video Components Inc.	Video Aids of Colorado B103	Video Components Inc.
	<b>ELECTRONIC CONSULTING</b>	FNO CARTO
DISCS, VIDEO	Applied Video Electronics Inc. Comark Industries Inc.	ENG CARTS
Ampex Corp. Arvin/Echo Science Corp.	EEG Enterprises Inc. Levit Electronics	Gruber Products Co
Chyron Telesystems Computer Magnetics Corp.		K and H Products Ltd.
Eigen Video Panasonic Co	ELECTRONIC DESIGN AND DEVELOPMENT	Lee-Ray Industries Inc
Teknekron/TRAX	DESIGN AND DEVELOPMENT EEG Enterprises Inc.	video Components IIIC.
DISSOLVE CONTROLS	Lenco Inc.,	ENG REMOTE CONTROL
Logical Products Co.	Electronics Div	Micro Control Associates Inc. Moseley Associates Inc.

# **ENVELOPE DELAY MEASURING SET**

ASACA Corp. of America B17-B19

Rohde and Schwarz

#### **EXCITERS, FM**

CCA Electronics Corp. . . . . . . B29

CSI Electronics Inc. Cetec Broadcast Group Dyma Engineering Inc. Harris Corp., Broadcast Products Division LPB Inc. McMartin Industries Inc. Marconi Electronics Inc. North American Radio Corp. QEI Corp. RCA Broadcast Systems

Rohde and Schwarz Singer Products Co. Inc.

Sintronic Co. Val-Tronics Corp.

Versa-Count Engineering . . . . . . . . . B164-B165

Wilkinson Electronics Inc.

# **FIBER OPTICS**

Catel, Division of United Scientific Corp. GTE Lenkurt Inc Times Wire and Cable Co.

### FIELD INTENSITY METERS, AM

Atlantic Research Corp. B and K Instruments Inc. McMartin Industries Inc. Rohde and Schwarz

# FIELD INTENSITY METERS, FM

Atlantic Research Corp.

B and K Instruments Inc. Rohde and Schwarz Toner Cable Equipment Inc.

# FIELD INTENSITY METERS, TV

Atlantic Research Corp. Avantek Inc. B and K Instruments Inc. Rohde and Schwarz Toner Cable Equipment Inc.

#### FILM

AGFA-Gevaert Inc. Colour Images Unlimited Inc. Films Inc. Fuji Photo Film USA Inc. Image Devices Inc. Studio Film and Tape Inc. Transilwrap Co. Inc.

# **FILM ANALYST PROJECTORS**

Image Devices Inc. Technovations

# FILM CAMERA **CARRYING CASES**

Frezzolini Alan Gordon Enterprises Inc.

Image Devices Inc. Lowenthal Mfg. Samigon Division/Argraph Corp.

Video Components Inc.

#### FILM CAMERA LENSES

Arriflex Co. of America Century Precision Cine Optics Fax Co.

Frezzolini Alan Gordon Enterprises Inc.

Karl Heitz Inc. Image Devices Inc. Laird Telemedia Lenzar Optics Corp. Samigon Division/Argraph Corp.

Video Components Inc.

### FILM CAMERAS, CINE

Arriflex Co. of America

Frezzolini

Alan Gordon Enterprises Inc. Karl Heitz Inc. Image Devices Inc. Teledyne Camera Systems

### **FILM CAMERAS, HIGH SPEED**

Image Devices Inc. Teledyne Camera Systems

#### **FILM CANS**

Neumade Products Corp.

Plastic Reel Corp. of America

#### **FILM CASES**

Image Devices Inc. Logan Electric Specialty Mfg. Co. Lowenthal Mfg. Charles Mayer Studios Inc. Neumade Products Corp.

#### Plastic Reel Corp. of America

Samigon Division/Argraph Corp. Schuessler Case Co. Inc.

# **FILM CHAIN** LIGHT LEVEL CONTROLS

# B.E.I. Beston Electronics Inc. . B21

Cohu Inc., Electronice Division Comquip Inc. Harris Corp., Broadcast Products Division Industrial Sciences Inc.

Laird Telemedia

Specialized Industries Inc.

Video Components Inc. The Zei-Mark Corp.

# **FILM CHAIN SYSTEMS**

Cohu Inc., Electronics Division GBC Closed Circuit TV Corp. Laird Telemedia Quad-Eight Electronics

Singer Education Systems Video Components Inc.

# **FILM CLEANERS** AND PRESERVATIVES

R.D. Hanish Co. Image Devices Inc. Lipsner-Smith Corp Neumade Products Corp.

#### FILM EDITING EQUIPMENT

Accessories Manufacturers Ltd. Birns and Sawyer Inc. Alan Gordon Enterprises Inc. Harwald Co.

### J and R Film Co. -Goldberg/Compco KLM Associates

Kinetronics Corp. Lipsner-Smith Corp. Maier-Hancock Industries Neumade Products Corp.

Plastic Reel Corp. of America

# Research Technology Inc.

Samigon Division/Argraph Corp

#### FILM GATE PHOTOMETERS

Photo Research Division Kollmorgen Corp.

# **FILM INSPECTION AND CLEANING EQUIPMENT**

Chyron Corp......B42

Alan Gordon Enterprises Inc. Harwald Co. Image Devices Inc. Kinetronics Corp. Lipsner-Smith Corp. Neumade Products Corp.

Plastic Reel Corp. of America Research Technology Inc.

### **FILM LABORATORIES**

Alan Gordon Enterprises Inc. Houston Photo Products Inc. Kreonite Inc. W.A. Palmer Films Inc. Radmar Inc.

#### FILM LEADERS

Image Devices Inc. Neumade Products Corp. Photographic Specialties Starex Inc.

### FILM MULTIPLEXERS

Laird Telemedia

Video Components Inc.

### FILM PROCESSING CHEMICALS

AGFA-Gevaert Inc. AIDS, A Damon Co.

#### Eastman Kodak Co.

Phillip A. Hunt Chemical Corp. Samigon Division/Argraph Corp.

# **FILM PROCESSORS**

AIDS, A Damon Co. Alan Gordon Enterprises Inc. Houston Photo Products Inc. Image Devices Inc

Kreonite Inc.

Samigon Division/Argraph Corp. Sickles Inc.

#### FILM PRODUCTION

Colour Images Unlimited Inc. Communication Commission, National Council of Churches Design-Form

#### FILM PROJECTORS, 8MM

Image Devices Inc. Laird Telemedia MPC Educational Systems Inc. Minolta Corp. Technovations

# FILM PROJECTORS **8MM REPEATER**

Permafilm International Corp.

# FILM PROJECTORS, 16MM

Arriflex Co. of America Alan Gordon Enterprises Inc. Image Devices Inc. L-W International Laird Telemedia MacKenize Laboratories Inc. Magna-Tech Electronic Co. Inc. Optical Radiation Corp.

# Singer Education Systems Video Components Inc.

# FILM PROJECTORS, CARTRIDGE

Fairchild Industrial Products Image Devices Inc. MPC Educational Systems Inc.

#### FILM PROJECTORS, SLIDE

Fairchild Industrial Products
Heindl Masks 'N' Mounts
Image Devices Inc.
Laird Telemedia
MPC Educational Systems Inc.
MacKenzie Laboratories Inc.
Radmar Inc.
Samigon Division/Argraph Corp.

Spindler and Sauppe' Inc.

### FILM PROJECTORS, FILMSTRIP

Beacon-Camera Audio-Visual Co. Inc. Dukane Corp. — Audio-Visual Division Fairchild Industrial Products MPC Educational Systems Inc. Radmar Inc.

#### FILM PROTECTION

Lipsner-Smith Corp. Permafilm International Corp.

### **FILM REJUVENATION**

Permafilm International Corp.

# FILM MAGNETIC RECORDING EQUIPMENT AND ACCESSORIES

Frezzolini

Alan Gordon Enterprises Inc. Image Devices Inc. International Electro Magnetics

KLM Associates

MPC Educational Systems Inc. Quad-Eight Electronics RCA Broadcast Systems Transist-O-Sound Inc. Wide Range Electronics Corp.

#### FILM SPLICERS

Image Devices Inc. Maier-Hancock Industries Neumade Products Corp.

# FILM TREATMENT (PERFORATION REPAIR)

Harwald Co. Image Devices Inc. Permafilm International Corp.

Plastic Reel Corp. of America

### **FILM TO VIDEO TRANSFER**

AIDS, A Damon Co.
American Cable Network
Communications Systems,
Division of Powell Tool Supply Inc.
W.A. Palmer Films Inc.
VIDECOMM International

# **FILM TRUCKS**

Image Devices Inc.

Lee-Ray Industries Inc.
Neumade Products Corp.

The Winsted Corp..... B175-B182

#### FILM VIEWERS

Image Devices Inc. Lipsner-Smith Corp. Maier-Hancock Industries

#### FILMS/FILMSTRIPS

Benchmark Films Inc.
Cablefilms
Colour Images Unlimited Inc.
Communication Commission,
National Council of Churches
Design-Form

# FILMSTRIP STORAGE ALBUMS/CONTAINERS

Neumade Products Corp. Reliance Plastics and Packaging Division Richard Mfg. Co.

#### **FILTERS**

Bird Electronic Corp. CADCO Coaxial Dynamics Inc. Comark Industries Inc. The Finney Co. Image Devices Inc.

# FILTER SETS, AUDIO, THIRD-OCTAINE (For Electronic Music Processing)

Spectrum Instruments Inc.

#### **FM EQUALIZER**

Bogen Division/Lear Siegler Inc. CADCO

# FRAME/FIELD COUNTERS

QSI Systems Inc.

# FRAME STORERS/ FLOPPY DISC

Arvin/Echo Science Corp.

#### FRAME SYNCHRONIZERS

Grass Valley Group Inc. Thomson-CSF Laboratories

# FREQUENCY DIVISION MULTIPLEX

Catel, Division of United Scientific Corp. Coastcom GTE Lenkurt Inc.

#### FREQUENCY METERS, RF

Lampkin Laboratories

# FREQUENCY MONITORS AND COUNTERS

Ballantine Laboratories Inc.
Data Precision Corp.
Dranetz Engineering Labs Inc.

# 

Gaw Co. Inc.
Leader Instruments Corp.
Leasametric
Lec Tro Tech Inc.
McMartin Industries Inc.
Nationwide Electronics Systems Inc.
Wilkinson Electronics Inc.

# G

# GAFFERS TOOL AND ACCESSORY BOX

Walter S. Brewer Co. Image Devices Inc.

#### **GAFFERS BASKET**

Walter S. Brewer Co.

# GAME SHOW SCOREBOARDS, CLOCKS, ETC.

Logitek Electronic Systems

## **GENERATORS, AUDIO SINE**

Altec Lansing Co. Amber Electro Design Ltd. Automated Processes Inc. B and K Instruments Inc. Bald Mountain Lab Barker and Williamson Inc. Beta Technology Inc.
Delta Electronics Inc., Div. of Long Engineering Corp.
Dyma Engineering Inc. Frequency Devices Inc. Heath Co. Hickok Electric Instrument Leader Instruments Corp. Marconi Instruments, Div. of Marconi Electronics Potomac Instruments Inc. Quad-Eight Electronics Rohde and Schwarz SPI-ITT Metrix Instruments Corp. Sencore Inc. Sound Technology Spectra Sonics Sphere Electronics Inc. TEAC Corp. of America Val-Tronics Inc. Wavetek Indiana Inc. Westlake Audio

# **GENERATORS, AUDIO SWEEP**

Allied Broadcast Equipment
Altec Lansing Sound Products
Amber Electro Design Ltd.
B and K Instruments Inc.
Bald Mountain Lab
Dyma Engineering Inc.
Heath Co.
Hickok Electric Instrument
Leader Instruments Corp.
Lec Tro Tech Inc.
Marconi Electronics Corp.
Radiometer US Corp.
Radiometer US Corp.
Rohde and Schwarz Sales Co.
United Recording Electronics Industries
United Research Laboratory Corp.
Wavetek Indiana Inc.

# GENERATORS, BACKGROUND COLOR

# Digital Video Systems

Grass Valley Group Harris Corp., Broadcast Products Division

# Industrial Sciences Inc.

International Nuclear Corp.
J and D International

# Lenco Inc.,

Richmond Hill Laboratories Ltd. Shintron Co. Inc. Sigma Electronics Inc.

# **GENERATORS**, BURST

### Digital Video Systems

Dranetz Engineering Labs Inc.
Dynair Electronics Inc.
Grass Valley Group
Harris Corp., Broadcast Products Division
International Nuclear Corp.
J and D International
Leader Instruments Corp.
Leitch Video Ltd.

# Lenco Inc.,

Richmond Hill Laboratories Ltd. Rohde and Schwarz Sales Co. Sencore Inc.

Sigma Electronics Inc.	Heath Co. Kallman Associates Inc.	Broadcast Video
Tektronix Inc.	Leader Instruments Corp.	Systems Ltd
Telemetion	Lec Tro Tech Inc. Leitch Video Ltd.	Comquip Inc.  Digital Video Systems
Ultra Audio Pixtec	Lenco Inc.,	Dyma Engineering Inc.
Video Aids of Colorado	Electronics Div	Harris Corp., Broadcast Products Division International Communications and Control Corp. Leader Instruments Inc.
GENERATORS, COLOR BAR	Instrument Inc.	Lec Tro Tech Inc.
	Richmond Hill Laboratories Inc.	Leitch Video Ltd.  Lenco Inc.,
ASACA Corp. of America B17-B19 B and K Precision Dynascan Corp.	SPI-ITT Metrix Instruments Division Sencore Inc.	Electronics Div
Cohu Inc., Electronics Division	Sigma Electronics Inc.	Marconi Electronics Inc.
Digital Video Systems	Tektronix Inc.	Philips Test and Measuring
Dyma Engineering Inc.	Ultra Audio Pixtec	Instruments Inc.
<b>Dynasciences</b> Harris Corp., Broadcast Products Division	GENERATORS, CROSS PULSE	Richmond Hill Laboratories Inc. Rohde and Schwarz Sales Co.
Heath Co.	Harris Corp., Broadcast Products Division	Shintron Co. Inc.
Hickok Electric Instrument Leader Instruments Corp.	Leitch Video Ltd.	Sigma Electronics Inc. <b>Tektronix</b>
Lec Tro Tech Inc.	Siegel Electronics	Toner Cable Equipment Inc.
Leitch Video Ltd.  Lenco Inc.,	<b>Tektronix</b> 3M Co. — Mincom Division	Ultra Audio Pixtec
Electronics Div	Ultra Audio Pixtec	
Marconi Electronics	Video Aids of Colorado B163	GENERATORS, POWER
Panasonic Co	Video Components Inc.	Communications Distribution Corp.  J and D International
Philips Test and Measuring		Rohde and Schwarz
Instruments Inc.	GENERATORS, DIGITAL SYNC	
SPI-ITT Metrix Instruments Division Sencore Inc.	ADDA Corp	GENERATORS, SCA
Shintron Co. Inc.	Broadcast Video	Leader Instruments Corp.
Sigma Electronics Inc.  Tektronix	Systems Ltd	McMartin Industries Inc.  Marti Electronics Inc B110, B111
3M Co. — Mincom Division	Central Dynamics Corp	Micro Control Associates Inc.
Toner Cable Equipment Inc.	Crosspoint Latch Corp	Moseley Associates Inc.
Ultra Audio Pixtec	Dyma Engineering Inc.	Solid Electronics Laboratories  Versa-Count
GENERATORS, COLOR SYNC	Digital Video Systems	Engineering B164-B165
	Dynair Electronics Inc.	Wilkinson Electronics Inc.
Broadcast Video Systems Ltd	Grass Valley Group Harris Corp., Broadcast Products Division	
Cohu Inc., Electronics Division	Industrial Sciences Inc.	GENERATORS, SAFE AREA
Crosspoint Latch Corp	International Communications and Control Corp.	Broadcast Video
Digital Video Systems	Leitch Video Ltd.	Systems Ltd
Dyma Engineering Inc.	Lenco Inc., Electronics Div	
Dynasciences  Dynasciences	Marconi Electronics Inc.	CENEDATORS SIGNAL AS
GBC Closed Circuit TV Corp.	Panasonic Co	GENERATORS, SIGNAL AF
Grass Valley Group Harris Corp., Broadcast Products Division	RCA Broadcast Systems Richmond Hill Laboratories Inc.	Altec Lansing Amber Electro Design Ltd.
Heath Co.	Rohde and Schwarz Sales Co.	Automated Processes Inc. B and K Precision Dynascan Corp.
International Communications and Control Corp.  JVC Industries	Sigma Electronics Inc. <b>Telemation</b>	Bald Mountain Lab
Leitch Video Ltd.	Video Components Inc.	Delta Electronics Inc., Div. of Long Engineering Co. Dranetz Engineering Labs
Lenco Inc.,	Video Data Systems	Dyma Engineering Inc.
Electronics Div	Vital Industries	Gaw Co. Inc. Heath Co.
Panasonic Co B124-B129	Vital Industrios	Lampkin Labs Inc. Leader Instruments Corp.
Philips Test and Measuring	CENEDATORS EM SURCADDIED	Modular Audio ProductsB117
Instruments Inc.	GENERATORS, FM SUBCARRIER AEL Inc.	Opamp Labs Inc
RCA Broadcast Systems Richmond Hill Laboratories Inc.	CCA Electronics Inc	Philips Test and Measuring
Rohde and Schwarz Sales Co.	CSI Electronics Inc.	Instruments Inc.
Sharp Electronics Corp. —	Catel, Division of United Scientific Corp. Cetec Broadcast Group	Potomac Instruments Inc.
Professional Products	Coastcom	Rohde and Schwarz Sales Co. Sencore Inc.
Shintron Co. Inc.	Harris Corp., Broadcast Products Division McMartin Industries Inc.	Sound Technology Inc.
Sigma Electronics Inc.	Marti Electronics Inc B110, B111	Spectra Sonics  Tektronix
Tektronix Telemation	Micro Control Associates Inc.	Telecommunications Technology
3M Co. — Mincom Division	Moseley Associates Inc. QEI Corp.	Val-Tronics Inc.
Ultra Audio Pixtec	RCA Broadcast Systems Rockwell International-Collins Division	
Video Aids of Colorado B163	Singer Products Co. Inc.	GENERATORS, SIGNAL BAR DOT
		ASACA Corp. of America B17-B19
Video Components Inc.	Solid Electronics Laboratories	
Viscount Industries Ltd.	Tektronix	Broadcast Video
•	Tektronix Versa-Count	Systems Ltd
Viscount Industries Ltd.	Tektronix Versa-Count Engineering	Systems Ltd
Viscount Industries Ltd.	Tektronix Versa-Count Engineering	Systems Ltd
Viscount Industries Ltd. Vital Industries	Tektronix Versa-Count Engineering	Systems Ltd
Viscount Industries Ltd. Vital Industries GENERATORS, CONVERGENCE	Tektronix Versa-Count Engineering	Systems Ltd
Viscount Industries Ltd. Vital Industries  GENERATORS, CONVERGENCE  Broadcast Video	Tektronix Versa-Count Engineering	Systems Ltd

I among the		
Lenco Inc., Electronics Div	Broadcast Video Systems Ltd	GENERATORS, SUBCARRIER
Philips Test and Measuring		ATV Research
Instrument Inc.	Colorado Video Inc	Broadcast Video Systems Ltd
Richmond Hill Laboratories Inc.	Dage - MTI Inc.	CCA Electronics Corp
Sencore Inc.	Diamond Electronics, Div. of Arvin Systems Inc.  Dynair Electronics Inc.	CSI Electronics Inc.
Tektronix	Dynasciences	Cetec Broadcast Group
Telemation	Grass Valley Group	Cohu Inc., Electronics Division Communications Technology Inc.
Olifa Addio Pixtec	Heath Co. Industrial Sciences Inc.	Crosspoint Latch Corp
GENERATORS, SIGNAL MARKER	Leitch Video Ltd.	Grass Valley Group
	Lenco Inc.,	Harris Corp., Broadcast Products Division  Industrial Sciences Inc.
ASACA Corp. of America B17-B19  B and K Precision Dynascan Corp.	Electronics Div	Leitch Video Ltd.
Blonder-Tongue Labs	Philips Broadcast Equipment Corp.	Lenco Inc.,
Leader Instruments Corp. Lec Tro Tech Inc.	Portac Inc. Sencore Inc.	Electronics Div B91-B103
Sencore Inc.	Sigma Electronics Inc.	McMartin Industries Inc.
Tektronix	Tektronix	Marti Electronics Inc B110, B111 Merill Cable Equipment Corp.
	Telemation	Micro Control Associates Inc.
GENERATORS, SIGNAL PULSE	Ultra Audio Pixtec	Moseley Associates Inc.
ASACA Corp. of America B17-B19	Video Aids Corp. of Colorado B163	Philips Test and Measuring Instrument Inc.
Dranetz Engineering Labs Inc.		Rockwell International-Collins Division
Heath Co. Leitch Video Ltd.	GENERATORS, SIGNAL VITS	Rohde and Schwarz Sales Co.
Lenco Inc.,	ASACA Corp. of America B17-B19	Solid Electronics Laboratories  Telemation
Electronics Div	Beta Technology Inc.	Val-Tronics Inc.
Marconi Electronics Inc.	Harris Corp., Broadcast Products Division Industrial Sciences Inc.	
Philips Test and Measuring	J and D International	GENERATORS, SYNC
Instrument Inc. Richmond Hill Laboratories Corp.	Lenco Inc.,	ASACA Corp. of America B17-B19
Sigma Electronics	Electronics Div B91-B103	Broadcast Video
Systron-Donner TM Systems Inc.	Philips Test and Measuring	Systems Ltd
Tektronix	Instrument Inc.	Cohu Inc., Electronics Division
Wavetek Indiana Inc.	Rohde and Schwarz Sales Co.	Colorado Video Inc B31-B38
	Tektronix	Crosspoint Latch CorpB46
CENEDATORS SIGNAL AS		Dage — MTI Inc.
GENERATORS, SIGNAL AF	GENERATORS, STAIRCASE	Digital Video Systems  Dynair Electronics Corp.
ASACA Corp. of America B17-B19	ASACA Corp. of America B17-B19	Dynasciences
B and K Instruments Corp. Blonder-Tongue Labs	Broadcast Video	GBC Closed Circuit TV Corp.
Boonton Electronics Engineering Associates	Systems Ltd	Grass Valley Group Harris Corp., Broadcast Products Division
Gaw Co. Inc.	Colorado Video IncB31-B38	Hitachi-Denshi
Harris Corp., Broadcast Products Division Heath Co.	International Communications and Control Corp.	America Ltd
International Microwave Corp.	Leader Instruments Corp. Leitch Video Ltd.	Ikegami Electronics USA Inc.
Lampkin Laboratories Inc. Leader Instruments Corp.	Lenco Inc.,	Image Devices Inc.  Industrial Sciences Inc.
McMartin Industries Inc.	Electronics Div B91-B103	International Communications and Control Corp.
Microdyne Corp.  Philips Test and Measuring	Philips Test and Measuring	JVC Industries B75-B82
Instrument Inc.	Instrument Inc.	Javelin Electronics
Radiometer US Corp.	Richmond Hill Laboratories Ltd. Rohde and Schwarz Sales Co.	Leitch Video Ltd.
Rohde and Schwarz Sales Co.	Tektronix	Lenco Inc.,
Sadelco Inc. Scientific — Atlanta Inc.		Electronics Div B91-B103
Sencore Inc.	GENERATORS STEREO	Panasonic Co
Tektronix Triple Crown Electronics Inc.	GENERATORS, STEREO AEL Inc.	Philips Test and Measuring
Val-Tronics Inc.	Boonton Electronics	Instrument Inc. Rohde and Schwarz Sales Co.
Wavetek Indiana Inc.	CCA Electronics Corp B29	Sharp Electronics Corp. —
CENEDATORS	Catel, Division of United Scientific Corp. Cetec Broadcast Group	Professional Products
GENERATORS,	Dyma Engineering Inc.	Shintron Co. Inc.
SIGNAL SQUARE WAVE	Harris Corp., Broadcast Products Division Heath Co.	Sigma Electronics
Amber Electro Design Ltd.  ASACA Corp. of America B17-B19	Kahn Communications Inc.	Sony Corp. of America
B and K Precision Dynascan	Leader Instruments Inc. McMartin Industries Inc.	Tektronix Tolomation P154 P156
Heath Co.	Moseley Associates Inc.	Telemation
Leader Instruments Corp. Leitch Video Ltd.	Philips Test and Measuring	Ultra Audio Pixtec
Philips Test and Measuring	Instrument Inc.	Video Aids Corp.
Instrument Inc.	QEI Corp. Radiometer US Corp.	of Colorado
Sencore Inc.	Rockwell International-Collins Broadcast Products Rohde and Schwarz Sales Co.	Video Components Inc.
Tektronix Wavetek Indiana Inc.	Sencore Inc.	
The state making mo.	Solid Electronics Laboratories Sound Technology	GENERATORS,
GENERATORS, SIGNAL	Val-Tronics Inc.	TIME CODE/READER
TV SYNCHRONIZING	Versa-Count	Beta Technology Inc.
ASACA Corp. of America B17-B19	Engineering	Central Dynamics Corp B41
AUAUA UUIP. UI AIIIBIIVA DI /-DIS	Wilkinson Electronics	Chrono-Log Corp.

		0 0
Datametrics Inc. Datatron Inc.	Н	Superex Corp. Telex Communications Inc.
F.S.F	••	Wilkinson Electronics Inc.
Electronics Engineering Co. of California (EECO)		
Laird Telemedia	HARMONIC	HEADPHONES, MONO
Listec Television	DISTORTION METERS	AKG Acoustics B7, B8
Equipment Corp B104-B107  Media Concepts Inc.	Amber Electro Design Ltd.	Audiosears Corp.
MicroVision Systems	B and K Instruments Inc. Crown International Inc.	Avid Corp.
Nationwide Electronic Systems Inc.	Gaw Co. Inc.	Broadcast
Recortec Shintron Co. Inc.	Heath Co. Leader Instruments Corp.	Electronics Inc
Skotel CorpB146	Radiometer US Corp.	CCA Electronics Corp B29
Tektronix	Sound Technology	Cetec Broadcast Group Ercona Corp.
		Frezzolini
	HARMONIC FILTERS, FM	Electronics Inc
GENERATORS, TONE	Bird Electronic Corp. Cetec Jampro	Hamilton Electronics Corp.
Altec Lansing	Coaxial Dynamics Inc.	Harris Corp., Broadcast Products Division
Broadcast	Comark Industries Inc. Micro Communications Inc.	Heath Co.
Electronics Inc	Micro Communications inc.	Image Devices Inc. Koss Corp.
Channelmatic Electronics Inc.	HARMONIC FILTERS, TV	MPC Educational Systems Inc.
Di-Tech Inc	Bird Electronic Corp.	Newcomb Audio Products Co. R-Columbia Products Co. Inc.
Elcom Engineering Co	Cetec Jampro	Sennheiser
Gaw Co. Inc.	Comark Industries Inc.	Singer Products Co. Inc.
Gorman-Redlich Mfg. Co. Lampkin Laboratories	Micro Communications Inc.	Studer Revox America
McMartin Industries Inc.	LIEAD ALICHBAENT CALICES	Television Equipment Associates
Opamp Labs IncB123	HEAD ALIGNMENT GAUGES	Telex Communications Inc. Uher Corp.
Rohde and Schwarz Sales Co.	Broadcast Cartridge Service	Westlake Audio
Shure Brothers Inc B144, B145	Broadcast	Wilkinson Electronics Inc.
	Electronics IncB22-B27	HEADDHONES STEDES
	Fidelipac Mincom Division, 3M Co.	HEADPHONES, STEREO
GENERATORS, TONE EBS	Willicom Division, Swi Co.	AKG AcousticsB7, B8
Broadcast	HEAD CLEANING PRODUCTS	Avid Corp.
Electronics Inc		Broadcast 522 D27
Channelmatic Electronics Inc.	Broadcast	Electronics Inc
<i>E.S.E.</i>	Electronics IncB22-B27	CCA Electronics Corp B29
Elcom Engineering Co	Fidelipac MPC Educational Systems Inc.	Dyma Engineering Inc. Ercona Corp.
Gorman-Redlich Mfg. Co. International Nuclear Corp.	Nortronics Co. Inc.	Frezzolini
Logitek Electronic Systems	Robins Broadcast and Sound Equipment Corp. TDK Electronics Corp.	Electronics Inc
McMartin Industries Inc.	Uher Corp.	Hamilton Electronics Inc.
	United Research Laboratory Corp. VIF International	Heath Co.
GENERATORS, VIDEO CARRIER	THE THEORY OF THE TENT OF THE	Image Devices Inc. Koss Corp.
Sigma Electronics Inc.	HEADPHONES, ANNOUNCERS	MPC Educational Systems Inc.
Signa Liectionics inc.	AKG Acoustics B7, B8	Neutrik Newcomb Audio Products Co.
	AKG ACOUSTICS	Panasonic Co
GENERATORS, VIDEO SWEEP	Broadcast	R-Columbia Products Co. Inc.
ASACA Corp. of America B17-B19	Electronics IncB22-B27	Sansui Electronics Corp.
Harris Corp., Broadcast Products Division	Cetec Broadcast Group	Sennheiser
Leader Instruments Corp.	Dyma Engineering Inc.	Singer Products Co. Inc.
Lec Tro Tech Inc.	Electro-Voice Inc	Superscope Inc.
Lenco Inc.,	Ercona Corp. Harris Corp., Broadcast Products Division	Telex Communications Inc. Uher Corp.
Electronics Div B91-B103	Image Devices Inc.	Wilkinson Electronics
Philips Test and Measuring	MPC Educational Systems Inc. Neutrik	
Instrument Inc. Rohde and Schwarz Sales Co.	R-Columbia Products Co. Inc.	HEADS RECONDITIONED AND
Tektronix	Sennheiser	RECONDITIONING SERVICE
Wavetek Indiana Inc.	Studer Revox America	FOR AUDIO HEADS
	Television Equipment Associates Telex Communications Inc.	Image Devices Inc.
	Wilkinson Electronics Inc.	International Electro Magnetics
GRAPH PAPER		Minneapolis Magnetics Inc B116
Charles Mayer Studios Inc.	HEADPHONES,	Saki Magnetics IncB142
	BROADCAST MONITORING	Taber Mfg. and Eng. Co. United Research Laboratory Corp.
GRAPH RECORDER	AKG Acoustics	VIF International
Neutrik Products	Audiosears Corp.	
	Broadcast	
CDADUICE CENEDATORS	Electronics IncB22-B27	HEADS RECONDITIONED AND
GRAPHICS GENERATORS	Ercona Corp.	RECONDITIONING SERVICE
Chyron CorpB42	Harris Corp., Broadcast Products Division Image Devices Inc.	FOR VIDEO HEADS
Telestrator Division, Interand Corp. Thomson-CSF Laboratories	LPB Inc.	Image Devices Inc.
Thomson-Car Laboratories	MPC Educational Systems Inc. Neutrik	Minneapolis Magnetics Inc B116
	Panasonic CoB124-B129	Spin Physics Inc
GROUP LISTENING CENTERS	R-Columbia Products Co. Inc.	Taber Mfg. and Eng. Co.
Avid Corp.	Sennheiser	United Research Laboratory Corp.
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HEADS, RECORDER	IMAGE ENHANCERS	ITFS SYSTEMS
REPLACEMENT AUDIO	Consolidated Video Systems . B39	Electronics, Missiles and Communications Inc.
Broadcast	Dynasciences	Genesys Systems Inc. Varian Electron Device Group
Electronics Inc B22-B27	Mincom Division, 3M Co. Thomson-CSF Laboratories	
Ercona Corp. Grandy Inc.		
Image Devices Inc. International Electro Magnetics	IMAGE PROCESSORS	
Minneapolis Magnetics Inc B116	Microtime Inc	J
Nortronics Co. Inc.		
Saki Magnetics Inc	IMPEDANCE BRIDGES	JACK PANELS
Taber Mfg. and Eng. Co.	B and K Instruments Inc. Delta Electronics Inc. — VA	Audio Accessories Inc.  Broadcast
United Research Laboratory Corp. VIF International	Delta Electronics Inc., Div. of Long Engineering Co.	Electronics IncB22-B27
• • • • • • • • • • • • • • • • • • • •	Leader Instruments Corp. Leasametric	
HEADS RECORDER	Wide Band Engineering Co. Inc.	
REPLACEMENT VIDEO	IMPEDANCE MATCHING PADS	1
Broadcast 522 F27	Rohde and Schwarz	L .
Electronics IncB22-B27 Image Devices Inc.	Tech Laboratories Inc. Wide Band Engineering Co. Inc.	LAMINATING EQUIPMENT
Minneapolis Magnetics Inc B116		Graphic Laminating Inc.
Saki Magnetics Inc	INDUCTORS	MPC Educational Systems Inc.
Spin Physics Inc	Multronics Inc.	LABAINATING COLUDAGNIT
Taber Mfg. and Eng. Co. United Research Laboratory Corp.	INFORMATION SYSTEMS,	LAMINATING EQUIPMENT TRANSPARENCY
	WEATHER-NEWS	Graphic Laminating Inc.
HEADSETS WITH MICROPHONE	CADCO	Seal Inc. Transilwrap Co. Inc.
Avid Corp. EDCOR	Gorman Redlich Mfg. Co.  Knox Ltd	Transitivap Co. Inc.
Electro-Voice Inc	TapeAthon Corp.	LAMPS, STUDIO
Ercona Corp. Image Devices Inc.	•	Bardwell and McAlister Inc.
MPC Educational Systems Inc.	INTERCOM SYSTEMS	Berkey Colortran
Shure Brothers Inc B144, B145 Telex Communications Inc.	Altec Lansing	Cine 60 Inc
, 510% 550000	Atlas Sound Audio Designs and Mfg. Inc.	GBC Closed Circuit TV Corp.
<b>HEADSETS, TV CAMERAMAN</b>	Automated Processes Inc.	Alan Gordon Enterprises Inc. Image Devices Inc.
GBC Closed Circuit TV Corp. Image Devices Inc.	Bayly Engineering Ltd. Bogen Division/Lear Siegler Inc.	Kliegl Brothers B84-B88
Sony	David Clark Co. Inc. Clear-Com	Leedal Inc. Packaged Lighting Systems Inc.
Telex Communications Inc.	Coastcom Collins Television Services	Smith-Victor Corp B147-B150
HIGH FIDELITY CARTRIDGES	Crosspoint Latch Corp	Strand Century Inc.
	Custom Audio Electronics Delta Electronics Inc., Div. of Long Engineering Co.	Video Components Inc.
Shure Brothers Inc B144, B145	Erskine-Shapiro Theatre Technology Inc.	LEGTERNO AND AGGEOGRAPH
LUCLI FIDELITY COMPONENTS	Fisher Berkeley Corp.  Frezzolini	LECTERNS AND ACCESSORIES
HIGH FIDELITY COMPONENTS	Electronics Inc	Argos Sound Audio Visual Contractors
Altec Lansing BGW Systems Inc.	Harris Corp., Broadcast Products Division	D'San Corp. EDCOR
H.H. Scott Inc.	Holland Corp. Image Devices Inc.	MPC Educational Systems Inc. Charles Mayer Studios Inc.
HI-LIGHT ELIMINATOR	Locator Electronics Co. McCurdy Radio Industries Inc.	Ora Visual Co. Inc.
Video Components Inc.	McMartin Industries Inc. Paso Sound Products Inc.	Paso Sound Products Inc. Perma Power Electronics Inc.
ava vapanama ma	RTS Systems Inc	Sound-Craft Systems Inc. Special Instruments Laboratory Inc.
HIP PACK	Rivers Associates Roh Corp.	Van San Corp.
Image Devices Inc.	Singer Products Co. Inc.	LENS REPAIR SERVICE
The Rotary Co. Inc.	Vamco	Achro Video
HUM-STOP COILS	Engineering Inc B160-B162	Angenieux Corp.
Audio-Video Engineering	Video Aids of ColoradoB163 Ward-Beck Systems Ltd.	Century Precision Cine Optics Ercona Corp.
Microtran	World Video Inc.	Alan Gordon Enterprises Inc. Image Devices Inc.
Telemation		Lenzar Optics Corp.
Video Aids Corp. of Colorado	INTERMODULATION METERS	Tele-Cine Inc.
UI CUIUI adu	Amber Electro Design Ltd.	LETTERING EQUIPMENT,
	B and K Instruments Inc. Crown International Inc.	MECHANICAL
	EEG Enterprises Inc. Heath Co.	Fax Co.
IDEA AND CODIDE		Harwald Co. Image Devices Inc.
IDEA AND SCRIPT	INVERTERS, SINE WAVE	Kroy Industries Inc. Charles Mayer Studios Inc.
DEVELOPMENT Kapco Communications	Topaz Electronics	
Multi Media Forum B122	Versa-Count	LIGHT DIMMER CONTROLS
Webb Telemedia	Engineering B164-B165	Berkey Colortran
		p. 201

Custom Audio Electronics Delta Electronics Inc., Div. of Long Engineering Co.	Kliegl Brothers	QSI Systems Inc. Telex Communications Inc.
EEG Enterprises Inc.  Electronics Diversified Inc B54	Rex Rheostat and Co. Inc.  Strand Century Inc.	LOW VOLTAGE
Fax Co.	Union Connectors Co. Inc.	POWER SUPPLIES
Image Devices Inc.  Kliegl Brothers	Video Components Inc.	California Instruments
Lumitrol Ltd. Theatre Lighting		Video Components Inc.
Packaged Lighting Systems Inc. Skirpan Lighting Control Corp.	LIGHTING STANDS	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Spindler and Sauppe' Inc.	AND HANGERS	
Strand Century Inc.	Automatic Devices Co.	
Technamics Co. Ultra Audio Pixtec	Bardwell and McAlister Inc. Berkey Colortran	M
LIGHT METERS	Cine 60 Inc	MACNETIC CHAA
	Image Devices Inc.	MAGNETIC FILM Image Devices Inc.
Frezzolini Electronics Inc	Kliegl Brothers B84-B88	J and R Film Co. —
Alan Gordon Enterprises Inc.	Lowel-Light Mfg. Inc B108	Goldberg/Compco
Image Devices Inc.	Packaged Lighting Systems Inc. Samigon Division/Argraph Corp.	
Minolta Corp. Photo Research, Division Kollmorgen Corp.	Smith-Victor Corp B147-B150	MAGNETIC TAPE EDITING PEN
Samigon Division/Argraph Corp.	Strand Century Inc.	Image Devices Inc.
Strand Century Inc.	Video Components Inc.	Microtran
		orodan
LIGHTING CONTROL CONSOLES	LIGHTING SYSTEMS	MAGNETIC TAPE ERASERS
Custom Audio Electronics	CONSULTANT	R.B. Annis Co.
LIGHTING FIVEHOLD	Walter S. Brewer	
LIGHTING FIXTURES	Custom Audio Electronics Image Devices Inc.	Broadcast Electronics Inc
Bardwell and McAlister Inc.	Lumitrol Ltd. Theatre Lighting	Chyron Corp
Belden Communications Inc. Berkey Colortran Fax Co.	Oregon Sound and Lights	Ercona Corp. Fidelipac
Alan Gordon Enterprises Inc. Image Devices Inc.	LIGHTING TV	Garner Industries Inc
Kliegl	STUDIO SYSTEMS	Image Devices Inc. Magnasonics Mfg. and Sales Co.
Lowel-Light Mfg. Inc B108	Bardwell and McAlister Inc.	Microtran
Charles Mayer Studios Inc.	Berkey Colortran Comquip	Nortronics Co. Inc.
Oregon Sound and Lights Packaged Lighting Systems Inc.	Dyma Engineering Inc.	Robins Broadcast and Sound Equipment Corp. Taber Mfg. and Eng. Co.
Smith-Victor Corp B147-B150	Electro Controls Inc.	VIF International
Strand Century Inc.	Electronics Diversified	MAGNETIC TAPE
LIGHTING KITS	Janson Industries	SYNCHRONIZERS
Berkey Colortran	Kliegl Brothers	Electronic Engineering Co. of California (EECO) Image Devices Inc.
Cine 60 Inc	Packaged Lighting Systems Inc.	-
Crouse-Hinds Co.	Skirpan Lighting Control Corp.	MAILERS, AUDIO VISUAL
Frezzolini BEO BEO	Smith-Victor Corp B147-B150	Cases IncB40
Electronics Inc	Stand Century Inc.	Image Devices Inc.
Alan Gordon Enterprises Inc. Harwood Mfg. Co.	Video Components Inc. Weather Scan Inc.	Reliance Plastics and Packaging Division
Image Devices Inc.		MAINTENANCE CATV
Kliegl Brothers B84-B88	LIGHTNING	AMPLIFIERS/EQUIPMENT
Lowel-Light Mfg. Inc	ELIMINATION SYSTEMS	Applied Video Electronics Inc.
Smith-Victor Corp B147-B150	Lightning Elimination Associates Inc.	Com Sonics Inc.
Strand Century Inc.		AAAINITENANGE OO OO UOTO ANA
Unarco-Rohn, Division of Unarco Industries Inc.	LIGHTNING WARNING SYSTEMS	MAINTENANCE PRODUCTS, AV
Utility Tower Co.	Lightning Elimination Associates Inc.	FilMagic Products Inc. <b>Tentel</b>
Video Components Inc.		renter
	LIMIT INDICATOR	AS A INITENIA NICE
LIGHTING PATCH PANELS	Colorado Video IncB31-B38	MAINTENANCE
Berkey Colortran Image Devices Inc.		SERVICES AM/FM
Kliegi Brothers B84-B88	LINE	Applied Video Electronics Inc. McMartin Industries Inc.
Lumitrol Ltd. Theatre Lighting	INSTALLATION EQUIPMENT	Solid Electronics Laboratories Swager Tower Corp.
Packaged Lighting Systems Inc. Rex Rheostat and Co. Inc.	Burnup and Sims Inc.	Swagar rower Corp,
Strand Century Inc.		MAINTENANCE SERVICES
Union Connector Co. Inc.	LISTENING CENTERS/TABLES	CARTRIDGE/TAPE
	Hamilton Electronics Corp.	
LIGHTING PLUGS		Broadcast Cartridge Service Broadcast
AND CONNECTORS		Li Vaucas i

**AND CONNECTORS** 

Bardwell and McAlister Inc.
Berkey Colortran
Fax Co.
Image Devices Inc.

**LOGGERS AND** 

LOGGER EQUIPMENT
Moseley Associates Inc.
Nationwide Electronic Systems Inc.

MAINTENANCE SERVICES,	METERS, WOW AND FLUTTER	Newcomb Audio Products
MICROWAVE	B and K Instruments Inc.	Marti Electronics Inc B110, B111
Atlantic Research Corp.	Dyma Engineering Inc. Fidelipac	Panasonic CoB124-B129
Comark Industries Inc. Farinon Electric	Gotham Audio Corp.	Paso Sound Products Co. RCA Broadcast Products Division
Fort Worth Tower Co. Inc.	Leader Instruments Corp. Leasametric	R-Columbia Products Co. Inc.
Microwave Associates	Video Research Corp.	Rockwell International-Collins Broadcast Products Sennheiser
Fred A. Nudd Corp B119 Prodelin Inc.		
Raytheon Data Systems	MICROPHONE ACCESSORIES	Shure Brothers Inc B144, B145
Swager Tower Corp.	AKG Acoustics	Singer Products Co. Inc.
MAINTENANCE SERVICES, TV	Altec Lansing Atlas Sound	Sony Corp. of America Superscope Inc.
	Addiosears Corp.	TEAC Corp. of America
Applied Video Electronics Inc. Atlantic Research Corp.	Bogen Division/Lear Siegler Inc.	Turner Division of Conrac Uher Corp.
Comark Industries Inc.	Broadcast	Wilkinson Electronics Inc.
Comsonics Inc. C.R.V. Systems Inc.	Electronics IncB22-B27	
Evenview Television Systems Fort Worth Tower Co. Inc.	Electro-Voice Inc	MICROPHONES, FLOOR
Image Devices Inc.	Ercona Corp.	AKG Acoustics
Fred A. Nudd Corp B119	Frezzolini	Altec Lansing
RCA Broadcast Systems Swager Tower Corp.	Electronics Inc	Bayly Engineering Ltd.
Townsend Associates Inc.	Alan Gordon Enterprises Inc. HM Electronics Inc.	Bogen Division/Lear Siegler Inc. <b>Broadcast</b>
	Heath Co.	Electronics IncB22-B27
MAINTENANCE	Image Devices Inc. MPC Educational Systems Inc.	CCA Electronics Corp
TEST EQUIPMENT	Paso Sound Products Inc.	Cetec Broadcast Group
Comsonics Inc.	Perma Power Electronics Inc.	Dyma Engineering Inc.
Dranetz Engineering Laboratories Inc.	Sennheiser	Electro-Voice Inc
TentelB157	Shure Brothers Inc B144, B145	Ercona Corp. Alan Gordon Enterprises Inc.
	Special Instruments Laboratory Inc. Switchcraft Inc.	Harris Corp., Broadcast Products Division
MANUFACTURERS	Turner Division of Conrac Corp.	Image Devices Inc. Newcomb Audio Products Co.
REPRESENTATIVES	Uher Corp.	Panasonic Co
Broadcast Video	MICROPHONES DOOM	Paso Sound Products Inc.
Systems Ltd	MICROPHONES, BOOM	RCA Broadcast Systems Rockwell International-Collins Broadcast Products
Video Components	AKG AcousticsB7, B8	Sennheiser
Video Components	Atlas Sound Audiosears Corp.	Shure Brothers Inc B144, B145
	B and K Instruments Inc.	
MATCHING TRANSFORMERS	Bayly Engineering Bogen Division/Lear Siegler Inc.	Singer Products Co. Inc. Studer Revox America
Altec Lansing North Hills Electronics Inc.	Broadcast	Superscope Inc.
NOTH THIS Electronics Inc.	Electronics IncB22-B27	TEAC Corp. of America Uher Corp.
	CCA Electronics Corp	Wilkinson Electronics
MDS EQUIPMENT	Cetec Broadcast Group	
Electronics, Missiles and Communications Inc. Oak CATV Division/Oak Industries Inc.	Comquip Corp.	MICROPHONES, HAND HELD
Toner Cable Equipment Inc.	Electro-Voice Inc	AKG Acoustics
Varian Electron Device Group	Alan Gordon Enterprises Inc.	Altec Lansing
	Gotham Audio Corp.	Audiosears Corp. Avid Corp.
MEDICAL FIBER SCOPE	Harris Corp., Broadcast Products Division Image Devices Inc.	Bogen Division/Lear Siegler Corp.
Fujinon Optical Inc B60, B61	MPC Educational Systems Inc.	Broadcast
	Panasonic CoB124-B129	Electronics Corp B22-B27
MEGAPHONES	Paso Sound Products Inc. RCA Broadcast Systems	CCA Electronics Corp B29
Paso Sound Products Inc.	Sansui Electronics Corp.	EDCOR
	Sennheiser	Electro-Voice Corp B50, B51
	Shure Brothers Inc B144, B145	Ercona Corp. Frezzolini
MESSAGE CHANNEL	Singer Products Co. Inc.	Electronics Corp B58, B59
CADCO	Studer Revox America Wilkinson Electronics Inc.	Alan Gordon Enterprises Inc.
Catel, Division of United Scientific Corp.	WIRRISON Electromes inc.	Gotham Audio Corp.
METAL EARDICATING	MICROPHONES, DESK	HM Electronics Inc. Image Devices Inc.
METAL FABRICATING	AKG Acoustics B7, B8	MPC Educational Systems Inc.
Harwood Mfg. Co. Fred A. Nudd Corp	Accurate Sound	Marti Electronics Inc B110, B111
Ramko Research Inc B140, B141	Altec Lansing	Newcomb Audio Products Co.  Panasonic Co
namko nesearch mc br40, br41	Bayly Engineering Ltd. Bogen Division/Lear Siegler Inc.	Paso Sound Products Co.
METER MALIE TIPLIERO	Broadcast	RCA Broadcast Systems
METER MULTIPLIERS	Electronics Inc	R-Columbia Products Co. Inc. Rockwell International-Collins Broadcast Products
Tech Laboratories Inc.	CCA Electronics Corp	Sansui Electronics Corp.
	Cetec Broadcast Group	Sennheiser
METERS DECIBEL	Dyma Engineering Corp. EDCOR	Shure Brothers Inc B144, B145
Amber Electro Design Ltd.	Electro-Voice Inc	Singer Products Co. Inc.
Lec Tro Tech Inc.	Ercona Corp.	Sony Corp. of America
Weinschel Engineering Co. Inc.	GBC Closed Circuit TV Corp.	Superscope
METERS, PEAK PROGRAM	Alan Gordon Enterprises Inc. Harris Corp., Broadcast Products Division	TEAC Corp. of America Uher Corp.
Eric Small and Associates Inc.	Image Devices Inc. MPC Educational Systems Inc.	VIF International
and omail and maddiated ille.	ivii o caucational Systems IIIC.	Wilkinson Electronics

MICROPHONES, LAVALIER	Cetec Broadcast Group	MICROWAVE, PORTABLE/ENG
AKG AcousticsB7, B8	Comquip Dyma Engineering Inc.	Coastcom Estimate Electric
Altec Lansing	EDCOR	Farinon Electric International Microwave Corp.
Bogen Division/Lear Siegler Inc.	Electro-Voice Inc	Leasametric
Broadcast Electronics Inc	Frezzolini	Marti Electronics Inc B110, B111 Nurad Inc.
CCA Electronics Corp	Electronics Corp B58, B59	Rockwell International-Collins Broadcast Products
Dyma Engineering Inc.	Alan Gordon Enterprises Inc.	Terra Com Division of Conic Corp. Thomson-CSF Laboratories
EDCOR	HM Electronics Inc.  Ikegami Electronics Inc.	THOMSON-COT EBBORATORIES
Electro-Voice Inc	Image Devices Inc.	MICROWAVE STL
Frezzolini	MPC Educational Systems Inc.	AND REMOTE PU
Electronics Inc	Perma Power Electronics Inc.  Singer Products Co. Inc.	Coastcom
Alan Gordon Enterprises Inc.	Special Instruments Laboratory Inc.	International Microwave Corp.
Gotham Audio Corp. Harris Corp., Broadcast Products Division	Thomson-CSF Laboratories VIF International	Marti Electronics Inc B110, B111 Micro Control Associates Inc.
Image Devices Inc.	Val-Tronics Inc.	Moseley Associates Inc.
MPC Educational Systems Inc. Paso Sound Products Inc.	Vega Electronics	Nurad Inc. Rockwell International-Collins Broadcast Products
RCA Broadcast Systems	Wilkinson Electronics	Tenco Corp.
Sennheiser	MICROPHONE/TRANSDUCER	Terra Com, Division of Conic Corp. Time and Frequency Technology Inc.
Shure Brothers Corp B144, B145	INPUT TRANSFORMERS	
Singer Products Co. Inc.		MICROWAVE
Sony Corp. of America Studer Revox America	Broadcast Electronics IncB22-B27	SUPPORTS/ACCESSORIES
Uher Corp.	Image Devices Inc.	Innovative Television Equipment
Wilkinson Electronics	Microtran	International Microwave Corp. Microflect Co. Inc.
MICROPHONES, PARABOLIC		Wild officer Go. Wild.
AND SHOTGUN	MICROPROCESSOR	MAIVEDE COVETAL
	CONTROLLED EARTH	MIXERS CRYSTAL Weinschel Engineering Co. Inc.
AKG Acoustics	STATION RECEIVER	vveinschei Engineering Co. Inc.
Broadcast	AUTOMATION SYSTEMS	MOBILE VAN CONSTRUCTION
Electronics Inc	Channelmatic Electronics Inc.	Applied Video Electronics Inc.
Dyma Engineering Inc.		Atlantic Research Corp.
Electro-Voice Inc	MICROPROCESSOR	Soll Inc.
Ercona Corp. Frezzolini	CONTROLLED PROGRAMMABLE	MOBILE VIDEO CARTS
Electronics Inc	CLOCKS	Image Devices Inc.
Gotham Audio Corp.	Channelmatic Electronics Inc.	Lee-Ray Industries Inc
Image Devices Inc. Sennheiser		Multiplex Display Fixture Co. Peerless Sales Co.
Westlake Audio	MICROPROCESSOR	Video Components Inc.
	REAL-TIME CONTROLLERS	H. Wilson Corp.
MICROPHONES	Bristol Division of Acco  Broadcast	The Winsted Corp B175-B182
STANDS AND BOOMS	Electronics IncB22-B27	
AKG AcousticsB7, B8	Channelmatic Electronics Inc.	MOBILE VTR CENTERS
Altec Lansing Atlas Sound		Applied Video Electronics Inc.
BSC Inc.	MICROSCOPE CCTV SYSTEMS	Bretford
Bayly Engineering Ltd. Bogen Division/Lear Siegler Corp.	GBC Closed Circuit TV Corp.	H. Wilson Corp.  The Winsted CorpB175-B182
Broadcast	MICROWAVE ACCESSORIES	mo vimotou oorpbiro broz
Electronics Inc B22-B27	Broadcast	MODULAR STAGES/
CCA Electronics Corp B29	Electronics IncB22-B27	DANCE FLOORS —
Comquip Inc. EDCOR	Cablewave Systems Inc.	ILLUMINATED
Ercona Corp.	Catel, Division of United Scientific Corp. Coastcom	Packaged Lighting Systems Inc.
G.C. Electronics Corp. Alan Gordon Enterprises Inc.	EEV Inc. GTE Lenkurt Inc.	r schaged Lighting Oystems inc.
Gotham Audio Corp.	Innovative Television Equipment	MODULATION METERS, AM/FM
Karl Heitz Inc. Image Devices Inc.	International Microwave Corp. Leasametric	The Sequerra Co. Inc.
MPC Educational Systems Inc.	Marti Electronics Inc B110, B111	
Panasonic Co	Maury Microwave Corp.	MODULATION MONITORS
RCA Broadcast Systems	Moseley Associates Inc.	
Sansui Electronics Corp.	North Hills Electronics Inc.	Lampkin Labs Inc.
Sennheiser R143	North Hills Electronics Inc. Summit Cinevideo Corp.	Leasametric
Sennheiser	North Hills Electronics Inc. Summit Cinevideo Corp. UTE Microwave Inc. Varian Electron Device Group	Leasametric McMartin Industries Inc. The Sequerra Co. Inc.
Shure Brothers Inc B144, B145	North Hills Electronics Inc. Summit Cinevideo Corp. UTE Microwave Inc.	Leasametric McMartin Industries Inc. The Sequerra Co. Inc. Time and Frequency Technology Inc.
Shure Brothers Inc B144, B145 Singer Products Co. Inc.	North Hills Electronics Inc. Summit Cinevideo Corp. UTE Microwave Inc. Varian Electron Device Group Weinschel Engineering Co. Inc.	Leasametric McMartin Industries Inc. The Sequerra Co. Inc. Time and Frequency Technology Inc. Versa-Count
Shure Brothers Inc B144, B145 Singer Products Co. Inc. Strand Century Inc. Studer Revox America	North Hills Electronics Inc. Summit Cinevideo Corp. UTE Microwave Inc. Varian Electron Device Group Weinschel Engineering Co. Inc.	Leasametric McMartin Industries Inc. The Sequerra Co. Inc. Time and Frequency Technology Inc.
Shure Brothers Inc B144, B145 Singer Products Co. Inc. Strand Century Inc. Studer Revox America Television Products Co. Inc.	North Hills Electronics Inc. Summit Cinevideo Corp. UTE Microwave Inc. Varian Electron Device Group Weinschel Engineering Co. Inc.	Leasametric McMartin Industries Inc. The Sequerra Co. Inc. Time and Frequency Technology Inc. Versa-Count Engineering
Shure Brothers Inc B144, B145 Singer Products Co. Inc. Strand Century Inc. Studer Revox America Television Products Co. Inc. Uher Corp. Westlake Audio	North Hills Electronics Inc. Summit Cinevideo Corp. UTE Microwave Inc. Varian Electron Device Group Weinschel Engineering Co. Inc.  MICROWAVE KLYSTRONS Ceco Communications Inc. Levit Electronics	Leasametric McMartin Industries Inc. The Sequerra Co. Inc. Time and Frequency Technology Inc. Versa-Count Engineering
Shure Brothers Inc B144, B145 Singer Products Co. Inc. Strand Century Inc. Studer Revox America Television Products Co. Inc. Uher Corp.	North Hills Electronics Inc. Summit Cinevideo Corp. UTE Microwave Inc. Varian Electron Device Group Weinschel Engineering Co. Inc.  MICROWAVE KLYSTRONS Ceco Communications Inc. Levit Electronics  MICROWAVE PATH	Leasametric McMartin Industries Inc. The Sequerra Co. Inc. Time and Frequency Technology Inc.  Versa-Count Engineering
Shure Brothers Inc B144, B145 Singer Products Co. Inc. Strand Century Inc. Studer Revox America Television Products Co. Inc. Uher Corp. Westlake Audio Wilkinson Electronics Inc.	North Hills Electronics Inc. Summit Cinevideo Corp. UTE Microwave Inc. Varian Electron Device Group Weinschel Engineering Co. Inc.  MICROWAVE KLYSTRONS Ceco Communications Inc. Levit Electronics  MICROWAVE PATH SURVEY AND MONITOR	Leasametric McMartin Industries Inc. The Sequerra Co. Inc. Time and Frequency Technology Inc. Versa-Count Engineering
Shure Brothers Inc B144, B145 Singer Products Co. Inc. Strand Century Inc. Studer Revox America Television Products Co. Inc. Uher Corp. Westlake Audio	North Hills Electronics Inc. Summit Cinevideo Corp. UTE Microwave Inc. Varian Electron Device Group Weinschel Engineering Co. Inc.  MICROWAVE KLYSTRONS Ceco Communications Inc. Levit Electronics  MICROWAVE PATH	Leasametric McMartin Industries Inc. The Sequerra Co. Inc. Time and Frequency Technology Inc.  Versa-Count Engineering

MONITOR/RECEIVERS, BLACK AND WHITE	Tektronix Inc. Ultra Audio Pixtec	ON LOCATION VIDEO PRODUCTION
Canadian General Electric Co. Inc. Cohu Inc., Electronics Division	MOTION DETECTOR	Webb Telemedia Corp.
Conrac Dage — MTI Inc. Diamond Electronics, Division of Arvin Systems Inc.  Electrohome	Colorado Video Inc B31-B38 GBC Closed Circuit TV Corp.	OPEN SHELF STORAGE SYSTEMS
NEC America Inc.	MOTION PICTURE	The Winsted Corp B175-B182
Panasonic Co	DIST./PRODUCER American Educational Films Inc.	OPTICAL COLOR COMPARATOR Power Optics
Sanyo Electric Inc.	MOTION PICTURE AND	Total option
Sony Video Components Inc.	SLIDE FILM LIBRARIES	OPTICAL EFFECTS
MONITOR/RECEIVERS, COLOR	AIDS, A Damon Co. American Educational Films Inc. BNA Communications Inc.	Technamics Co.  Video Components Inc.
Canadian General Electric Co. Ltd.	Cable Films Color Stock Library Inc. and Lem Bailey Prod.	ODTICAL EVETERAC
Conrac	Colour Images Unlimited Inc. Harwald Co.	OPTICAL SYSTEMS
Electrohome	National Telefilm Associates Sherman Films Inc.	Fujinon Optical Inc
Image Devices Inc	MULTI-MEDIA PODIUMS	OSCILLOSCOPES
JVC	Communications Systems,	B and K Instruments Inc.
Kallman Associates Inc.  Panasonic Co	Division of Powell Tool Supply Inc.	Heath Co. Leader Instruments Corp. Leasametric
Sanyo Electric Inc.	MULTI-MEDIA RENTAL	Lec Tro Tech Inc. Wavetek Indiana Inc.
Sharp Electronics Corp. — Professional Products	Communications Systems, Division of Powell Tool Supply Inc.	
Sony	MULTIPOINT DISTRIBUTION	
Videotek IncB172	AUDIO PROGRAMMING RCA American Communications	P
MONITORS, BROADCAST FM	MILL TIPOLNIT DIOTPUPLITION	PAN AND TILT EQUIPMENT
Conrac	MULTIPOINT DISTRIBUTION TV PROGRAMMING	Catel, Division of United Scientific Corp.
The Sequerra Co. Inc.  Versa-Count	RCA American Communications	Diamond Electronics, Division of Arvin Systems Inc. GBC Closed Circuit TV Corp.
Engineering		Genesys Systems Inc. Alan Gordon Enterprises Inc.
	MUSIC LIBRARY	Image Devices Inc. Innovative Television Equipment
MONITORS, VIDEO PULSE CROSS	De Wolfe Music Library B47	Javelin Electronics Karl Heitz Inc.
Amtron Corp.	MUSIC PRODUCTION	Listec Television Equipment Corp B104-B107
ASACA Corp. of America B17-B19	De Wolfe Music Library B47	Nurad Inc.
CCA Electronics Corp B29 Conrac	The Money Machine TapeAthon Corp.	Pelco <b>Quick-Set Inc</b>
Dyma Engineering Inc.	Ruth White Films/Rhythms Productions	RCA Electro Optics and Devices
Electrohome LtdB52, B53 Lenco Inc.,	T.J. Valentino	Video Components Inc.
Electronics Div B91-B103 Panasonic Co B124-B129	MUSIC SYNTHESIZERS	PASSIVE REPEATERS
Rohde and Schwarz Sales Co.	ARP Instruments Inc. Spectrum Instruments Inc. Ruth White Films/Rhythms Productions	Microflect Co. Inc.
Sony Corp. of America Tektronix	Nutri Write Films/ Knythins Productions	PATCH CORDS
Ultra Audio Pixtec		Audio Accessories Inc.
Unimedia Corp.  Video Aids Corp.		PEDESTALS, FIBERGLAS CATV
of Colorado	0	T.R. Pitts Co.
Videotek IncB172	0	
	ODOTRUCTION LIGHTO	PHASE CONVERTERS,
MONITORS, WAVEFORM	OBSTRUCTION LIGHTS (FAA APPROVED)	TRANSMITTER
Broadcast Video	Crouse-Hinds Co.	(SINGLE TO THREE) California Instruments
Systems Ltd		Dyma Engineering Inc. Harris Corp., Broadcast Products Division
Harris Corp., Broadcast Products Division	ON AIR LIGHTS	Kay Industries Inc.
Hitachi-Denshi Ltd B65-B72	Broadcast Cartridge Service	Val-Tronics Inc.
Ikegami Electronics Inc. Lec Tro Tech Inc.	Broadcast Electronics Inc	PHASE METERS
Lenco Inc.,	Fidelipac	Amber Electro Design Ltd. B and K Instruments Inc.
Electronics Div B91-B103	QRK Electronic	Dranetz Engineering Labs Inc.
Sharp Electronics Corp. —	D - 1 . 1	
Professional Products	Products Inc	Fidelipac Gorman Redlich Mfg. Co. Leasametric

Roger Mayer Electronics Inc.

Video Aids of Colorado.....B163 Video Components Inc.

# PHOTOGRAPHY TIME LAPSE MOVIE CONTROLS

Sample Engineering Co.

### PIPE LOCATERS

Agua-Tropics Inc.

### PLASTIC DUCT LOCATERS

Aqua-Tronics Inc.

### **POINTERS** PROJECTION SCREEN

Audio Visual Contractors Charles Mayer Studios Inc. Ednalite Corp. Samigon Division/Argraph Corp.

#### **POLE LINE HARDWARE**

Kortick Mfa. Co.

# PORTABLE SLIDE SHOWCASE

General Audio Visual Inc. (GAVI)

# **PORTABLE TV** PRODUCTION CENTER

GBC Closed Circuit TV Corp.

## POWER/DIMMER RIGGING SYSTEMS — REMOTE CONTROL

Lumitrol Ltd. Theatre Lighting Packaged Lighting Systems Inc.

#### POWER LINE MONITORS

Dranetz Engineering Laboratories Inc.

#### POWER PACKS

Andan Pausan

Anton bauer	<i>D 13-D 10</i>
Cine 60 Inc	<i>B44-B45</i>
Frezzolini	
Electronics Inc	<i>B58, B59</i>
Alan Gordon Enterprises Inc.	
Heath Co.	

D12 D16

Image Devices Inc.

Perrott Engineering ......B130 Video Components Inc.

#### **POWER SUPPLIES**

Anton	Rauer							_	B	1	3-	B	1	6
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California Instruments Communication Distribution Corp. Control Technology Inc.

GBC Closed Circuit TV Corp.

Alan Gordon Enterprises Inc. Heath Co.

Frezzolini

Image Devices Inc.

International Nuclear Corp.

Kay Industries Inc. Leasametric

McCurdy Radio Industries Inc.

McMartin Industries Inc. Magnavox CATV System Inc.

# Modular Audio Products . . . . B117

Optical Radiation Corp.

Robins Broadcast and Sound Equipment Corp.

Sample Engineering Co.

Sawver Industries Inc.

Sitco Antennas Spectra Sonics Tonaz Electronics Varian Electron Device Group Weinschel Engineering Co. Inc.

# POWER SYSTEMS. UNINTERRUPTIBLE

Topaz Electronics

# **POWER TUBES**

EEV Inc. Levit Electronics RCA Electro Optics and Devices RCA Distributor and Special Products Division Thomson-CSF Electron Tubes Varian Electron Device Group

#### PRE-RECORDED TAPES/FILMS

Advanced Systems Inc. Benchmark Films Inc. Cable Films Color Stock Library Inc. and Lem Bailey Prod. Design-Form EvenView Television Systems Florida State University, Student Government Video Center Microcampus — University of Arizona Nightingale — Conant Corp. VIF International

# PRINTING AND TYPESETTING

The Bill Daniels Co. Inc. . B55, B74, B91, B109, B112, B174

Kroy Industries Inc. Charles Mayer Studios Inc. T.R. Pitts Co.

# **PRODUCERS AND DISTRIBUTORS OF** VIDEOCASSETTE TRAINING PROGRAMS

BNA Communications Inc.

# **PRODUCT DEMONSTRATION CARTS**

Ferno-Washington Inc. 

# PRODUCTION. **MOTION PICTURE**

Color Stock Library Inc. and Lem Bailey Prod.

# PROGRAMMED MUSIC

The CNB Studios CaVox Stereo Productions Cetec Broadcast Group Concept Productions TapeAthon Corp. VIF International

Ruth White Films/Rhythms Productions

# PROGRAMMERS

Portac Inc.

# PROGRAMMERS, **MULTI-SCREEN**

Audio-Sine Inc. Audio Visual Laboratories Inc. Communications Systems, Division of Powell Tool Supply Inc. Delta Electronics Inc., Div. of Long Engineering Co. EEG Enterprises Inc. Impact Communications Inc. Mincom Division, 3M Co.

#### Spindler and Sauppe' Inc.

Technamics Co.

# PROJECTION SCREENS. CABINET AND TABLE TOP

Audio Visual Products Division/BCI Daystar Audio Visual Inc. General Audio Visual Inc. (GAVI) Image Devices Inc MPC Educational Systems Inc. Charles Mayer Studios Inc. Raven Screen Corp.

## PROJECTION SCREENS, FRONT

Da-Lite Screen Co. Inc. Delta Electronics Inc., Div. of Long Engineering Co. Alan Gordon Enterprises Inc. Image Devices Inc.
MPC Educational Systems Inc. Charles Mayer Studios Inc. Projection Systems Inc. Raven Screen Corp.

# PROJECTION SCREENS, REAR

Audio Visual Contractors
Audio Visual Products Division/BCI Da-Lite Screen Co. Inc. Daystar Audio Visual Inc Delta Electronics Inc., Div. of Long Engineering Co. Image Devices Inc. Impact Communications Inc. MPC Educational Systems Inc. Charles Mayer Studios Inc. Projection Systems Inc. Raven Screen Corp. Spectro-Vue Inc. H. Wilson Corp.

# PROJECTION SYSTEMS, **16MM XENON**

Image Devices Inc. Strong Electric Corp.

### PROJECTOR, 8MM REPEATER

General Audio Visual Inc. (GAVI)

#### PROJECTOR LAMPS

Barbizon Electric GTE Sylvania Inc. General Audio Visual Inc. (GAVI) Image Devices Inc. Charles Mayer Studios Inc. Riluma Co. of America Schuessler Case Co. Inc.

#### Strand Century Inc.

Strong Electric Corp. Varian Electron Device Group H. Wilson Corp.

# **PROJECTOR** TABLES AND STANDS

Accessories Mfg. Ltd. **Audio Visual Contractors** Bretford

Heindl Masks 'N' Mounts Image Devices Inc

# J and R Film Co. — Goldberg/Compco

Karl Heitz Inc.

# KLM Associates

Logan Electric Specialty Mfg. Co. MPC Educational Systems Inc. Charles Mayer Studios Inc. Neumade Products Corp. Optical Radiation Corp. Samigon Division/Argraph Corp. Smith System Mfg. H. Wilson Co.

The Winsted Corp. . . . . B175-B182

### PROJECTORS, SLIDE/SOUND

Technicolor Audio-Visual Systems

PROJECTORS, SUPER 8	RADAR/FLIR	RECEIVERS, MULTIPLEX
Technicolor	VIDEO FILM RECORDERS	Altec Lansing
Audio-Visual Systems	Teledyne Camera Systems	Beta Technology Inc.
· · · · · · · · · · · · · · · · · · ·		CCA Electronics Corp
DDOMDTEDO	RADAR, WEATHER	GTE Lenkurt Inc.
PROMPTERS	Levit Electronics	Heath Co.
D'San Corp. Image Devices Inc.	TSC Development Laboratories	International Microwave Corp. McMartin Industries Inc.
Listec Television		Moseley Associates Inc.
Equipment Corp B104-B107	RADIO	Raytheon Data Systems
Q-TV/Telesync	AUTOMATION EQUIPMENT	Singer Products Co. Inc.
Telescript Inc.	VIF International	Summit Cinevideo Corp. Superscope Inc.
raidanpt mai	The state of the s	Superscope IIIC.
DULGE ACCIONISTENT OVOTERS		
PULSE ASSIGNMENT SYSTEMS	RADIO-TV	RECEIVERS, TIME SIGNAL
Central Dynamics Ltd B41	PROGRAM CONTROLS	Caringella Electronics Inc. Catel, Division of United Scientific Corp.
Lenco Inc.,	D'San Corp.	
Electronics Div		E.S.E
	RADIO PROGRAMS	Elcom Engineering CoB49
DILLOS DEL AVALINEO	Nightingale-Conant Corp.	Electrohome Ltd
PULSE DELAY LINES		
Allen Avionics Inc	RADIO SPOT CARRIERS	
Broadcast Video	Nightingale-Conant Corp.	RECEIVERS, TV
Systems Ltd	Mightingale-Conditi Corp.	BLACK AND WHITE
Lenco Inc.,	RADIO/CASSETTE	Heath Co.
Electronics Div B91-B103		Panasonic Co
Liectromes Div	PLAYERS/RECORDERS	QSI Systems Inc.
	Hamilton Electronics Corp.	Rohde and Schwarz
PULSE	·	Sanyo Electric Inc.
DISTRIBUTION AMPLIFIER		Sharp Electronics Corp. —
American Data	RASTER GENERATOR	Professional Products
Applied Video Electronics Inc.	Colorado Video IncB31-B38	Sony
Beaveronics Inc		•
Central Dynamics Ltd B41	DEAL TIME ANALYZEDO	
Cobu Inc. Flectronics Division	REAL TIME ANALYZERS	RECEIVERS, TV COLOR
Diamond Electronics, Division of Arvin Systems	Crown International Inc.	Comquip
Di-Tech Inc		Electrohome Ltd
Dynair Electronics Inc. Dynasciences	RECEIVERS, AM/FM	Evenview Television Systems
GBC Closed Circuit TV Corp.	Altec Lansing	Heath Co.
Grass Valley Group Inc.	Bayly Engineering Ltd.	Image Devices Inc.
International Nuclear Corp.  J and D International	Bell Audio Systems Inc. Bogen Division/Lear Siegler Inc.	Image Magnification Inc.
Leitch Video Ltd.	CCA Electronics Corp	Panasonic CoB124-B129
Lenco Inc.,	Catel, Division of United Scientific Corp.	Pleasantville Labs QSI Systems
Electronics Div B91-B103	Comrex Corp.	Sanyo Electric Inc.
North Hills Electronics Inc.	Elcom Engineering	Sharp Electronics Corp. —
Shintron Co. Inc. Sigma Electronics Inc.	Electrohome LtdB52, B53	Professional Products
oighta Electronics inc.	Fixtune Electronics Inc.	
	GTE Lenkurt Inc.	Sony Corp. of America
	GTE Lenkurt Inc. Heath Co. International Microwave Corp.	Sony Corp. of America Telescript Inc.
	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics	Sony Corp. of America
	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.	Sony Corp. of America Telescript Inc.
Q	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111	Sony Corp. of America Telescript Inc. Videodetics Corp.
Q	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc. Marti Electronics Inc B110, B111 Panasonic Co	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE
Q QUADRAPHONIC DECODERS	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111	Sony Corp. of America Telescript Inc. Videodetics Corp.
QUADRAPHONIC DECODERS	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.
QUADRAPHONIC DECODERS Sansui Electronics Corp.	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc.  Singer Products Co. Inc.	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER
Sansui Electronics Corp.	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp.
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc.	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER
Sansui Electronics Corp.	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc.	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS  Sansui Electronics Corp.	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co.	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS  Sansui Electronics Corp.	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast Electronics Inc	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS Sansui Electronics Corp.	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast Electronics Inc	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS Sansui Electronics Corp.  R  RACK MOUNT ENCLOSURES	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast Electronics Inc	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS Sansui Electronics Corp.	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast Electronics Inc	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
Sansui Electronics Corp.  QUADRAPHONIC ENCODERS Sansui Electronics Corp.  R  RACK MOUNT ENCLOSURES	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast Electronics Inc	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
RACK MOUNT ENCLOSURES  Cases Inc	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc.  Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast Electronics Inc B22-B27 CCA Electronics Corp B29 Elcom Engineering Co B49 Fixtune Electronics Inc. Gorman Redlich Mfg. Co. Harris Corp., Broadcast Products Division International Nuclear Corp.	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
RACK MOUNT ENCLOSURES Cases Inc	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast Electronics Inc	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
RACK MOUNT ENCLOSURES Cases Inc	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast Electronics Inc B22-B27 CCA Electronics Corp B29 Elcom Engineering Co B49 Fixtune Electronics Inc. Gorman Redlich Mfg. Co. Harris Corp., Broadcast Products Division International Nuclear Corp. Logitek Electronic Systems McMartin Industries Inc. Rivers and Associates Inc.	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc
RACK MOUNT ENCLOSURES Cases Inc	GTE Lenkurt Inc. Heath Co. International Microwave Corp. Johnson Electronics McMartin Industries Inc.  Marti Electronics Inc B110, B111 Panasonic Co B124-B129 Rohde and Schwarz Sales Co. Sansui Electronics Corp. H.H. Scott Inc. Singer Products Co. Inc. Studer Revox America Superscope Inc. Tandberg of America Inc. Wilkinson Electronics Inc.  RECEIVERS, EBS American Microsignal Co. Broadcast Electronics Inc	Sony Corp. of America Telescript Inc. Videodetics Corp.  RECEIVERS, TV SATELLITE Microdyne Corp.  RECEIVERS, WEATHER Catel, Division of United Scientific Corp. Gorman Redlich Mfg. Co.  RECORD PLAYERS Broadcast Electronics Inc

RADAR/FLIR

**PROJECTORS, SUPER 8** 

RECEIVERS, MULTIPLEX

# RECORDERS, AUDIO REEL TO REEL

Ampex Corp.
Applied Video Electronics Inc.
B and K Instruments Inc.

#### **Broadcast**

Image Devices Inc.

International Electro Magnetics (IEM)
Karl Heitz Inc.
MCI Inc.
Magna-Tech Electronic Co. Inc.
Martel Electronics
Scully Recording Instruments

Scully Recording Instrument Superscope Inc. Telex Communications Inc. Uher Corp. United Research Labs Corp.

VIF International

# RECORDERS, AUDIO TAPE CAMERA/TAPE TO FILM

Image Devices Inc. Martel Electronics W.A. Palmer Films Inc. Teledyne Camera Systems

### **RECORDERS, CASSETTE AUDIO**

Amilon Corp.
Avid Corp.
EDCO Products Inc.
Alan Gordon Enterprises Inc.
Heath Co.
Image Devices Inc.
MPC Educational Systems Inc.
MacKenzie Laboratories Inc.
Mincom Division, 3M Co.
Newcomb Audio Products Co.
Sansui Electronics Corp.

## Sanyo Electric Inc. Sharp Electronics Corp. — Professional Products

Superscope Inc.
Telectro Systems Corp.
Telex Communications Inc.
Uher Corp.
United Research Lab Corp.

### **RECORDERS, CASSETTE VIDEO**

# RECORDERS, DISC MAGNETIC

Ampex Corp. Arvin/Echo Science Corp.

#### RECORDERS, FILM LIGHT

Wide Range Electronics Corp.

#### RECORDERS, FILM MAGNETIC

Image Devices Inc.
Magna-Tech Electronic Co. Inc.
Quad-Eight Electronics
Wide Range Electronics Corp.

### RECORDERS, LOGGING

GYYR
QSI Systems Inc.
Scully Recording Instruments
The Stancil-Hoffman Corp.
Telectro Systems Corp.
Telex Communications Inc.
VIF International

#### RECORDERS, AUDIO TAPE

Ampex Corp.

Broadcast

Gotham Audio Corp.
Image Devices Inc.
International Electro Magnetics (IEM)
MCI Inc.
MPC Educational Systems Inc.
Magna-Tech Electronic Co. Inc.
Scully Recording Instruments
Superscope Inc.
Telex Communications Inc.

Telex Communications Inc. Uher Corp. United Research Labs Corp. VIF International

#### **RECORDERS, SLOW MOTION**

Ampex Corp. Arvin/Echo Science Corp. Image Devices Inc.

# RECORDERS, TAPE AUDIO CARTRIDGE

Amilon Corp. Audio-Sine Inc.

International Electro Magnetics (IEM)
MPC Educational Systems Inc.

ORK Electronic

Telectro Systems Corp. Telex Communications Inc. United Research Labs Corp.

# RECORDERS, TIME BASE CORRECTION

Ampex Corp. Digital Video Systems

#### RECORDERS, VIDEO KINESCOPE

W.A. Palmer Films Inc. Teledyne Camera Systems

# RECORDERS, VIDEO TIME LAPSE

Arvin/Echo Science Corp. Eigen Corp. GYYR

RCA Electro Optics and Devices Sanyo Electric Inc.

# RECORDERS, VIDEO CARTRIDGE

# RECORDERS, VIDEO TAPE HELICAL

Ampex Corp.

Recorted Inc.
Sanyo Electric Inc.
Sony

# RECORDERS, VIDEO TAPE QUAD

Ampex Corp. RCA Broadcast Systems

#### **RECTIFIERS**

EEV Inc. Levit Electronics Thor Electronics Corp. Varian Electron Device Group Wilkinson Electronics Inc.

### **REELS, CABLE AND WIRE**

Burnup and Sims Inc. D'San Corp.

#### REELS, FILM

Alan Gordon Enterprises Inc. Harwald Co. Image Devices Inc.

J and R Film Co. — Goldberg/Compco Neumade Products Corp. Plastic Reel Corp. of America [PRC]

Schuessler Case Co. Inc.

### REELS, TAPE

Image Devices Inc.

J and R Film Co. —
Goldberg/Compco

MPC Educational Systems Inc. Neumade Products Corp.

Plastic Reel Corp. of America [PRC] Schuessler Case Co. Inc.

Schuessler Case Co. Inc Superscope Inc. Uher Corp.

# REGULATORS, AC LINE

Topaz Electronics

#### RELAYS

Electronic Instrument and Specialty Corp. ITT Jennings Multronics Inc.

#### REMOTE CONTROL SYSTEMS

American Microsignal Inc. Bayly Engineering Ltd.

CCA Electronics Corp. .... B29
Cetec Broadcast Group

Comark Industries Inc.
Continental Electronics Mfg. Co.
Datalogic Rust Co.
Delta Electronics Inc.

Image Magnification Inc.
Logitek Electronic Systems

Marti Electronics..... B110, B111
Micro Control Associates Inc.

Monroe Electronics Inc. . . . . . B118
Panasonic Co. . . . . . . . B124-B129
Portae Inc.

Power Optics Inc.

Robins Broadcast and Sound Equipment Corp. Eric Small and Associates Inc. Sono-Mag Corp. Tayburn Electronics Inc. Tele-Cine Inc. Time and Frequency Technology Inc.

Val-Tronics Inc.

Engineering Inc. . . . . . B160-B162
Vega Electronics

The Widget Works Inc. Wilkinson Electronics

# REMOTE DATA ACQUISITION

Micro Control Associates Inc. Nationwide Electronic Systems Inc.

#### REPEATING CASSETTES

Heindl Masks 'N' Mounts MacKenzie Laboratories Inc.

#### **REVERBERATION SYSTEMS**

Eventide Clockworks Inc.
Gotham Audio Corp.
Quantum Audio Labs Inc.
Sansui Electronics Corp.
Technical Audio Products Corp. (TAPCO)
VIF International

#### REWINDERS, FILM

Alan Gordon Enterprises Inc. Harwald Co.

# J and R Film Co. — Goldberg/Compco

Kinetronics Corp. Neumade Products Corp. Recortec Inc.

### **REWINDERS, TAPE**

# 

Neumade Products Corp. Telex Communications Inc.

#### R.F. AMMETERS

Delta Electronics Inc. - VA

#### **R.F. AMPLIFIERS**

AVA Electronics
Avantek Inc.
CADCO
C-Cor Electronics Inc.
EEV Inc.
Electronics, Missiles and Communications Inc.
The Finney Co.
International Microwave Corp.
LPB Inc.
McMartin Industries Inc.
Magnavox CATV Systems Inc.
Microwave Power Devices Inc.
Moseley Associates Inc.
T.R. Pitts Co.
R.F. Systems Co. — PA
Raytheon Data Systems
Sitco Antennas

# Sony

Summit Cinevideo Corp. TOCOM Inc. Triple Crown Electronics Inc. Varian Electron Device Group

# Versa-Count

Engineering . . . . . . . . B164-B165

Wide Band Engineering Co. Inc. Wilkinson Electronics Inc.

# R.F. CABLES

AVA Electronics Cablewave Systems Inc. The Finney Co. Micro Communications Inc. T.R. Pitts Co. Toner Cable Equipment Inc.

# Trompeter Electronics ..... B158

# R.F. COAXIAL RELAYS

Comsonics Inc. ITT Jennings Kilovac Corp.

#### **R.F. CONNECTORS**

AVA Electronics
Bird Electronic Corp.
Cablewave Systems Inc.
Comark Industries Inc.
The Finney Co.
Magnavox CATV System Inc.
Maury Microwave Corp.
T.R. Pitts Co.
Toner Cable Equipment Co.

Trompeter Electronics ..... B158

Weinschel Engineering Co. Inc.

#### **R.F. CONSULTING**

Comark Industries Inc.

#### R.F. CONTROL SYSTEMS

Fung Engineering Inc.

### R.F. CONVERTERS, PAY TV

EEG Enterprises Inc.
GTE Sylvania Inc.,
CATV Equipment and Installation Operation
Magnavox CATV System Inc.
Oak CATV Division/Oak Industries Inc.
T.R. Pitts Co.
Summit Cinevideo Corp.
TOCOM Inc.
Toner Cable Equipment Inc.

# **R.F. CONVERTERS, STANDARD**

CADCO
The Finney Co.
Fung Engineering Inc.
GTE Sylvania Inc.,
CATV Equipment and Installation Operation
Oak CATV Division/Oak Industries Inc.
T.R. Pitts Co.
R.F. Systems Co. — PA
Summit Cinevideo Corp.
TOCOM Inc.
Television Technology Corp.
Triple Crown Electronics Inc.
Varian Electron Device Group

# **R.F. DATA MODEMS FOR CATV**

American Modem Corp. Catel, Division of United Scientific Corp. Fung Engineering Inc. GTE Lenkurt Inc.

#### **R.F. DEMODULATORS**

American Modem Corp.
Catel, Division of United Scientific Corp.
Coastcom
Comark Industries Inc.
Dynair Electronics Inc.
Fung Engineering Inc.
Phasecom Corp.
TOCOM Inc.
Toner Cable Equipment Inc.

### R.F. DIPLEXERS

Coastcom
Comark Industries Inc.
Continental Electronics Mfg. Co.
Dielectric Communications
Micro Communications Inc.
Microwave Filter Co. Inc.
Multronics Inc.
UTE Microwave Inc.
Varian Electron Device Group

# R.F. DISTRIBUTION ACCESSORIES

CADCO
C-Cor Electronics Inc.
The Finney Co.
GTE Sylvania Inc.,
CATV Equipment and Installation Operation
Magnavox CATV System Inc.
Microwave Filter Co. Inc.
Multronics Inc.
North Hills Electronics Inc.
T.R. Pitts Co.
TOCOM Inc.
Toner Cable Equipment Inc.
Wide Band Engineering Co. Inc.

# R.F. DISTRIBUTION AMPLIFIERS

CADCO
C-Cor Electronics Inc.
The Finney Co.
GTE Sylvania Inc.,
CATV Equipment and Installation Operation
Magnavox CATV System Inc.
T.R. Pitts Co.
R.F. Systems Co. — PA
Toner Cable Equipment Inc.
Triple Crown Electronics Inc.

#### **R.F. GENERATORS**

Delta Electronics Inc. — VA
GTE Sylvania Inc.,
CATV Equipment and Installation Operation
Gaw Co.
International Microwave Corp.
Lampkin Labs Inc.
Leader Instrument Corp.
McMartin Industries Inc.
Radiometer US Corp.
Rockwell International-Collins Broadcast Products
Sound Technology
Triple Crown Electronics Inc.
U.H.F. Associates
Wavetek Indiana Inc.

#### R.F. HEADEND PROCESSORS

American Modem Corp.
CADCO
Phasecom Corp.
T.R. Pitts Co.
TOCOM Inc.
Toner Cable Equipment Inc.
Triple Crown Electronics Inc.

## **R.F. INDUCTORS**

Multronics Inc.

# **R.F. LINE EXTENDERS**

CADCO
The Finney Co.
GTE Sylvania Inc.,
CATV Equipment and Installation Operation
Magnavox CATV System Inc.
T.R. Pitts Co.
TOCOM Inc.
Toner Cable Equipment Inc.
Triple Crown Electronics Inc.

# R.F. LOADS

Bird Electronic Corp.
Coaxial Dynamics Inc.
Comark Industries Inc.
Continental Electronics Mfg. Co.
Dielectric Communications
Electro Impulse Laboratory Inc.
Lec Tro Tech Inc.

# Trompeter Electronics . . . . . . B158

Varian Electron Device Group Wide Band Engineering Co. Inc. Wilkinson Electronics Inc.

#### R.F. MODULATORS

American Modem Corp.
Catel, Division of United Scientific Corp.
Coastcom
Dynair Electronics Inc.
Fung Engineering Inc.
Phasecom Corp.
Rohde and Schwarz

# Sony

Toner Cable Equipment Inc. Triple Crown Electronics Inc. U.H.F. Associates Varian Electron Device Group

# R.F. NON-DUPLICATION SWITCHERS

Multronics Inc.
T.R. Pitts Co.
Toner Cable Equipment Inc.
Triple Crown Electronics Inc.

# R.F. PHASING SYSTEMS

Continental Electronics Mfg. Co. Multronics Inc.

# R.F. POWER MONITORS/ ALARMS REMOTE

Bird Electronic Corp. Coaxial Dynamics Inc.

#### **R.F. POWER SUPPLIES**

Communications Distribution Corp.

Continental Electronics Mfg. Co. GTE Sylvania Inc., CATV Equipment and Installat on Operation Magnavox CATV System Inc. T.R. Pitts Co. Sawyer Industries Inc. Toner Cable Equipment Inc. Varian Electron Device Group

#### **R.F. RECEIVERS**

Catel, Division of United Scientific Corp. International Microwave Corp. KEL Corp. Moseley Associates Inc. Raytheon Data Systems Scientific Radio Systems Inc. Weinschel Engineering Co. Inc.

# **R.F. SWITCHERS**

Barker and Williamson Inc.
Delta Electronics Inc. — VA
Dielectric Communications
Kilovac Corp.
Micro Communications Inc.
Multronics Inc.
T.R. Pitts Co.
Rockwell International-Collins Broadcast Products
Soll Inc.
Triple Crown Electronics Inc.
Wide Band Engineering Co. Inc.

#### R.F. TRUNK AMPLIFIERS

CADCO
C-Cor Electronics Inc.
The Finney Co.
GTE Sylvania Inc.,
CATV Equipment and Installation Operation
Magnavox CATV System Inc.
T.R. Pitts Co.
Toner Cable Equipment Inc.
Triple Crown Electronics Inc.

#### R.F. WATTMETERS

Barker and Williamson Inc.
Bird Electronic Corp.
Coaxial Dynamics Inc.
Dielectric Communications
Electro Impulse Laboratory Inc.
Leader Instruments Corp.
Lec Tro Tech Inc.
Rohde and Schwarz

# S

# SATELLITE AUDIO TRANSMISSION

**RCA American Communications** 

### SATELLITE EARTH STATIONS

Coastcom
Farinon Electric
Microdyne Corp.
Osawa and Co. USA Inc.
Prodelin Inc.
R.F. Systems Inc. — FL
Raytheon Data Systems
Rockwell International-Collins Broadcast Products
Soll Inc.
Terra Corn, Division of Conic Corp.
Varian Electron Device Group

# SATELLITE EARTH STATION ACCESSORIES

Catel, Division of United Scientific Corp.

# SATELLITE EARTH STATION CONTROL SYSTEMS

Moseley Associates Inc.

#### SATELLITE TV ANTENNAS

Microdyne Corp.

### SATELLITE TV RECEIVERS

Microdyne Corp.

# SATELLITE VIDEO TRANSMISSION

Fung Engineering Inc. RCA American Communications

#### **SCA EQUIPMENT**

Fixtune Electronics Inc. McMartin Industries Inc.

Marti Electronics Inc... B110, B111
Rockwell International-Collins Broadcast Products

Solid Electronics Laboratories

Versa-Count

Engineering . . . . . . . . . B164-B165

Wilkinson Electronics Inc.

#### SCRAMBLERS, SPEECH

Telectro Systems Corp.

### **SCREENS, PROJECTION**

Audio Visual Products Division/BCI Daystar Audio Visual Inc. Alan Gordon Enterprises Inc. Heindl Masks 'N' Mounts MPC Educational Systems Inc. Charles Mayer Studios Inc. Raven Screen Corp. Wilcox Lange Inc.

### SHADING GENERATOR

Colorado Video Inc..... B31-B38

# SECURITY MOUNTING SYSTEMS

Lucasey Mfg. Co.

# SHELVING, STEEL

Equipto Storage Systems Image Devices Inc.
Neumade Products Corp.

The Winsted Corp.

The Winsted Corp. . . . . B175-B182

### **SHIPPING CASES**

J and R Film Co. — Goldberg/Compco

Charles Mayer Studios Inc. Neumade Products Corp.

Image Devices Inc

# Plastic Reel Corp. of America [PRC]

Samigon Division/Argraph Corp. Schuessler Case Co. Inc.

Sony

Thermodyne International Ltd.

Video Components Inc.

#### SIGNAL S AMPLIFIERS

Coaxial Dynamics Inc.

# SIGNAL LEVEL METERS CATV/MATV

Fung Engineering Inc. Sadelco Inc.

# SINGLE CHANNEL PER CARRIER (SCPC)

Coastcom

## SLIDE COLLATING EQUIPMENT

Sickles Inc.

# SLIDE DUPLICATING EQUIPMENT

Sickles Inc.

#### SLIDE DUPLICATORS

Leedal Inc.

# SLIDE AND FILMSTRIP SERVICES

AIDS, A Damon Co. Charles Mayer Studios Inc. Radmar Inc. Richard Mfg. Co. Starex Inc.

#### SLIDE MAKING KITS

The Film Makers

#### SLIDE MOUNTING EQUIPMENT

Ercona Corp.
Heindl Masks 'N' Mounts
Karl Heitz Inc.
Kaiser Corp.
The Kimac Co.
Samigon Division/Argraph Corp.
Sickles Inc.
Wess Plastics Inc.

# SLIDE PROJECTION EQUIPMENT

Heindl Masks 'N' Mounts MacKenzie Laboratories Inc.

## SLIDE PROJECTORS, XENON 35MM

MacKenzie Laboratories Inc. Strong Electric Corp.

# SLIDE REQUEST DEVICE

CA Compton Inc.

# SLIDE SORTING EQUIPMENT

Edna-Lite Corp. Franklin Distributors Corp. Harwood Mfg. Co. Heindl Masks 'N' Mounts

# J and R Film Co. — Goldberg/Compco

Leedal Inc. Logan Electric Specialty Mfg. Co. MPC Educational Systems Inc. Multiplex Display Fixture Co. Reliance Plastics and Packaging Division

Research Technology Inc.
Richards Mfg. Co.

#### SLIDE STORAGE EQUIPMENT

Bretford
Franklin Distributors Corp.
Heindl Masks 'N' Mounts
The Kimac Co.
Leedal Inc.
Logan Electric Specialty Mfg. Co.
MPC Educational Systems Inc.
Multiplex Display Fixture Co.
Neumade Products Corp.

# Plastic Reel Corp. of America [PRC]

Radmar Inc.

# Research Technology Inc.

Samigon Division/Argraph Corp. H. Wilson Corp.

#### SLIDE TITLING EQUIPMENT

Heindl Masks 'N' Mounts

#### SLIDE TRAY LEADER

Sickles Inc.

#### **SLIDE VIEWERS**

Franklin Distributors Corp.

# SMPTE CODE EDITING EQUIPMENT

Ampex Corp

Consolidated Video Systems . B39 Datametrics Inc.

Datatron Inc.

Electronic Engineering Co. of California (EECO)

#### SOUND CONSULTANTS

Erskine-Shapiro Theatre Technology Inc. Richmond Sound Design Ltd.

#### **SOUND EFFECTS**

AIDS, A Damon Co.
Color Stock Library Inc. and Lem Bailey Prod.
Columbia Special Products... B43
De Wolfe Music Library ..... B47
MacKenzie Laboratories Inc.
T.J. Valentino Inc. ..... B159

#### SOUND LIBRARY

Columbia Special Products... B43
De Wolfe Music Library ..... B47

#### SOUND/SLIDE PROGRAMS

AIDS, A Damon Co.

#### SOUND SYSTEMS

Paso Sound Products Inc.
Perma Power Electronics Inc.

Shure Brothers Inc. ... B144, B145

Sound Craft Systems Inc.
Special Instruments Laboratory Inc.
Spectra Sonics
Telectro Systems Corp.

# **SPEAKER ENCLOSURES**

Altec Lansing Argos Sound Atlas Sound

Bogen Division/Lear Siegler Inc.

Ercona Corp.
Oregon Sound and Lights
Paso Sound Products Inc.

Superscope Inc. Telectro Systems Corp.

# SPEAKERS, MONITOR

Altec Lansing

Shure Brothers Inc. ... B144, B145

# SPEAKER — TIME CONTROLS (LIGHT SIGNALS)

D'San Corp. Ercona Corp.

# **SPEAKERS**

Gotham Audio Corp. Heath Co. Newcomb Audio Products Co.

Paso Sound Products Inc.
Quam-Nichols Co.
Sansui Electronics Corp.
H.H. Scott Inc.

Rank Hi Fi (USA)

Shure Brothers Inc. ... B144, B145

Special Instruments Laboratory Inc. Spectra Sonics Superscope Inc. Telectro Systems Corp. VIF International

#### SPECTRUM ANALYSERS

Amber Electro Design Ltd. B and K Instruments Inc.

Inovonics Inc. ..... B73

Leasametric
Special Instruments Laboratory Inc.

### SPEECH THERAPY AMPLIFIERS

Eckstein Brothers Inc.

# SPOTLIGHTS, FOLLOW

Lumitrol Ltd. Theatre Lighting Strong Electric Corp.

#### **SPOTMETERS**

Photo Research, Division Kollmorgen Corp.

# SQ QUAD DECODER

Audionics of Oregon

### STANDBY POWER SYSTEMS

Communications Distribution Corp. Sawyer Industries Inc.

Versa-Count Engineering........... B164-B165

# STATUS AND ALARM INDICATORS

Atlas Sound
Delta Electronics Inc., Div. of Long Engineering Co.
GTE Lenkurt Inc.
Locator Electronics Co.

Marti Electronics Inc. . . B110, B111
Moseley Associates Inc.

# STEREO MULTIPLEX

Catel, Division of United Scientific Corp. Coastcom

STORAGE EQUIPMENT, ELECTRONIC STILL

## STORAGE RACKS FILM AND TAPE

Accessories Mfg. Ltd. Avid Corp. Equipto Storage Systems Fidelipac Harwald Co. Harwood Mfg. Co.

J and R Film Co. — Goldberg/Compco Lyon Metal Products Inc.

Neumade Products Corp.

Plastic Reel Corp.

of America [PRC]

Storeel Corp. H. Wilson Corp.

The Winsted Corp. . . . . B175-B182

#### STORY BOARD CARDS

Medro Educational Products

#### STORY PLANNING BOARDS

Fax Co. Heindl Masks 'N' Mounts Leedal Inc. Charles Mayer Studios Inc. Medro Educational Products

## STUDIO CARTRIDGES

Shure Brothers Inc. ... B144, B145

#### STUDIO CONSTRUCTION

Aderhold Construction Co. Applied Video Electronics Inc.

Soll Inc. Val-Tronics Inc.

# STUDIO DESIGN, RADIO

Aderhold Construction Co.
Applied Video Electronics Inc.
Delta Electronics Inc., Div. of Long Engineering Co.
Kallman Associates Inc.
Soll Inc.
Ultra Audio Pixtec

Val-Tronics Inc.

#### STUDIO DESIGN, TV

Aderhold Construction Co.
Applied Video Electronics Inc.
CRV Systems Inc.
Delta Electronics Inc., Div. of Long Engineering Co.
Kallman Associates Inc.
The Media Works Inc. (Industrial)
Soll Inc.

Strand Century Inc.

Ultra Audio Pixtec

Vamco

Engineering Inc. . . . . . B160-B162

# STUDIO DESIGN, TV LIGHTING

#### STUDIO FURNITURE

Amco Engineering Co.

#### STUDIO LIGHTING LADDER

Walter S. Brewer Co.

### STUDIO SET DESIGN

Design-Form Hexcel Corp. The Media Works Inc.

SUBCARRIER	SYNC STRIPPER	TELETYPE MOTOR					
DISTRIBUTION AMPLIFIER	Colorado Video Inc B31-B38	CONTROL ON/OFF  B and I Electronics Inc.					
American Data		b and I Electronics inc.					
Dynair Electronics Inc.	<b>~</b>	TEMPERATURE PROBES					
Dynasciences Inc.  Industrial Sciences Inc.	I	Data Precision Corp.					
International Microwave Corp. International Nuclear Corp.	TAPE AND FILM	TEST EQUIPMENT, CATV					
Leitch Video Ltd.  Lenco Inc.,	STORAGE SYSTEMS	ASACA Corp. of America B17-B19 Avantek Inc.					
Electronics Div B91-B103	Neumade Products Corp.	B and K Instruments Inc. Comsonics Inc.					
	The Winsted CorpB175-B182	EEG Enterprises Inc. Leader Instruments Corp.					
EEV Inc.	TAPE AND FILM TRUCKS	Leasametric					
Lightning Elimination Associates Inc. Toner Cable Equipment Inc.	Lee-Ray Industries Inc	Lenco Inc., Electronics Div					
Wilkinson Electronics Inc.	Neumade Products Corp.  The Winsted Corp B175-B182	Mid State Communications Inc. Rohde and Schwarz Sadelco Inc.					
SWEEP GENERATORS	TARE TENOION CALLOES	Sigma Electronics Inc. Toner Cable Equipment Inc.					
Weinschel Engineering Co. Inc.	TAPE TENSION GAUGES Tentel	Triple Crown Electronics Inc. Wavetek Indiana Inc.					
SWITCHES, COAXIAL	VIF International	Wide Band Engineering Co. Inc.					
Bird Electronic Corp. Comark Industries Inc.	TAPE TRANSPORT	TEST EQUIPMENT AND					
The Finney Co. Weinschel Engineering Co. Inc.	MECHANISM FOR CASSETTES	INSTRUMENT CART					
Wide Band Engineering Co. Inc.	Amilon Corp.	Lee-Ray Industries Inc					
SWITCHERS, MANUAL	TAPE TRANSPORT	TEST EQUIPMENT,					
AND SEQUENTIAL	MECHANISMS FOR	RENTAL/LEASE					
Broadcast Video Systems Ltd	NAB CARTRIDGES Amilon Corp.	Leasametric Neutrik Products					
Diamond Electronics, Division of Arvin Systems Inc. Fung Engineering Inc.	TELECOMMUNICATIONS	TEST SETS, RETURN LOSS					
GBC Closed Circuit TV Corp. International Nuclear Corp.	EQUIPMENT	Weinschel Engineering Co. Inc.					
J and D International Javelin Electronics	Catel, Division of United Scientific Corp. Levit Electronics	TEST MONITORING SWITCHERS					
Lenco Inc., Electronics Div	Micro Control Associates Inc. Raytheon Data Systems	Lenco Inc., Electronics Div					
Quick-Set Inc	TELEPHONE	QSI Systems Inc.					
Sigma Electronics Inc. Sony	COUPLING EQUIPMENT	TEST RECORDS					
U.H.F. Associates	Broadcast Electronics IncB22-B27	B and K Instruments Inc. Crown International Inc.					
Vamco Engineering Inc B160-B162	Channelmatic Electronics Inc. D'San Corp.						
Video Components Inc.	Delta Electronics Inc., Div. of Long Engineering Co. Image Devices Inc.	TEST SLIDES/TAPES Diamond Electronics, Division of Arvin Systems Inc.					
014/701/500	Leasametric Locator Electronics Co.	Heindl Masks 'N' Mounts Porta-Pattern Telecommunications Industries Ltd.					
SWITCHERS, MASTER CONTROL	McCurdy Radio Industries Inc. Magnesonics Mfg. and Sales Co.	Spindler and Sauppe' Inc.					
Central Dynamics Ltd B41	Microtran Co	TDK Electronics Corp.					
Dytek Industries Inc. Industrial Sciences Inc.	Shure Brothers Inc B144, B145	TEST CHARTS, CAMERA					
Vitex CoB173	TELEPHONE	ATV Research					
	COUPLING TRANSFORMERS	Diamond Electronics, Division of Arvin Systems Inc. EEV Canada Ltd. Harris Corp., Broadcast Products Division					
SYNC CHANGEOVER SWITCH, AUTOMATIC	Microtran B115	Porta-Pattern Telecommunications Industries Inc. RCA Broadcast Systems Telecommunications Industries Ltd.					
Lenco Inc.,	TELEPHONE	Ultra Audio Pixtec					
Electronics Div B91-B103	JACKS AND PLUGS	TEXT BOOKS					
SYNC DELAY	Audio Accessories Inc.	Didactic Systems Inc. Heindl Masks 'N' Mounts					
Colorado Video Inc B31-B38	TELEPHONE LINE	Image Devices Inc. The Media Works Inc.					
Lenco Inc.,	VIDEO TRANSMISSION						
Electronics Div	Colorado Video Inc	TIME BASE CORRECTORS  ADDA Corp					
SYNC GENERATOR SUBSTITUTE	TELECOORIO DOMED	Ampex Corp. Automation Techniques Inc.					
California Instruments  Lenco Inc.,	TELESCOPIC POWER BRIDGES — PORTABLE	C.R.V. Systems Inc.  Consolidated Video Systems . B39					
Electronics Div B91-B103	Packaged Lighting Systems Inc.	Digital Video Systems . D39					

Dyma Engineering Inc.	TOUCH-TONE CONTROLLED	CCA Floretro visa Os
Edutron Inc.		CCA Electronics Corp
Merlin Engineering Works Inc. Micro Consultants	EARTH STATION RECEIVER	Dyma Engineering Inc.
Microtime Inc	AUTOMATION SYSTEMS	E-Z Way Products Inc.
NEC America Inc.	Channelmatic Electronics Inc.	Fort Worth Tower Co. Inc.
	Fung Engineering Inc.	Harris Corp., Broadcast Products Division Kline Iron and Steel Co.
Panasonic CoB124-B129		RCA Broadcast Systems
RCA Broadcast Systems	TOUCH TONE SYSTEMS	Singer Products Co. Inc.
Seigel Electronics	Di-Tech Inc	Stainless Inc.
Sony Corp. of America	Di-18cii iiic	Swager Tower Co.
		Up-Right Scaffolds
TIME - COMPRESSION	TOWER HARDWARE	Val-Tronics Inc.
	D.H.V. Inc.	
PHOTO SYSTEMS	Lightning Elimination Associates Inc.	TRAINING CASSETTES, SALES
Technovations	Fred A. Nudd Corp B119	AND MANAGEMENT AND
	Swager Tower Corp.	MOTIVATION
TIME / DATE CENEDATORS	Tiner Communications SVC Inc.	Nightingale-Conant Corp.
TIME/DATE GENERATORS	Unarco-Rohn Utility Tower Co.	riightingale-conditt Corp.
Chrono-Log Corp. Electronic Engineering Co. of California (EECO)	Othity Tower Co.	TO A INVINCE CONTRACTOR OF THE
GBC Closed Circuit TV Corp.	T014/ED	TRAINING - SIMULATIONS,
GYYR	TOWER	BOOKS, FILMS
Laird Telemedia	INSTALLATION SERVICES	Didactic Systems Inc.
Portac Inc. QSI Systems Inc.	Locator Electronics Co.	
Quick-Set Inc	Microflect Co. Inc.	TRANSFORMERS, ISOLATION
RCA Electro Optics and Devices	Fred A. Nudd Corp B119	
Sigma Electronics Inc.	Prodelin Inc.	Topaz Electronics
Video Components	Soil Inc.	
Video Devices Co.	Swager Tower Corp. Tiner Communications SVC Inc.	TRANSFORMERS,
	Unarco-Rohn	TOROIDAL, CURRENT
TIME DELAYO	Utility Tower Co.	Delta Electronics Inc. — VA
TIME DELAYS		Solid Elocitotico Ilic. — VA
Sawyer Industries Inc.	TOWER LIGHTING	TRANCIENT ELIMINATORO
		TRANSIENT ELIMINATORS
TIME/TEMPERATURE	Elcom Engineering CoB49	Lightning Elimination Associates Inc.
	Flash Technology Corp.	
GENERATORS	of America	TRANSLATORS, FM
Nationwide Electronic Systems Inc.	Hughey and Phillips Inc.	D.N. Latus and Co. Inc.
Vamco	Hunt-Pierce Corp.	RCA Electro Optics and Devices
Engineering Inc B160-B162	Fred A. Nudd Corp B119	Rodelco Electronics Corp.
•	Swager Tower Corp. Tiner Communications SVC Inc.	Television Technology Corp. Tepco Corp.
	Unarco-Rohn	Versa-Count
TIMERS, VIDEO TAPE	Utility Tower Co.	
Artists Engineering	TOMER DAINTING	Engineering
Sony	TOWER PAINTING	
•	Fred A. Nudd Corp B119	TRANSLATORS, TV
	Utility Tower Co.	Acrodyne Industries Inc.
TITLING EQUIPMENT,		Canadian General Electric Co. Ltd.
MECHANICAL	TOWERS	Electronics, Missiles and Communications Inc.
Kroy Industries Inc.		D.N. Latus and Co. Inc.
Kroy industries inc.	Kline Iron and Steel Co. Microflect Co. Inc.	RCA Electro Optics and Devices Rodelco Electronics Corp.
	Fred A. Nudd Corp B119	Television Technology Corp.
TITLING GENERATORS	Swager Tower Corp.	Tepco Corp.
B. E. I.	Tiner Communications SVC Inc.	Triple Crown Electronics Inc.
[Beston Electronics Inc.] B21	Unarco-Rohn	Versa-Count
	Utility Tower Co.	Engineering B164-B165
Knox Ltd		
Laird Telemedia Portac Inc.	TOWERS, FM	TRANSMISSION LINE
Sigma Electronics Inc.	Allied Tower Co. Inc.	
Thomson-CSF Laboratories	CCA Electronics Corp	SUPERVISION SYSTEMS
Telestrator Division, Interand Corp.	Cetec Broadcast Group	Di-Tech
Video Data Systems	Dyma Engineering Inc.	
	E-Z Way Products Inc.	
TONE ARMS	Fort Worth Tower Co. Harris Corp., Broadcast Products Division	TRANSMISSION
	Kline Iron and Steel Co.	LINES AND CONNECTORS
Broadcast	RCA Broadcast Systems	Comark Industries Inc.
Electronics IncB22-B27	Singer Products Co. Inc.	Maury Microwave Corp.
LPB Inc.	Stainless Inc.	Multronics Inc.
Micro-Trak Corp	Swager Tower Co.	Phelps Dodge Communications Co.
Osawa and Co. USA Inc.	Up-Right Scaffolds Wilkinson Electronics	
QRK Electronic		TD 4410141TTTTT
	TTIMISOT LICETOTICS	IRANSMITTERS AM
		TRANSMITTERS, AM
Products IncB131	TOWERS, MICROWAVE	Audio-Sine Inc.
Products Inc		Audio-Sine Inc. Continental Electronics Mfg. Co. Harris Broadcast Products
Products IncB131	TOWERS, MICROWAVE Kline Iron and Steel Co.	Audio-Sine Inc. Continental Electronics Mfg. Co. Harris Broadcast Products Heath Co.
Products Inc	TOWERS, MICROWAVE	Audio-Sine Inc. Continental Electronics Mfg. Co. Harris Broadcast Products Heath Co. International Microwave Corp.
Products Inc	TOWERS, MICROWAVE Kline Iron and Steel Co.	Audio-Sine Inc. Continental Electronics Mfg. Co. Harris Broadcast Products Heath Co.
Products Inc	TOWERS, MICROWAVE Kline Iron and Steel Co. TOWERS, RADIO	Audio-Sine Inc. Continental Electronics Mfg. Co. Harris Broadcast Products Heath Co. International Microwave Corp. LPB Inc. McMartin Industries Inc.
Products Inc	TOWERS, MICROWAVE Kline Iron and Steel Co.  TOWERS, RADIO Kline Iron and Steel Co.	Audio-Sine Inc. Continental Electronics Mfg. Co. Harris Broadcast Products Heath Co. International Microwave Corp. LPB Inc.
Products Inc	TOWERS, MICROWAVE Kline Iron and Steel Co.  TOWERS, RADIO Kline Iron and Steel Co.  TOWERS, TV	Audio-Sine Inc. Continental Electronics Mfg. Co. Harris Broadcast Products Heath Co. International Microwave Corp. LPB Inc. McMartin Industries Inc.  NEC America Inc. RCA Broadcast Systems Raytheon Data Systems
Products Inc	TOWERS, MICROWAVE Kline Iron and Steel Co.  TOWERS, RADIO Kline Iron and Steel Co.	Audio-Sine Inc. Continental Electronics Mfg. Co. Harris Broadcast Products Heath Co. International Microwave Corp. LPB Inc. McMartin Industries Inc.  NEC America Inc. RCA Broadcast Systems

# TRANSMITTERS, FM

Harris Broadcast Products Heath Co. International Microwave Corp. KEL Corp. LPB Inc. McMartin Industries Inc. Microwave Power Devices Inc.

# NEC America Inc.

RCA Broadcast Systems Raytheon Data Systems Rockwell International-Collins Broadcast Products Sintronic Corp. Solid Electronics Laboratories

### Versa-Count

Engineering..... B164-B165

Wilkinson Electronics Inc.

### TRANSMITTERS, TV

Acrodyne Industries Inc.

# CCA Electronics Corp. . . . . . . B29

CSI Electronics Inc. Canadian General Electric Co. Ltd. Comark Industries Inc. Electronics, Missiles and Communications Inc. Harris Corp., Broadcast Products Division McMartin Industries Inc. Microwave Power Devices Inc.

# NEC America Inc.

North American Radio Corp. RCA Broadcast Systems

# Singer Products Co. Inc.

Sintronic Corp. Val-Tronics Inc. Varian Electron Device Group Wilkinson Electronics Inc.

# TRANSMITTER INSTALLATION

Soll Inc.

# TRANSMITTER REMOTE **CONTROL SYSTEMS —** AM, FM TV

Moseley Associates Inc. The Widget Works Inc.

# TRANSMITTING **ELECTRON TUBES**

Ceco Communications Inc. Levit Electronics Thomson-CSF Electron Tubes

# TRANSPARENCIES AND PREPARATION MATERIALS

Impact Communications Inc. Starex Inc. Transitwrap Co. Inc.

# TRENCHERS/CABLE PLOWS

Jacobsen Mfg. Co., Minneapolis Division F.B. Ryan Mfg. Co. Inc.

# TRIPODS, HEADS, DOLLIES

Commercial Electronics Inc. . . B30 Davis and Sanford Co. Inc. Frezzolini

GBC Closed Circuit TV Corp. Alan Gordon Enterprises Inc. Innovative Television Equipment

Listec Television

Equipment Corp. . . . . B104-B107

Miller Professional Equipment

O'Connor Engineering Labs . . . . B120, B121 Samigon Division/Argraph Corp. Sharp Electronics Corp. -Professional Products Smith-Victor Corp. .... B147-B150 Sonv Video Cinema Industries Inc.

# TUNERS, FM

Accurate Sound Co. Catel, Division of United Scientific Corp. Collins, Division Rockwell International Inc. Crown International Inc. McMartin Industries Inc. Panasonic Co......B124-B129 Ram Audio Systems Inc.

Video Components Inc.

Ramko Research Inc. . . B140, B141 SWR Inc. Sansui Electronics Corp.

The Sequerra Co. Inc. TEAC Corp. of America

# TV - AUDIO DIPLEXER

Coastcom

# TV CARTS

Bretford

KLM Associates

Peerless Sales Co. H. Wilson

# TV CEILING/ WALL MOUNTS/STANDS

EvenView Television Systems GBC Closed Circuit TV Corp.
Innovative Television Equipment

KLM Associates

Lucasev Mfg. Co. Peerless Sales Co

Video Components Inc.

H. Wilson Corp.

### TV CLOCK

Chrono-Log Corp. Portac Inc.

# TV/FILM PRODUCTION CONSULTANTS

Kapco Communications

Multi Media Forum ..... B122

Sherman Films Inc. Webb Telemedia Corp.

# TV FILM PROJECTORS

L and W International RCA Broadcast Systems

Singer Education Systems

# TV GRAPHICS PANELS

Charles Mayer Studios Inc.

# TV LARGE **SCREEN PROJECTORS**

Canadian General Electric Co. Ltd. Frvan Porta Vision

General Electric Corp.

Image Devices Inc.

# Image Magnification Inc.

Kallman Associates Inc. Keyser Video Inc. Projection Systems Inc.

# TV LIGHT METER

Image Devices Inc. Power Optics

# **TURNTABLES, PHONO**

Audio Interface Inc.

Broadcast Electronics Inc......B22-B27 CCA Electronics Corp. . . . . . . B29

Cetec Broadcast Group Collins, Division of Rockwell International Dyma Engineering Inc. Gotham Audio Corp.

Hamilton Electronics Corp.

Harris Corp., Broadcast Products Division Heath Co. McCurdy Radio Industries Inc. 

Panasonic Co..... B124-B129 **QRK Electronic** 

RCA Broadcast Systems Ramko Research Inc. . . B140, B141

Russco Electronic Mfg. Co. Sansui Electronics Corp.

Singer Products Co. Inc. Stanton Magnetics Inc. TEAC Corp. of America Val-Tronics Inc. Wilkinson Electronics Inc.

# TV SYSTEMS. **CLOSED CIRCUIT**

A.F. Associates Inc. ATV Research AIDS, A Damon Co.

American Data Corp. ..... B12 Berkey-Colortran

Broadcast Video Canadian General Electric Co. Ltd. Catel, Division of United Scientific Corp.

Central Dynamics Corp. . . . . . . B41 Colorado Video Inc..... B31-B38

Communications Systems,
Division of Powell Tool Supply Inc. Dage - MTI Inc.

Davis and Sanford Co. Inc.

Diamond Electronics, Division of Arvin Systems **Dynair Electronics** Evenview Television Systems GBC Closed Circuit TV Corp.

**GYYR** 

Grass Valley Group

# Ikegami Electronics Inc.

Image Devices Inc. International Microwave Corp.

Javelin Electronics

Laird Telemedia Inc. Leitch Video Ltd. Lenzar Optics

Panasonic Co. . . . . . . . . B124-B129

Philips Broadcast Equipment Corp.

Power Optics Inc. RCA Broadcast Systems

Sanyo Electric Inc. Sharp Electronics Corp. — Professional Products

Teltron Temtron Inc. Varian Electron Device Group Videodetics

The Zei-Mark Corp.

### Image Devices Inc. Cohu Inc. Dage - MTI Inc. Lenzar Optics Corp. Diamond Electronics, Division of Arvin Systems Inc. GBC Closed Circuit TV **UNDERGROUND TAPE** General Electrodynamics Corp. T.R. Pitts Co. Hitachi-Denshi Video Components Inc. Ikegami UNIVERSAL AMPLIFIER Image Devices Inc. Lenco Inc., **VIDEO CAMERA LENS SERVICE** QSI Systems Inc. RCA Electro Optics and Devices Electronics Div. ..... B91-B103 Achro-Video International Ltd. B5 Angenieux Corp. Sanyo Electric Inc. Century Precision Cine Optics **UTILITY REMOTE CONTROL** Video Optics Inc. Ercona Corp. Alan Gordon Enterprises Inc. Moseley Associates Inc. Image Devices Inc. VIDEO CAMERAS. Lenzar Optics Corp. **BLACK AND WHITE PORTABLE BATTERY VIDEO CAMERA LENS, FIXED OPERATED** Achro-Video International Ltd. B5 Image Devices Inc. Century Precision Cine Optics Cohu Inc. Sanyo Electric Inc. VACUUM TUBES, CAMERA Commercial Electronics Inc. . . B30 Sony Amperex Electronic Corp. Ceco Communications Corp. Diamond Electronics, Division of Arvin Systems Inc. Frezzolini Comquip EEV Inc. VIDEO CAMERAS, General Electric Co. Fujinon Optical Inc. .... B60, B61 **BLACK AND WHITE STUDIO** General Electrodynamics Corp. GBC Closed Circuit TV Corp. Dage - MTI Inc. Image Devices Inc Levit Electronics Image Devices Inc. RCA Broadcast Systems Lenzar Optics Corp. Panasonic Co..... B124-B129 Teltron NEC Temtron Electronics Sanyo Electric Inc. Thomson-CSF Laboratories Sony Thor Electronics Corp. RCA Electro Optics and Devices Video Optics Inc. Sharp Electronics Corp. — **VECTORSCOPES Professional Products** VIDEO CAMERAS. Sonv Broadcast Video **BLACK AND WHITE** Toyo Optics of America Inc. **SURVEILLANCE** Leader Instruments Corp. Video Components Inc. Leasametric Canadian General Electric Co. Ltd. Lec Tro Tech Inc. Cohu Inc. Dage — MTI Inc. Lenco Inc., VIDEO CAMERA LENSES, ZOOM Diamond Electronics, Division of Arvin Systems Inc. GBC Closed Circuit TV Corp. Electronics Div. ..... B91-B103 Achro-Video International Ltd. B5 Ultra Audio Pixtec Angenieux of America General Electrodynamics Corp. Century Precision Cine Optics Hitachi-Denshi VIDEO ACTIVATED Commercial Electronics Inc. . . B30 **POWER SWITCH** Ikegami Image Devices Inc. Video Aids of Colorado . . . . . B163 Diamond Electronics, Division of Arvin Systems Inc. NEC Frezzolini VIDEO ADAPTA-LENS/ QSI Systems Inc. RCA Electro Optics and Devices Fujinon Optical Inc. . . . . . B60, B61 **POSITIONER** GBC Closed Circuit TV Corp. R.F. Systems Co. - PA Warren R. Smith Co. Hitachi-Denshi Sanyo Electric Inc. Sharp Electronics Corp. -**VIDEO ANALYZER** Image Devices Inc. Professional Products Lenzar Optics Corp. ASACA Corp. of America B17-B19 Sonv Colorado Video Inc......B31-B38 RCA Electro Optics and Devices Rohde and Schwarz Sharp Electronics Corp. -**Professional Products** VIDEO CAMERAS. **VIDEO CABLE EQUALIZERS** Sonv Cohu Inc. Toyo Optics of America Ltd. Lenco Inc.. Video Components Inc. Electronics Div. ..... B91-B103 **Philips** VIDEO CAMERA REBUILDING

Applied Video Electronics Inc.

VIDEO CAMERAS.

VIDEO CAMERAS.

LOW LIGHT LEVEL

**BLACK AND WHITE** 

Canadian General Electric Co. Ltd.

Dage - MTI Inc. Image Devices Inc.

**VIDEO CAMERA** 

Frezzolini

LENS ACCESSORIES

Commercial Electronics Inc. . . B30

Dage — MTI Inc. Diamond Electronics, Division of Arvin Systems Inc.

Fujinon Optical Inc. .... B60, B61

Century Precision Cine Optics

GBC Closed Circuit TV Corp.

Hitachi-Denshi

# **COLOR FILM CHAIN**

Commercial Electronics Inc. . . B30 

RCA Broadcast Systems

Sharp Electronics Corp. -**Professional Products** Sonv

Thomson-CSF Laboratories

# VIDEO CAMERAS. **COLOR PORTABLE**

Ampex Corp. ASACA Corp. of America B17-B19

Commercial Electronics Inc... B30

B-215

**BLACK AND WHITE FILM CHAIN** 

Frezzolini	VIDEO CASSETTE RELOADING	Broadcast Video
Electronics Inc	Video Cassette SVCs Inc.	Systems Ltd
GBC Closed Circuit TV Corp.  Hitachi-Denshi	AND TO BE SEED OF THE SEED OF	Listec Television
America Ltd	VIDEO CASSETTE SHIPPING	Equipment Corp B104-B107
Impan Dovinso Inc	CARTONS AND CASES	Leitch Video Ltd.
JVC	Amaray International Corp. Fiberbilt Photo Products/Ikelheimer-Ernst Inc.	Lenco Inc.,
Panasonic CoB124-B129	Harwald Co.	Electronics Div B91-B103
Philips	Ray Jacobs Audio Inc. Reliance Plastics and Packaging Division	
RCA Broadcast Systems	Sony	VIDEO DETECTOR
Sharp Electronics Corp. —	Univex International	Colorado Video Inc B31-B38
Professional Products	Video Components Inc.	Di-Tech Inc
Sony		Lenco Inc.,
Thomson-CSF Laboratories	VIDEO	Electronics Div B91-B103
VIDEO CAMERAS,	CHARACTERS GENERATORS	2.000.000.000
COLOR PORTABLE,	Ampex Corp.	VIDEO DIGITAL
BATTERY OPERATED	B.E.I.	NOISE REDUCER
Ampex Corp.	[Beston Electronics Inc.] B21	Thomson-CSF Laboratories
ASACA Corp. of America B17-B19	Chyron CorpB42	Thomson-CSF Laboratories
Commercial Electronics Inc B30	Dynasciences Knox Ltd	VIDEO DIGITIZERS
Frezzolini	Laird Telemedia	BJA Systems Inc.
Electronics Inc	Mincom Division, 3M Co.	Colorado Video Inc B31-B38
GBC Closed Circuit TV Corp.	Moxon Inc. Portac Inc.	Digital Video Systems
Hitachi-Denshi	QSI Systems Inc.	
America Ltd	Telestrator Division, Interand Corp. Thomson-CSF Laboratories	VIDEO DISCS
Image Devices Inc. <i>JVC</i>	Video Components	Eigen Corp.
Panasonic Co	Video Data Systems	Oktel Corp.
	Video Devices Co.	VIDEO EDITING EQUIPMENT
Philips RCA Broadcast Systems	VIDEO COLOR SIGNAL SYSTEM	
Sharp Electronics Corp. —		Videomedia Inc B166-B171
Professional Products	Lenco Inc., Electronics Div	
Sony	Electronics Div B31-B103	VIDEO EFFECTS GENERATORS
Thomson-CSF Laboratories		American Data
	VIDEO COLORIZERS	BJA Systems Inc.
VIDEO CAMERAS,	BJA Systems Inc.	Beaveronics Inc
COLOR STUDIO	Beaveronics IncB20	Broadcast Video
Cohu Inc.	Colorado Video IncB31-B38	Systems Ltd
Commercial Electronics Inc B30	Crosspoint Latch Corp B46	Central Dynamics Inc
GBC Closed Circuit TV Corp. Harris Broadcast Products	Industrial Sciences Inc.	Chyron Corp
Hitachi-Denshi	International Nuclear Corp.  J and D International	
America Ltd	Thomson-CSF Laboratories	Crosspoint Latch CorpB46  Dage — MTI Inc.
Image Devices Inc.		Digital Video Systems
JVC B75-B82	VIDEO COMPRESSOR	Dynair Electronics Inc. GBC Closed Circuit TV Corp.
Panasonic Co B124-B129	Colorado Video IncB31-B38	Industrial Sciences Inc.
Philips		International Nuclear Corp.
RCA Broadcast Systems	VIDEO CONNECTORS	J and D International Panasonic Co
Sanyo Electric Inc.	VIDEO CONNECTORS	Portac Inc.
Sharp Electronics Corp. — Professional Products	AVA Electronics GBC Closed Circuit TV Corp.	Sharp Electronics Corp. —
_	Hitachi-Denshi	Professional Products
<b>Sony</b> Thomson-CSF Laboratories	America Ltd	Shintron Co. Inc.
THOMSON CON EUDORIGINOS	Trompeter Electronics B158	Sony
	Video Components Inc.	Telestrator Division, Interand Corp. Viscount Industries Ltd.
VIDEO CARTS AND TABLES		Vital Industries Inc.
Bretford Design-Form	VIDEO CONSOLES	Vitex CoB173
Gruber Products Co	Bretford	
Harwald Co.	Broadcast	VIDEO ENCODERS, COLOR
Image Devices Inc.	Video Systems Ltd B28	
KLM Associates	Vitex CoB173	Broadcast Video
Lee-Ray Industries Inc	H. Wilson Corp.	Systems Ltd B28
Sony	The Winsted Co B175-B182	Central Dynamics Ltd B41 Cohu Inc.
H. Wilson Corp.		Lenco Inc.,
The Winsted Corp B175-B182	VIDEO CONTROLS	Electronics Div B91-B103
	Tech Laboratories Inc.	Thomson-CSF Laboratories
VIDEO CASSETTE BASED		
<b>AUTOMATION SYSTEMS</b>	VIDEO DELAY	VIDEO EQUIPMENT, RENTAL
Channelmatic Electronics Inc.	Allen Avionics IncB11	AIDS, A Damon Co.

Communications Systems, Division of Powell Tool Supply Inc.	VIDEO MASTER	VIDEO PATCH
Innovative Television Equipment Portable Channel Inc.	CONTROL SWITCHERS	PANELS AND ACCESSORIES
Video Devices Co. Videomax, Division of Orrox Corp.	Grass Valley Group Inc.  Vitex Co	Dynatech Data Systems  Trompeter Electronics
VIDEO EVE AND ES		
VIDEO EXPANDER	VIDEO MICROMETER	VIDEO POINTER
Colorado Video IncB31-B38	Colorado Video IncB31-B38	Colorado Video IncB31-B38
VIDEO GENERATORS	V/DEC 1401//TODG	VIDEO POST PRODUCTION
ASACA Corp. of America B17-B19	VIDEO MONITORS, BLACK AND WHITE	EQUIPMENT RENTAL
BJA Systems Inc.  Colorado Video Inc	AIDS, A Damon Co.	Kapco Communications
Crosspoint Latch Corp B46	ASACA Corp. of America B17-B19	Portable Channel Inc.
Leitch Video Ltd.  Lenco Inc.,	Conrac Dage — MTI Inc.	<b>VIDEO PRESENCE DETECTORS</b>
Electronics Div	Diamond Electronics, Division of Arvin Systems Inc.	Di-Tech Inc
Ultra Audio Pixtec Video Devices Co.	Electrohome	GYYR Lenco Inc.,
Wavetek Indiana Inc.	GYYR Ikegami	Electronics Div B91-B103
	Javelin Electronics  JVC	RCA Electro Optics and Devices Sigma Electronics Inc.
VIDEO GUIDE BOOK Video Info Publications	Lenco Inc	VIDEO
video into rubications	Electronics Div B91-B103	VIDEO PROCESSING AMPLIFIERS
VIDEO HEADS	NEC PanasonicB124-B129	Central Dynamics Ltd
Spin Physics Inc	QSI Systems Inc.	Cohu Inc.
videomax, division of Orrox Corp.	RCA Electro Optics and Devices  Sanyo Electric Inc.	Colorado Video IncB31-B38  Dynasciences
VIDEO - HUM BUCKERS	Sharp Electronics Corp. —	Grass Valley Group Inc.  Industrial Sciences Inc.
Audio-Video Engineering	Professional Products	International Nuclear Corp.  J and D International
	Sony	Leitch Video Ltd.
VIDEO HUM STOP COILS		Lenco Inc., Electronics Div
North Hills Electronics Inc.  Video Components Inc.	VIDEO MONITORS, COLOR AIDS, A Damon Co.	Sigma Electronics Inc.
,	ASACA Corp. of America B17-B19	Versa-Count Engineering B164-B165
VIDEO	Broadcast Video	Vitex Co
<b>IDENTIFICATION SYSTEMS</b>	Systems Ltd	
Di-Tech Inc	Electrohome	VIDEO PROCESSOR
GBC Closed Circuit TV Corp. GYYR	Image Devices Inc.	Colorado Video Inc B31-B38 Crosspoint Latch Corp B46
Leitch Video Ltd. Portac Inc.	Lenco Inc., Electronics Div	Lenco Inc.,
QSI Systems Inc. Sigma Electronics Inc.	QSI Systems Inc. Rohde and Schwarz	Electronics Div B91-B103
VIDEO 1001 4 TION	Sanyo Electric Inc.	VIDEO PRODUCTION
VIDEO ISOLATION TRANSFORMERS	Sharp Electronics Corp. —	EQUIPMENT RENTAL
North Hills Electronics Inc.	Professional Products Sony	J and D International Portable Channel Inc.
\(\(\text{IDEQ}\) \(\text{INTEQD}\)	Unimedia	Videcomm International
VIDEO INTEGRATOR  Colorado Video Inc B31-B38	Vamco Engineering Inc B160-B162	VIDEO
Colorado video IncB31-B38	Videotek	PRODUCTION SWITCHERS
VIDEO LARGE		American Data
SCREEN PROJECTORS	VIDEO MONITOR COLOR THE	
Fryan Porta-Vision	VIDEO MONITOR, COLOR, ENG	Beaveronics IncB20
	Rohde and Schwarz	Central Dynamics Ltd B41
General Electric Corp.	Rohde and Schwarz	Central Dynamics Ltd
General Electric Corp.  Image Magnification Inc.  Keyer Video Inc.		Central Dynamics Ltd
General Electric Corp. Image Magnification Inc.	Nonde and Schwarz  VIDEO MOTION ANALYZER  Colorado Video Inc	Central Dynamics Ltd
General Electric Corp. Image Magnification Inc. Keyer Video Inc. Projection Systems Inc.	VIDEO NOISE METER	Central Dynamics Ltd
General Electric Corp.  Image Magnification Inc.  Keyer Video Inc.	VIDEO MOTION ANALYZER Colorado Video Inc	Central Dynamics Ltd. B41 Crosspoint Latch Corp. B46 Dage — MTI Inc. Dytek Industries Inc. Duca-Richardson Corp. GBC Closed Circuit TV Corp. Grass Valley Group Inc. Industrial Sciences Inc. International Nuclear Corp. J and D International
General Electric Corp. Image Magnification Inc. Keyer Video Inc. Projection Systems Inc.  VIDEO LINE ISOLATOR	VIDEO MOTION ANALYZER Colorado Video Inc	Central Dynamics Ltd
General Electric Corp. Image Magnification Inc. Keyer Video Inc. Projection Systems Inc.  VIDEO LINE ISOLATOR Video Aids of Colorado	VIDEO MOTION ANALYZER Colorado Video Inc	Central Dynamics Ltd. B41 Crosspoint Latch Corp. B46 Dage — MTI Inc. Dytek Industries Inc. Duca-Richardson Corp. GBC Closed Circuit TV Corp. Grass Valley Group Inc. Industrial Sciences Inc. International Nuclear Corp. J and D International Shintron Co. Inc. Sony Vamco
General Electric Corp. Image Magnification Inc. Keyer Video Inc. Projection Systems Inc.  VIDEO LINE ISOLATOR Video Aids of Colorado	VIDEO MOTION ANALYZER Colorado Video Inc	Central Dynamics Ltd
General Electric Corp. Image Magnification Inc. Keyer Video Inc. Projection Systems Inc.  VIDEO LINE ISOLATOR Video Aids of Colorado	VIDEO MOTION ANALYZER Colorado Video Inc	Central Dynamics Ltd

VIDEO PRODUCTIONS,	GBC Closed Circuit TV Corp.	VIDEO TAPE ERASERS
STUDIO/LOCATION	JVC	Chyron CorpB42
Colour Images Unlimited Inc.	Lenco Inc.,	Garner Industries Inc
Design-Form Electronic Arts Intermix	Electronics Div B91-B103	Opamp Labs B123
Florida State University, Student Government Video Center	Sigma Electronics Inc.	Taber Mfg. Co.
Kapco Communications	Sony	1/10-00
Multi Media Forum	Thomson-CSF Laboratories  Vamco	VIDEO TAPE/FILM
Portable Channel Inc. Videcomm International	Engineering Inc B160-B162	RECORDING TRANSFER
Webb Telemedia Corp.	Video Aids of ColoradoB163	AIDS, A Damon Co. Kapco Communications
	Viscount Industries Ltd.	W.A. Palmer Films Inc.
VIDEO PROGRAMMING		Teledyne Camera Systems
Blue Hill Educational Systems Kapco Communications	VIDEO TAPE ACCESSORIES	VIDEO TAPE
Portable Channel Inc.	Ampex Corp. Display Media Inc.	MAGNETIC, CARTRIDGE
Webb Telemedia Corp.	Ray Jacobs Audio Inc.	Ampex Corp.
VIDEO QUANTIZER	Nortronics Co. Inc.  Panasonic Co	Fuji Photo Film USA Inc. Ray Jacobs Audio Inc.
Colorado Video Inc B31-B38	Sony	TDK Electronics Corp.
Colorado video Inc B31-B36	Vamco	Sony
VIDEO RECORDINO	Engineering B160-B162	
VIDEO RECORDING	2//g///00////g : : : : : : : 2 : 00 2 : 02	VIDEO TAPE
FILM CAMERAS	VIDEO TAPE	MAGNETIC, CASSETTE
Teledyne Camera Systems	AUTOMATED SYSTEMS	AGFA-Gevaert Inc.
VIDEO ROUTING SWITCHERS	Channelmatic Electronics Inc.	Ampex Corp. Down Stream-Keyer Inc.
American Data	Programmable Systems Inc.	Films Inc. Fuji Photo Film USA Inc.
Beaveronics Inc	Summit Cinevideo Corp.	International Audio Inc.
Beta Technology Inc.	VIDEO TAPE CLEANING AND	Irish Magnetic Recording Tape
Central Dynamics Ltd B41	EVALUATING EQUIPMENT	Ray Jacobs Audio Inc. Maxell Corp. of America
Di-Tech Inc		NEC
Duca-Richardson Corp.	Chyron Corp	Panasonic
Dynair Electronics Inc. Dytek Industries Inc.	Recortec Inc.	QSI Systems Inc.
Grass Valley Group Inc. International Nuclear Corp.	Research Technology Inc.	Sanyo Electric Inc.
J and D International		Sony TDK Electronics Corp.
Lenco Inc.,	VIDEO TARE DURI ICATION	Video Cassette SVCs Inc.
Electronics Div B91-B103 Mincom Division, 3M Co.	VIDEO TAPE DUPLICATION	
Sigma Electronics Inc.	Kapco Communications Webb Telemedia Corp.	VIDEO TAPE MAGNETIC, QUAD
Utah Scientific Inc.		AGFA-Gevaert Inc.
Vamco	VIDEO TAPE DUPLICATORS	Ampex Corp. Fuji Photo Film USA Inc.
Engineering Inc B160-B162 Viscount Industries Ltd.	AIDS, A Damon Co.	Ray Jacobs Audio Inc.
Vitex CoB173	Panasonic Co	VIDEO TADE MACNITIO
	Videcomm international	VIDEO TAPE MAGNETIC,
VIDEO SCRAMBLERS	VIDEO TAPE	REEL TO REEL
Oak CATV Division/Oak Industries Inc.	EDITING ACCESSORIES	AGFA-Gevaert Inc. Ampex Corp.
	Beta Technology Inc.	DAK Industries Inc. Fuji Photo Film USA Inc.
VIDEO SEQUENCERS	Convergence Corp. Datatron Inc.	Films Inc.
Videomedia Inc B166-B171	Down Stream-Keyer Inc.	Irish Magnetic Recording Tape Ray Jacobs Audio Inc.
	Electronic Engineering Co. of California (EECO) Media Concepts Inc.	Maxwell Corp. of America
VIDEO SIGNAL ENHANCER	Spectra-Vision Corp.	QSI Systems Inc.
Thomson-CSF Laboratories	Sony	Sony
	Vamco	
VIDEO SOURCE IDENTIFIERS	Engineering Inc B160-B162	VIDEO TAPE,
QSI Systems Inc.		PLAYBACK SERVICES
VIDEO OTUDIO CVOTELI	VIDEO TAPE EDITORS	Media Concepts Inc. RCA American Communications
VIDEO STUDIO SYSTEM	AIDS, A Damon Co.	NOA American communications
Crosspoint Latch CorpB46	Ampex Corp.	VIDEO TAPE PROGRAMS
Philips	Artists Engineering Beta Technology Inc.	Colour Images Unlimited Inc.
	Central Dynamics Ltd B41	Evenview Television Systems Genesys Systems Inc.
VIDEO SYNCHRONIZATION	Consolidated Video Systems . B39	Intercollegiate Video Clearing House
GENERATORS	Convergence Corp. Datatron Inc.	Microcampus — University of Arizona The Network for Continuing Medical Education
ADDA Corp	Down Stream-Keyer Inc.	Nightingale-Conant Corp. Studio Film and Tape Inc.
Cohu Inc.	Electronic Engineering Co. of California (EECO) Micro Vision Systems	отано гин ана таре ис.
Colorado Video IncB31-B38	Panasonic	VIDEO TAPE RECORDERS/

Crosspoint Latch Corp.....B46
Dage — MTI Inc.
Digital Video Systems

Electronic Engineering Co. of California (EECO)

Sony

**VIDEO TAPE RECORDERS/** 

PLAYERS CASSETTE

American Cable Network
Evenview Television Systems

Genesys Systems Inc.  JVC
VIDEO TAPE RECORDERS/ PLAYERS, HELICAL Ampex Corp.
Custom Films Inc. Javelin Electronics  JVC
Sanyo Electric Inc. Sony
Telectro Systems Corp. Telstar Productions Inc.
VIDEO TAPE RECORDERS/ PLAYERS, QUAD  Ampex Corp. Merlin Engineering Works Inc. RCA Broadcast Systems Telectro Systems Corp.
VIDEO TAPE RECORDERS/ PLAYERS, TIME LAPSE GBC Closed Circuit TV Corp. GYYR Javelin Electronics Merlin Engineering Works Inc. NEC America Inc. Panasonic Co
VIDEO TAPE REELS AND BOXES  AGFA-Gevaert Inc. Ampex Corp.  Plastic Reel Corp. of America Sony
VIDEO TAPE SEARCH AND LOCATE DEVICES Artists Engineering
VIDEO TAPE SPLICERS Nagy Research Products Sony
VIDEO TAPE TENSION GAUGES Tentel
VIDEO TEST GENERATORS  ASACA Corp. of America B17-B19 Cohu Inc.  Colorado Video Inc

Rohde and Schwarz Ultra Audio Pixtec

VIDEO TEST SIGNAL EQUIPMENT

ASACA Corp. of America B17-B19
Crosspoint Latch Corp......B46

Leasametric Leitch Video Ltd. Porta-Pattern Telecommunications Industries Ltd. Rohde and Schwarz Ultra Audio Pixtec

**VIDEO TAPE TIMERS** 

Sony Vamco Engineering Inc. . . . . . . B160-B162

**VIDEO TO FILM TRANSFER** 

W.A. Palmer Films Inc. Teledyne Camera Systems

VISUAL COMMUNICATIONS CABINETS

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Oravisual Co. Inc.

VOLTAGE CONTROLLED AMPLIFIERS

**Modular Audio Products .... B117**Richmond Sound Design Ltd.

**VOLTMETERS/MULTIMETERS** 

B and K Instruments Inc.
Ballantine Laboratories Inc.
Bayly Engineering Ltd.
Boonton Electronics
California Instruments
Data Precision Corp. Inc.
Dranetz Engineering Labs Inc.
Gralex Industries

Hamilton Electronics Corp. Harris Corp., Broadcast Products Division

Heath Co.
ITT Jennings
Leader Instruments Corp.
Leasametric
Lec Tro Tech Inc.
Nationwide Electronic Systems Inc.

Philips Test and Measuring Instruments Inc.

Rohde and Schwarz Sales Co. Sencore Inc. Systron-Donner **Tektronix Inc.** 

VTR HEAD REBUILDING

VTR MODIFICATION KITS, QUAD

Recortec Inc.

**VTR REBUILDING** 

Applied Video Electronics Inc.

**VU METER AMPLIFIERS** 

Automated Processes Inc.

**VU AND PEAK METERS** 

Audio Designs and Mfg. Inc. Gotham Audio Corp. Heath Co. Lec Tro Tech Inc. Roger Mayer Electronics Inc. Quad-Eight Electronics Corp. Sphere Electronics Inc.

W

WANTED TO BUY

Image Devices Inc. Ronald Phillips

WAVEFORM MONITORS AND ANALYZERS

Amber Electro-Design Ltd.
B and K Instruments Inc.
Broadcast Video

Crown International Inc. Leasametrics Lec Tro Tech Inc.

Sharp Electronics Corp. — Professional Products

**WAVE GUIDE SUPPORT** 

Microflect Co. Inc.

WAVEGUIDES

Andrew Corp.
Comark Industries Inc.
Gabriel Electronics Inc.
Harris Corp., Broadcast Products Division
Leasametric
Maury Microwave Corp.
Micro Communications
Microwave Associates
Nurad Inc.
Prodelin Inc.
RCA Broadcast Systems
RF Systems

Singer Products Co. Inc.

WEATHER CHANNEL CADCO

WINCHES AND HOISTS

T.R. Pitts Co.

WIRE AND CABLE

Brand-Rex Inc. California Switch and Signal Prodelin Inc. Times Wire and Cable Co.

WIRELESS SOUND SYSTEMS

Avid Corp.
Edcor
Erskine-Shapiro Theatre Technology Inc.
Alan Gordon Enterprises
HM Electronics Inc.
Image Devices Inc.
KEL Corp.
Paso Sound Products Inc.
Special Instruments Laboratory Inc.
Telectro Systems Corp.

Vega Electronics

WIRING AND CABLING SERVICES

Erskine-Shapiro Theatre Technology Inc. Locator Electronics Co.

Soll Inc. Summit Cinevideo Corp. TOCOM Inc. Telectro Systems Corp.

# **WOW AND FLUTTER METER**

B and K Instruments Inc. Fidelipac Gotham Audio Corp. Leader Instruments Corp. Leasametric Saxton Products Inc.



# X-Y DIGITIZER

Colorado Video Inc...... B31-B38

X-Y INDICATOR

Colorado Video Inc...... B31-B38

# TECHNICAL DATA AND INFORMATION

The Following Data/Information Section is provided as a ready reference source for the

**BROADCAST** 

Practitioner.

# WIRE/CABLE TERMINOLOGY

# THIS INFORMATION REPRINTED COURTESY OF: BELDEN

A - Ampere

abrasion resistance - Ability to resist surface wear

AC - Alternating current.

accelerated aging — A test that duplicates long time environmental conditions in a relatively short time.

AF - Audio frequency

AGC-Automatic gain control.

AM - Amplitude modulation

ambient — Conditions existing at a test or operating location prior to energizing of equipment (example: ambient temperature).

ampere — A standard unit of current. Designated as the amount of current that occurs when one volt of emf is applied across one ohm of resistance. An ampere of current is produced by one coulomb of charge passing a point in one second.

amplitude — The maximum value of a varying wave form.

anneal — To soften and relieve strains in any solid material, such as metal or glass, by heating to just below its melting point and then slowly cooling it. This also generally lowers the tensile strength of the material, while improving its flex life.

attenuation—The decrease in magnitude of a wave as it travels through any transmitting medium, such as a cable or circuitry. Attenuation is measured as a ratio or as the logarithm of a ratio (decibel).

attenuation constant—A rating for a cable or other transmitting medium, which is the relative rate of amplitude decrease of voltage or current in the direction of travel. It is measured in decibels per unit length of cable.

audio — A term used to describe sounds within the range of human hearing. Also used to describe devices which are designed to operate within this range.

audio frequency — That range of frequencies lying within the range of human hearing: approximately 20 to 20,000 Hz.

AWG — American Wire Gauge. A wire diameter specification. The lower the AWG number, the larger the wire diameter.

balanced line — A cable having two identical conductors with the same electromagnetic characteristics in relation to other conductors and to ground.

balun—A device for matching an unbalanced coaxial transmission line to a balanced twowire system. Normally also gives impedance transformation, as 300 ohm balanced to 75 ohm unbalanced.

bandwidth — The difference between the upper and lower limits of a given band of frequencies. Expressed in Hertz

**Beldfoil** ® — Belden trademark for highly effective electrostatic shield using reinforced metallic foil.

Beldsol — Solderable Belden magnet wire combining films of polyurethane for excellent dielectric characteristics and Nylon for mechanical protection.

BEV - One billion electron volts

binder — A tape or thread used for holding assembled cable components in place. bonding—The method used to produce good electrical contact between metallic parts of any device. Used extensively in automobiles and aircraft to prevent static buildup. Also refers to the connectors and straps used to bond equipment.

booster — A device inserted into a line (or cable) to increase the voltage. Boosting generators are also used to raise the level of a dc line. Transformers are usually employed to boost ac voltages. The term booster is also applied to antenna preamplifiers.

braid—A group of textile or metallic filaments interwoven to form a tubular structure which may be applied over one or more wires, or flattened to form a strap.

bunch strand—Conductors twisted together with the same lay and direction without regard to geometric pattern.

Bus-bar Wire—Uninsulated tinned copper wire used as a common lead.

butyl rubber—A synthetic rubber with good electrical insulating properties.

 $\mathbf{C}-\mathbf{Symbol}$  designation for: capacitance, bias supply and centigrade.

cabling — The method by which a group of insulated conductors is mechanically assembled (or twisted together).

capacitance — The ability of a dielectric material between conductors to store electricity, when a difference of potential exists between the conductors. The unit of measurement is the farad, which is the capacitance value which will store a charge of one coulomb when a one-volt potential difference exists between the conductors. In ac, one farad is the capacitance value which will permit one ampere of current, when the voltage across the capacitor changes at a rate of one volt per second.

capacitive reactance—The opposition to alternating current due to the capacitance of a capacitor, cable, or circuit. It is measured in ohms and is equal to 1/6.28fC where f is the frequency in Hz and C is the capacitance in farads.

capacitor — Two conducting surfaces separated by a dielectric material. The capacitance is determined by the area of the surfaces, type of dielectric, and spacing between the conducting surfaces.

CATV - Community antenna television.

CB — Citizens band.

CCTV - Closed-circuit television.

cellular polyethylene—Expanded or "foam" polyethylene, consisting of individual closed cells of inert gas suspended in a polyethylene medium, resulting in a desirable reduction of dielectric constant.

circuit—A system of conducting mediums designed to pass an electric current.

circular mil—A term used to define cross sectional areas using an arithmetic short-cut in which the area of a round wire is taken as "diameter in mils (.001") squared," hence one circular mil is equal to #/4 square mils.

coaxial cable—A cylindrical transmission line comprised of a conductor centered inside a metallic tube or shield, separated by a dielectric material, and usually covered by an insulating jacket.

coil effect—The inductive effect exhibited by a spiral-wrapped shield, especially above audio frequencies. concentric stranding—A group of uninsulated wires twisted together and containing a center core with subsequent layers spirally wrapped around the core to form a single conductor.

conductivity — The ability of a material to allow electrons to flow, measured by the current per unit of voltage applied. Also, it is the reciprocal of resistivity.

conductor — A material suitable for carrying an electric current.

Copperweld ® — Trademark of Copperweld Steel Co. for copper clad steel conductor.

cord - A very flexible insulated cable.

corona—The ionization of gasses about a conductor that results when the potential gradient reaches a certain value. Also called brush discharge.

coupling — The transfer of energy between two or more cables or components of a circuit.

CPS — Cycles per second. This is an obsolete designation and is now called Hertz (Hz).

crosstalk—A type of interference caused by audio frequencies from one line being coupled into adjacent lines. The term is loosely used also to include coupling at higher frequencies.

current, alternating (ac)—An electric current that periodically reverses direction of electron flow. The rate at which a full cycle occurs in a given unit of time (generally a second) is called the frequency of the current.

current, direct (dc)—Electrical current whose electrons flow in one direction only. It may be constant or pulsating as long as their movement is in the same direction.

cut-through resistance—The ability of a material to withstand mechanical pressure without damage.

db - Decibel.

DC - Direct current. (See current, direct.)

dc resistance - See resistance

decibel (db) — One-tenth of a bel. It is equal to 10 times the logarithm of the power ratio, 20 times the log of the voltage ratio, or 20 times the log of the current ratio. One decibel is the amount by which the pressure of a pure sine wave of sound must be varied in order for the change to be detected by the average human ear. The decibel can express an actual level only when comparing with some definite reference level that is assumed to be zero db.

delay line — An artificial or real transmission line or equivalent device designed to delay a wave or signal for a specific length of time.

dielectric — An insulating (nonconducting)
 medium.

dielectric breakdown—Any change in the properties of a dielectric that causes it to become conductive. Normally a catastrophic failure of an insulation because of excessive voltage.

dielectric constant—Also called permittivity. That property of a dielectric which determines the amount of electrostatic energy that can be stored by the material when a given voltage is applied to it. Actually, the ratio of the capacitance of a capacitor using the dielectric to the capacitance of an identical capacitor using a vacuum as a dielectric.

dielectric heating — The heating of an insulating material when placed in a radio-frequency field, caused by internal losses during the rapid polarization reversal of molecules in the material.

# WIRE/CABLE TERMINOLOGY

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- dielectric loss-The power dissipated in a dielectric as the result of the friction produced by molecular motion when an alternating electric field is applied.
- distortion An undesired change in wave form as the signal passes through a device
- distribution cable in a catv system, the transmission cable from the distribution amplifier to the drop cable.
- drain wire An uninsulated wire in contact with a shield throughout its length, and used for terminating the shield.
- drop cable In a CATV system, the transmission cable from the distribution cable to a dwelling
- Duofoil® Belden trademark for a shield in which metallic foil is applied to both sides of a supporting plastic film
- E-Voltage (electromotive force)
- EIA-Electronic Industries Association (Formerly RMA or RETMA).
- earth British terminology for zero-reference ground.
- elastomer Any material that will return to its original dimensions after being stretched or distorted.
- electromagnetic Referring to the combined electric and magnetic fields caused by electron motion through conductors.
- electromagnetic coupling-The transfer of energy by means of a varying magnetic field. Inductive coupling.
- electron volt A measure of the energy gained by an electron falling through an electric field produced by one volt
- electrostatic Pertaining to static electricity, or electricity at rest. An electric charge, for example.
- electrostatic coupling The transfer of energy by means of a varying electrostatic field. Capacitive coupling
- EMF Electromotive force (voltage).
- energy The capability of doing work
- energy dissipation -- Loss of energy from a system due to the conversion of work into undesirable forms. An example of this is heat loss that is due to friction in a mechanical system.
- EPDM Ethylene-propylene-diene nonomer rubber. A material with good electrical insulating properties
- EPR Ethylene-propylene copolymer rubber. A material with good electrical insulating properties
- EPT Ethylene-propylene-terpolymer rubber. A material with good electrical insulating properties.
- equilay More than one layer of helically laid wires with the direction of lay reversed for successive layers, but with the length of lay the same for each layer.
- ev Electron volt
- expanded polyethylene See cellular polyethylene
- f-Frequency
- farad-A unit of capacity that will store one coulomb of electrical charge when one volt of electrical pressure is applied
- feedback Energy that is extracted from a highlevel point in a circuit and applied to a lower level. Positive feedback reduces the stability of a device and is used to increase the sensitivity or produce oscillation in a system. Negative

- feedback, also called inverse feedback, increases the stability of a system as the feedback in an amplifier improves stability and fidelity.
- feeder cable In a catv system, the transmission cable from the head end (signal pickup) to the trunk amplifier. Also called a trunk cable.
- ferrous Composed of an/or containing iron. A ferrous metal exhibits magnetic characteristics as opposed to a non-ferrous metal, such as aluminum, which does not.
- Fluorinated ethylene-propylene. A thermoplastic material with good electrical insulating properties and chemical and heat resistance
- field-An area through which pass electric and/or magnetic lines of force.
- fillers Nonconducting components cabled with the insulated conductors, to impart roundness, flexibility, tensile strength, or a combination of all three, to the cable.
- flex life The ability of a cable to bend many times before breaking.
- flexibility-The ability of a cable to bend in a short radius (also see limpness).
- floating-Referring to a circuit which has no connection to ground.
- FM Frequency modulation
- frequency-The number of times a periodic action occurs in a unit of time. The number of cycles that an electric current completes in 1 second.
- frequency, power-Normally, the 50 or 60 cycle power available in residential areas.
- frequency response-The characteristic of a device denoting the range of frequencies over which it may be used effectively.
- foam polyethylene See cellular polyethylene.
- gain The increase of voltage, current, or power over a standard or previous reading. Usually expressed in decibels.
- geophysical cable Cable used in exploring for underground oil deposits.
- Geosol™ A solderable, extra tough film insulation developed by Belden for use in geophysical cables and miniature cables.
- gimmick-A short length of wire which is soldered onto a circuit component and used as a small adjustable capacitor. A gimmick is often two short insulated wires that are twisted together to form a capacitor.
- gnd-Ground.
- ground-An electrical connection to the earth, generally through a ground rod. Also a common return to a point of zero potential, such as the metal chassis in radio equipment.
- ground loop-A completed circuit between shielded pairs of a multiple pair cable created by random contact between the shields. An undesirable circuit condition in which interference is created by ground currents when grounds are connected at more than one point.
- ground potential-The potential of the earth. A circuit, terminal, or chassis is said to be at ground potential when it is used as a reference point for other potentials in the system.
- H-Symbol designation for: Magnetic intensity and henry
- hash A type of interference produced by manmade devices, particularly those which experience arcing as contacts open and close. Automotive voltage regulators and power-supply vibrators are two common examples.

- henry-A practical unit of inductance that will produce a voltage drop of one volt when the current changes at the rate of one ampere per second. (abbreviated H.)
- Hertz-The unit of frequency, one cycle per second.
- **HF** High frequency
- high frequency-The band from 3 to 30 Hz in the radio spectrum, as designated by the Federal Communications Commission.
- hum-A term used to describe the 60- or 120cps sound present in the sound of some communications equipment. Usually hum is the result of undesired coupling to a 60-cps source or to the defective filtering of 120-cps ripple output of a rectifier.
- Hypalon A Du Pont trade name for a synthetic rubber (chlorosulfonated polyethylene) used as insulating and jacketing materials for wire and cable.
- I-Symbol used to designate current.
- IF Intermediate-frequency.
- impedance The total opposition a circuit, cable, or component offers to alternating current. It includes both resistance and reactance and is generally expressed in ohms.
- impedance, characteristic In a transmission cable of infinite length, the ratio of the applied voltage to the resultant current at the point the voltage is applied. Or, the impedance which makes a transmission cable seem infinitely long, when connected across the cable's output terminals. For a waveguide, it is the ratio of rms voltage to total rms longitudinal current at certain points on a diameter, when the waveguide is match-terminated.
- impedance, high Generally, the area of 25,000 ohms or higher
- impedance, low Generally, the area of 1 through 600 ohms.
- impedance match-A condition whereby the impedance of a particular circuit cable or component is the same as the impedance of the circuit, cable, or device to which it is connected.
- impedance matching stub-A section of transmission line or a pair of conductors cut to match the impedance of a load. Also called matching stub.
- impedance matching transformer-A transformer designed to match the impedance of one circuit to that of another.
- impulse See pulse.
- inductance-A property of a conductor or circuit which resists a change in current. It causes current changes to lag behind voltage changes and is measured in henrys.
- induction The phenomenon of a voltage, magnetic field, or electrostatic charge being produced in an object by lines of force from the source of such fields.
- induction heating-Heating a conducting material by placing it in a rapidly changing magnetic field. The changing field induces electric currents in the material and I2R losses account for the resultant heat.
- input A signal (or power) which is applied to a piece of electric apparatus, or the terminals on the apparatus to which a signal or power is
- insertion loss A measure of the attenuation of a device by determining the output of a system before and after the device is inserted into the system.

# WIRE/CABLE TERMINOLOGY

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- insulation—A material having good dielectric properties which is used to separate close electrical components, such as cable conductors and circuit components.
- insulation stress—The molecule separation pressure caused by a potential difference across an insulator. The practical stress on insulation is expressed in volts per mil.
- interference Disturbances of an electrical or electromagnetic nature that introduce undesirable responses into other electronic equipment.
- intermediate frequency A frequency to which a signal is converted for ease of handling. Receives its name from the fact that it is an intermediate step between the initial and final conversion or detection stages.
- ionization The formation of ions, lons are produced when polar compounds are dissolved in a solvent and when a liquid, gas, or solid is caused to lose or gain electrons due to the passage of an electric current.
- ionization voltage—The potential at which a material ionizes. The potential at which an atom gives up an electron.
- IPCEA—Insulated Power Cable Engineers
  Association.
- I<sup>2</sup>R Formula for power in watts, where I = current in amperes, R = resistance in ohms. Also see watt.
- IR drop A method of designating a voltage drop in terms of both current and resistance.
- IRS Ignition radiation suppression.
- Isolation—The ability of a circuit or component to reject interference, usually expressed in db.
- jacket Pertaining to wire and cable, the outer sheath which protects against environment and may also provide additional insulation.
- kev-1000 electron volts.
- kilo-Prefix meaning thousand.
- KV-Kilovolt (1000 volts)
- KVA Kilovolt ampere.
- KW-Kilowatt.
- L-Symbol for inductance.
- lay Pertaining to wire and cable, the axial distance required for one cabled conductor or conductor strand to complete one revolution about the axis around which it is cabled.
- lay direction—The twist in the cable as indicated by the top strands while looking along the axis of the cable away from the observer. Described as "right hand" or "left hand".
- lead dress—The placement or routing of wiring and component leads in an electrical circuit.
- lead-in—The conductor that provides the path for r-f energy between the antenna and the radio/television receiver or transmitter.
- leakage The undesirable passage of current over the surface of or through an insulator.
- level A measure of the difference between a quantity or value and an established reference.
- LF-Low frequency.
- limpness The ability of a cable to lay flat or conform to a surface as with microphone cables. (also see flexibility.)
- line drop A voltage loss occurring between any two points in a power or transmission line. Such loss, or drop, is due to the resistance, reactance, or leakage of the line.

- line equalizer A reactance (inductance and/or capacitance) connected in series with a transmission line to alter the frequency-response characteristics of the line.
- line level—The level of a signal at a certain point on a transmission line. Usually expressed in decibels.
- line voltage The value of the potential existing on a supply or power line.
- load A device that consumes or converts the power delivered by another device.
- loaded line A transmission line that has lumped elements (inductance or capacitance) added at uniformly spaced intervals. Loading is used to provide a given set of characteristics to a transmission line
- loading See loaded line.
- long-wire antenna—Any conductor length in excess of one-half of a wavelength. In a residential television installation, a horizontal run of unshielded lead-in will act as a long-wire antenna and introduce additional signal on top of the regular antenna signal, causing ghosts.
- loss The portion of energy applied to a system that is dissipated and performs no useful work.
- lossy Having poor efficiency.
- low frequency—A band of frequencies extending from 30 to 300 kc in the radio spectrum, designated by the Federal Communications Commission.
- M -- Mutual inductance.
- MA Milliampere (one-thousandth of an ampere).
- mega-Prefix meaning million.
- MEV One million electron volts.
- MFD Microfarad (one-millionth of a farad).
- MHO—The unit of conductance, equal to the reciprocal of the unit of resistance (ohm).
- MHz Megahertz (one million cycles per second).
  Formerly mc.
- micro Prefix meaning one-millionth.
- microfarad One-millionth of a farad (uf, ufd, mf, and mfd are common abbreviations).
- micromicrofarad One-millionth of a microfarad (uuf, uufd, mmf, mmfd are common abbreviations). Also, a picofarad (pf or pfd).
- microphonics Noise caused by mechanical excitation of a system component. In a single-conductor microphone cable, for example, microphonics can be caused by the shield rubbing against the dielectric, as the cable is flexed.
- mil A unit of length equal to one thousandth of an inch.
- milli-Prefix meaning one-thousandth.
- MMF or MMFD—Abbreviation for micromicrofarad (one-millionth of one-millionth of a farad). A picofarad (pf or pfd).
- mono filament A single strand filament as opposed to a braided or twisted filament.
- mutual capacitance Capacitance between two conductors when all other conductors are connected together.
- MV Millivolt (one-thousandth of a volt).
- MW-Milliwatt (one-thousandth of a watt).
- Mylar® Du Pont trademark for polyethylene terephtalate (polyester) film.
- NBR Butadiene-acrylonitrile copolymer rubber, a material with good oil and chemical resistance.
- NEC-National Electric Code.

NEMA — National Electrical Manufacturers
Association.

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- neoprene—A synthetic rubber with good resistance to oil, chemical, and flame. Also called polychloroprene.
- noise—In a cable or circuit any extraneous sounds or signal which tends to interfere with the sound or signal normally present in or passing through the system.
- Nomex® Du Pont trademark for a temperature resistant, flame retardant nylon.
- nylon An abrasion-resistant thermoplastic with good chemical resistance.
- ohm The electrical unit of resistance. The value of resistance through which a potential difference of one volt will maintain a current of one ampere.
- Ohm's law—Stated E = IR, I = E/R, or R = E/I, the current I in a circuit is directly proportional to the voltage E, and inversely proportional to the resistance R.
- output The useful power or signal delivered by a circuit or device.
- ozone Extremely reactive form of oxygen, normally occurring around electrical discharges and present in the atmosphere in small but active quantities. In sufficient concentrations it can break down certain rubber insulations under tension (such as a bent cable).
- parallel circuit A circuit in which the identical voltage is presented to all components, and the current divides among the components according to the resistances or the impedances of the components.
- patchcord—A flexible piece of electrical cord terminated at both ends with plugs, used for interconnecting circuits on a patchboard.
- peak The maximum instantaneous value of a varying current or voltage. Also called crest.
- periodicity—The uniformly spaced variations in the insulation diameter of a transmission cable that result in reflections of a signal, when its wavelength or a multiple thereof is equal to the distance between two diameter variations.
- phase The location of a position on a waveform of an alternating quality, in relation to the start of a cycle. Measured in degrees, with 360° corresponding to one complete cycle.
- phase shift A change in the phase relationship
  between two alternating quantities.
- pickup Any device which is capable of transforming a measurable quantity of intelligence (such as sound) into relative electrical signals, e.g., a microphone.
- pico Prefix meaning one-millionth of one-millionth, (10<sup>-12</sup>).
- picofarad One-millionth of one-millionth of a farad. A micromicrofarad, or picofarad (abbreviation of).
- plastic High polymeric substances, including both natural and synthetic products, but excluding the rubbers that are capable of flowing under heat and pressure.
- plasticizer A chemical added to plastics to make them softer and more flexible.
- **polybutadiene** A type of synthetic rubber often blended with other synthetic rubbers to improve their properties.
- polyethylene A thermoplastic material having excellent electrical properties.
- polymer A substance made of many repeating chemical units or molecules. The term polymer is often used in place of plastic, rubber, or elastomer.

# WIRE/CABLE TERMINOLOGY

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- polypropylene A thermoplastic similar to polyethylene but stiffer and having higher softening point (temperature)
- polyurethane Broad class of polymers noted for good abrasion and solvent resistance. Can be in solid or cellular form:
- polyvinyl chloride A general purpose thermoplastic used for wire and cable insulations and iackets.
- potting-Sealing by filling with a substance to exclude moisture
- power-The amount of work per unit of time. Usually expressed in watts, and equal to 12R
- power loss-The difference between the total power delivered to a circuit, cable, or device, and the power delivered by that device to a load.
- power ratio The ratio of the power appearing at the load, to the input power. Expressed in db, it is equal to 10 log<sub>10</sub> (P<sub>2</sub>/P<sub>1</sub>), where P<sub>1</sub> is input power and P2 is the power at the load.
- pulse A current or voltage which changes abruptly from one value to another and back to the original value in a finite length of time. Used to describe one particular variation in a series of wave motions.
- PVC Polyvinyl chloride
- R-Symbol for resistance or resistor
- radio frequency The frequencies in the electromagnetic spectrum that are used for radio communications.
- reactance The opposition offered an alternating electron flow by a capacitance or inductance. The amount of such opposition varies with the frequency of the current. The reactance of a capacitor decreases with an increase in frequency; the opposite occurs with an inductance.
- reflection The change in direction (or return) of waves striking a surface. For example, electromagnetic energy reflections can occur at an impedance mismatch in a transmission line, causing standing waves.
- resistance-In dc circuits, the opposition a material offers to current, measured in ohms. In ac circuits, resistance is the real component of impedance, and may be higher than the value measured at dc.
- resonance An ac circuit condition in which inductive and capacitive reactances interact to cause a minimum or maximum circuit impedance
- retractile cord A cord having specially treated insulation or jacket so that it will retract like a spring. Retractability may be added to all or part of a cord's length.
- R-F -- Radio-frequency
- RG/U-"RG" is the military designation for coaxial cable, and "U" stands for "general utility."
- RMS Root-mean-square.
- Romex & General Cable Company's trademark for nonmetallic sheathed cable
- rope strand-A conductor composed of a center group of twisted strands surrounded by layers of twisted strands
- rubber (wire insulation) A general term used to describe wire insulations made of thermosetting elastomers such as natural or synthetic rubbers, neoprene, Hypalon, butyl rubber and others
- SAE Society of Automotive Engineers.
- SBR-A copolymer of styrene and butadiene. Also GR-S or Buna-S. Most commonly used type of synthetic rubber.

- semiconductor In wire industry terminology, a material possessing electrical conduction properties that fall somewhere between conductors and insulators. Usually made by adding carbon particles to an insulator. Not the same as semiconductor materials such as silicon, germanium. etc., used for making transistors and diodes.
- separator Pertaining to wire and cable, a layer of insulating material such as textile, paper, Mylar®, etc., which is placed between a conductor and its dielectric, between a cable jacket and the components it covers, or between various components of a multipleconductor cable. It can be utilized to improve stripping qualities and/or flexibility, or can offer additional mechanical or electrical protection to the components it separates.
- series circuit A circuit in which the components are arranged end to end to form a single path for current.
- shield-A sheet, screen, or braid of metal, usually copper, aluminum, or other conducting material placed around or between electric circuits or cables or their components, to contain any unwanted radiation, or to keep out any unwanted interference.
- shield coverage See shield percentage
- shield effectiveness-The relative ability of a shield to screen out undesirable radiation. Frequently confused with the term shield percentage, which it is not.
- shield percentage The physical area of a circuit or cable actually covered by shielding material, expressed in percent.
- signal Any visible or audible indication which can convey information. Also, the information conveyed through a communication system.
- silicone A material made from silicon and oxygen. Can be in thermosetting elastomer or liquid form. The thermosetting elastomer form is noted for high heat resistance.
- single-ended Unbalanced, such as grounding one side of a circuit or transmission line.
- skin effect-The tendency of alternating current, as its frequency increases, to travel only on the surface of a conductor.
- spectrum Frequencies or radiations that exist in a continuous range and have a common characteristic. A spectrum may be inclusive of many spectrums, e.g., the electromagnetic radiation spectrum includes the light spectrum, radio spectrum, infrared spectrum, etc.
- standing wave The stationary pattern of waves produced by two waves of the same frequency traveling in opposite directions on the same transmission line. The existence of voltage and current maxima and minima along a transmission line is a result of reflected energy from an impedance mismatch.
- standing wave ratio (swr) A ratio of the maximum amplitude to the minimum amplitude of a standing wave stated in current or voltage amplitudes
- static charge An electrical charge that is bound to an object. An unmoving electrical
- stay cord A component of a cable, usually a high tensile textile, used to anchor the cable ends at their points of termination and to keep any pull on the cable from being transferred to the electrical connections.
- strain gauge-A device for determining the amount of strain (change in dimensions) when a stress is applied.

- suppressor A device used to reduce or eliminate unwanted actions in electric or electronic circuits. For example, a resistance conductor in, or a resistor in series with, a sparkplug cable, to suppress interference which would otherwise affect radio reception in and near the vehicle
- surge-A temporary and relatively large increase in the voltage or current in an electric circuit or cable. Also called transient.
- swamp-The condition that prevails when too large a signal is applied to an electronic device, resulting in distortion of the output from the
- sweep-test-Pertaining to cable, checking frequency response by generating an rf voltage whose frequency is varied back and forth through a given frequency range at a rapid constant rate and observing the results on an oscilloscope.
  - In CATV applications, the structural return loss sweep-test determines internal reflections in the cable. A high structural return loss is
- Teflon® Du Pont Company tradename for fluorocarbon resins. (See FEP and TFE.)
- TFE-Tetrafluoroethylene. A thermoplastic material with good electrical insulating properties and chemical and heat resistance
- thermoplastic -- A material which will soften, flow, or distort appreciably when subjected to sufficient heat and pressure. Examples are polyvinyl chloride and polyethylene.
- thermosetting A material which will not soften, flow, or distort appreciably when subjected to heat and pressure. Vulcanizable. Examples are rubber and neoprene.
- tinsel A type of electrical conductor comprised of a number of tiny threads, each thread having a fine, flat ribbon of copper or other metal closely spiralled about it. Used for small size cables requiring limpness and extra-long flex life.
- transmission line An arrangement of two or more conductors or a waveguide used to transfer signal energy from one location to another
- thermal rating The temperature range in which a material will perform its function without undue degradation.
- transducer A device for transforming mechanical energy to electrical energy, or for transforming electrical energy to mechanical energy, such as in microphones and loudspeakers, but not motors or generators.
- triboelectric noise Noise generated in a shielded cable due to variations in capacitance between shielding and conductor as the cable
- trunk cable See feeder cable.
- turn-key In caty, a contractural arrangement in which one party designs and installs the system and "turns over the keys" to another party who will operate the system.
- twin-lead A transmission line having two parallel conductors separated by insulating material. Line impedance is determined by the diameter and spacing of the conductors and the insulating material and is usually 300 ohms for television receiving antennas. Also called balanced transmission line and twin-line
- UHF-Ultrahigh frequency, the band extending from 300 to 3,000 mc as designated by the Federal Communications Commission.
- UL Underwriters' Laboratories, Inc.

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unbalanced line—A transmission line in which voltages on the two conductors are unequal with respect to ground, e.g., a coaxial cable.

unilay — More than one layer of helically laid wires with the direction of lay and length of lay the same for all layers.

V-Volt

VA—Volt-ampere. A designation of power in terms of volts and amperes.

velocity of propagation—The transmission speed of an electrical signal down a length of cable compared to speed in free space. Usually expressed as a percentage.

VHF—Very high frequency, the band extending from 30 to 300 mHz as designated by the Federal Communications Commission.

video — Pertaining to picture signals in a television system.

vIf—Very low frequency, the band extending from 10 to 30 kc, as designated by the Federal Communications Commission.

volt — A unit of electrical pressure. One volt is the amount of pressure that will cause one ampere of current in one ohm of resistance.

voltage — Electrical potential or electromotive force expressed in volts.

voltage drop—The voltage developed across a component or conductor by the current in the resistance or impedance of the component or conductor. W-Symbol for watt or wattage.

watt—A unit of electrical power. One watt is equivalent to the power represented by one ampere of current under a pressure of one volt in a dc circuit.

waveform—A graphical representation of a varying quantity. Usually, time is represented on the horizontal axis, and the current or voltage value is represented on the vertical axis.

wavelength—The distance between the nodes of a wave. The ratio of the velocity of the wave to the frequency of the wave.

X - Symbol for reactance

Z-Symbol for impedance



# METRIC-DECIMAL-INCH CONVERSIONS

		Frac	tions o	f an inc	h	Decim.		Frac	tions o	f an in	ch		Decim.		Frac	tions of	f an inc	h		Decim
1/8	116	1/32	1/64	1/128	Mm	of an inch	1/8	116	1/32	1/64	1/128	Mm	of an	18	116	1/32	1/64	1128	Mm	of an
				1	.198	.0078125			11	22	44	8.731	.343750	T				87	17.004	inch
			1	2	.397	.0156250					45	8.930	.3515625		11	22	44	88	17.264	.6796875
				3	.595	.0234375				23	46	9.128	.359.375	1					17.463	.687500
		1	2	4	.794	.031250					47	9.327	.3671875				45	89 90	17.661	.6953129
				5	.992	.0390625	3	6	12	24	48	9.525	.375000				40		17.859	.703125
٠.			3	6	1.191	.0468750					49	9.723	.3828125	1		23	46	91	18.058	.710937
				7	1.389	.0546875				25	50	9.922	.390625	1		23		92	18.256	.718750
	1	2	4	8	1.588	.062500					51	10.120	.3984375	1			47	93	18.455	726562
				9	1.786	.0703125			13	26	52	10.319	.406250	1			47	94	18.653	.734375
			5	10	1.984	.078125					53	10.517	.4140625	6	12	24	40	95	18.852	.742187
				11	2.183	.0859375				27	54	10.716	.421875		12	24	48	96	19.050	.750000
		3	6	12	2.381	.093750					55	10.914						97	19.248	.7578125
				13	2.580	.1015625		7	14	28	56	11 113	.4296875				49	98	19.447	.765625
			7	14	2.778	.109375	1	,	14	20	57		.437500					99	19.645	.7734379
				15	2.977	.1171875				29		11.311	.4453125			25	50	100	19.844	.78125
1	2	4	8	16	3.175	.125000					58	11.509	.453125					101	20.042	.7890629
				17	3.373	.1328125			45		59	11.708	4609375				51	102	20.241	.796875
			9	18	3.572	.140625			15	30	60	11.906	.46875					103	20.439	.8046879
			5	19	3.770						61	12.105	4765625		13	26	52	104	20.638	.81250
	. ,	5	10	20	3.770	.1484375				31	62	12 303	.484375					105	20.836	.8203125
		5		21	4.167	.156250					63	12 502	4921875				53	106	21 034	.828125
			11	22		.1640625	4	8	16	32	64	12.700	.500000	1				107	21.233	.8359379
				23	4.366	.171875					65	12.898	.5078125			27	54	108	21.431	.843750
	3	6	12	23	4.564	.1796875				33	66	13.097	.515625					109	21.630	.8515625
	J			25	4.763	.187500					67	13.295	.5234375				55	110	21.828	.859375
			12		4.961	1953125			17	34	68	13 494	.531250					111	22.027	.8671875
			13	26	5.159	.2031250					69	13.692	.5390625	7	14	28	56	112	22.225	.875000
		7	14	27	5.358	.2109375				35	70	13.891	.546875					113	22.423	.8828125
		/		28	5.556	.218750					71	14.089	.5546875				57	114	22.622	.890625
			45	29	5.755	.2265625		9	18	36	72	14.288	.562500	1				115	22.820	.8984375
			15	30	5.953	.234375					73	14.486	.5703125	1		29	58	116	23.019	.906250
 2				31	6.152	.2421875				37	74	14.684	.578125	1				117	23.217	
2	4	8	16	32	6.350	.250000					75	14.883	5859375	1			59	118	23.416	.9140625
				33	6.548	.2578125			19	38	76	15.081	.593750	1			35	119		.921875
,			17	34	6.747	.265625					77	15.280	.6015625	1	15	30	60	120	23.614	.9296875
				35	6.945	.2734375				39	78	15.478	.609375						23.813	.937500
		9	18	36	7.144	.281250					79	15.677	.6171875				C 1	121	24.011	.9453125
				37	7.342	.2890625	5	10	20	40	80	15.875	.625000				61	122	24.209	.953125
			19	38	7.541	296875				,,,	81	16.073						123	24.408	.9609375
				39	7.739	.3046875				41	82	16.073	.6328125			31	62	124	24.606	.968750
,	5	10	20	40	7.938	.312500					83		.640625					125	24.805	.9765625
				41	8.136	3203125			21	42		16.470	.6484375				63	126	25.003	.9843750
			21	42	8.334	.328125			Z I	42	84	16.669	656250					127	25.202	.9921875
				43	8.533	.3259375					85	16.867	.6640625	8	16	32	64	128	25.400	1.000
_					0.000	.5055575				43	86	17.066	.671875							

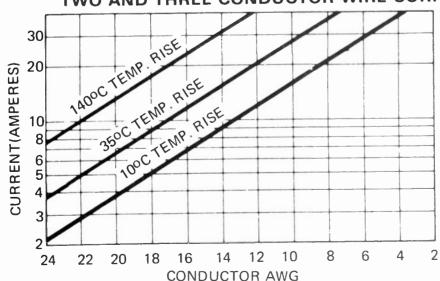
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# BARE COPPER WIRE PARAMETERS

		Cross-		Breaking Stre		Resista Ohms pe	r 1000 Ft.
AWG	Dia. Mils	Sect. Area Cir. Mils	Lbs. per 1000 Ft.	Soft (ANL)	Med. Hard	Soft (ANL)	Med. Hard
10 11 12 13 14 15	101.9 90.7 80.8 72.0 64.1 57.1	10,380 8,230 6,530 5,180 4,110 3,260	31.43 24.92 19.77 15.68 12.43 9.86	314.0 249.0 197.5 156.6 124.2 98.5	467.5 372.9 297.5 237.2 189.2 150.9	0.999 1.260 1.588 2.003 2.525 3.184	1.033 1.303 1.643 2.072 2.613 3.295
16 17 18 19 20 21	50.8 45.3 40.3 35.9 32.0 28.5	2,580 2,050 1,620 1,290 1,020 812	7.82 6.20 4.92 3.09 3.09 2.452	78.1 61.9 49.2 39.0 30.9 24.5	120.3 96.0 76.5 61.0 48.7 38.8	4.016 5.064 6.385 8.051 10.15 12.80	4.154 5.239 6.606 8.330 10.50 13.24
22 23 24 25 26 27	25.3 22.6 20.1 17.9 15.9 14.2	640 511 404 320 253 202	1.945 1.542 1.223 0.970 0.770 0.610	19.4 15.4 12.7 10.1 7.98 6.33	30.9 24.7 19.7 15.7 12.5 9.97	16.14 20.36 25.67 32.37 40.81 51.47	16.70 21.06 26.56 33.49 42.22 53.24
28 29 30 31	12.6 11.3 10.0 8.9	159 128 100.0 79.2	0.484 0.384 0.304 0.241	5.02 3.98 3.16 2.50	7.95 6.34 5.05 4.03	64.9 81.8 103.2 130.1 164.1	67.1 84.7 106.8 134.6 169.8
32 33 34 35	8.0 7.1 6.3 5.6	64.0 50.4 39.7 31.4	0.191 0.152 0.120 0.095	1.99 1.58 1.25 0.990	3.21 2.56 2.04 1.63	206.9 260.9 329.0	214.1 269.9 340.4
36 37 38 39	5.0 4.5 4.0 3.5	25.0 20.2 16.0 12.2	0.076 0.060 0.0476 0.0377	0.785 0.623 0.494 0.392	1.30 1.03 0.823 0.656	414.8 523.1 659.6 831.8	429.2 541.2 682.4 860.5
40 41 42 43 44 45	3.1 2.8 2.5 2.2 2.0 1.76	9.61 7.84 6.25 4.84 4.00 3.10	0.0299 0.0237 0.0188 0.0149 0.0118 0.00981	0.311 0.246 0.195 0.155 0.123 0.09	0.523 0.415 0.329 0.261 0.207	1,049 1,323 1,668 2,103 2,652 3,200	1,085 1,368 1,725 2,176 2,743
46 47 48 49 50 51	1.57 1.40 1.24 1.11 0.99 0.88	2.46 1.96 1.54 1.23 0.980 0.774	0.00775 0.00593 0.00436 0.00366 0.00303 0.00234	0.07 0.054 0.04 0.033 0.027 0.023		4,050 5,290 7,200 8,570 10,400 13,400	
52 53 54 55 56	0.78 0.70 0.62 0.55 0.49	0.603 0.490 0.384 0.302 0.240	0.00184 0.00148 0.00116 0.000916 0.000727	0.017 0.013 0.011 0.006 0.0052		17,000 21,200 26,900 34,300 43,200	

# TWO AND THREE CONDUCTOR WIRE CURRENT CARRYING CAPACITY



Temperature Rise of Conductors Surrounded by Still Air at 25°C.

Correction Factors
Chart for Current Carrying
Capacity of Other Multiconductor Cables

No. of Conductors	Multiplying Factor			
1	1.6			
2-3	1.0			
4-5	0.8			
6-15	0.7			
16-30	0.5			

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# LEAD WIRE CURRENT CARRYING CAPACITY—AMPERES\*

AWG	Rubber	Neoprene	Vinyl	Hypalon † XL-DUR T.M.	Silicone Nomex
24	2	3	4	4	6
22	3	4	5	5	8
20	5	6	7	7	12
18	8	9	10	10	18
16	13	14	15	15	29
14	20	21	22	22	45
12	25	27	29	29	55
10	40	43	47	47	75
8	65	70	75	75	100
6	95	100	105	105	135
4	125	135	150	150	180
3	145	155	175	175	210
2	170	180	205	205	240
1	195	210	235	235	280
0	230	245	275	275	325
00	265	285	315	315	370
000	310	330	375	375	430
0000	360	385	435	435	510

<sup>\*</sup>Amperes shown are maximum for a single conductor in free air and an assumed ambient or room temperature of 30C (86F). †Trademark of DuPont

# LEAD WIRE CURRENT CARRYING CAPACITY CHART

# How to Use

The choice of an appropriate Lead Wire with respect to current carrying capacity usually depends on one or more factors which vary according to the application. These factors include ambient or room temperature in which equipment operates, temperature rise of equipment, limitations of insulation, voltage drop and location of wires as in free air or enclosures such as formed by a compartment, tubing or a bundle of wires.

For these reasons it is not practical to provide a general chart showing the current carrying capacity of Lead Wire for all conditions. Accordingly the values shown in the chart below have been arbitrarily developed for stated conditions. If necessary, choose a larger or smaller size by trial for final determination to satisfy the requirements in the application for proper operation and safety of the equipment.

The insulations shown are those described for Belden Lead Wire constructions.

# **COMMON CONDUCTOR MATERIALS**

	DC Resistance Compared to	R-F Resistance	Tensile Strength (PSI)		
Material	Annealed Cop.	Compared to Annealed Cop.	Annealed	Hard	
Copper	100%	100%	35,000	66,000	
Copperweld ® 40% LC	250%	100%	50,000	96,000	
Copperweld ® 30% HM	333%	100%	70,000	130,000	
Cadmium Bronze 99% Cu, 1% Cd	115%	115%	38,000	90,000	
Aluminum <sup>3</sup>	164%	164%	17,0004	23.000	

(1) Flex life will, in general, be improved by use of higher strength material.

(2) Theoretically, annealed material will have longer fatigue life than hard. However, in practice the stiffness of hard material frequently tends to restrict the sharpness of bend, resulting in improved life.

(3) Aluminum used in aircraft and power distribution for weight reduction. Not normally used for electronic applications.

(4) 3/4 hard.

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# CONDUCTOR CONFIGURATIONS

For a given AWG wire size (based on equal cross-sectional area of conductor), limpness and flex life are increased by use of a large number of fine strands. It follows, costs are also increased with fine stranding.

Typical			AM	ERICAN	VIRE GAG			
Application:	12	14	16	18	20	22	24	26
Fixed Service	19x25	Solid or 19 x27	Solid or 19x29	Solid or 7x26	Solid or 7x28	Solid or 7x30	Solid or 7x32	Solid or 7x34
Hook-up Wire Cable in Raceway				or 16x30	or 10x30			
Moderate Flexing	65×30	19x27 or 41x30	19x29 or 26x30	16x30 or 41x34	7x28 or 10x30	7x30 or 19x34	7x32 or 10x34	7×34
Frequently Disturbed for Maintenance					or 19x32 or 26x34			
Severe Flexing  Microphones Test Prods	165×34	104×34	65x34 or 104x36	41x34 or 65x36	26x34 or 42x36	19x34 or 26x36	19x36 or 45x40	7x34 or 10x36
Most Severe Duty—Mercury Switches	259x36 (7x37** Rope Lay)	168x36 (7x24 Rope Lay)	105×36 (7×15 Rope Lay)	63x36 (7x9 Rope Lay)	105x40 (3x35 Rope Lay)	(Consider braid or tinsel)		tinsel)

<sup>\*</sup>Composite constructions consisting of 4 strands Copperweld and 3 strands copper are frequently used for severe flexing in small size cables. # 25 AWG (4 x 33 Copperweld + 3 x 33 Copper) is popular in microphone cables.

# METRIC PREFIXES AND SYMBOLS

### Prefixes Symbols Multiples and Submultiples $10^{1.2}$ Tera 1,000,000,000,000 T 10<sup>9</sup> Giga G 1,000,000,000 $10^{6}$ Mega M 1,000,000 Kilo $10^{3}$ K 1,000 $10^{2}$ Hecto 100 h Deca 10 10 dk 10-1 Deci d 0.1 $10^{-2}$ Centi 0.01 С $10^{-3}$ Milli 0.001 m 10<sup>-6</sup> Micro 0.000,001 μ 10<sup>-9</sup> Nano 0.000,000,001 n 10-12 Pico 0.000,000,000,001 р

# UL FLEXIBLE CORDAGE CURRENT CARRYING CAPACITY IN AMPERES

	Tinsel	Rubber and	Heater
AWG	Cords	Plastic Cords	Cords
27	0.5	_	_
18	_	10	10
17	_	_	12
16	_	13	15
14	_	18	20
12	_	25	30
10	_	30	_
8	_	40	_
6	_	55	_
4	_	70	_

<sup>\*</sup>Underwriters' Laboratories, Inc., & National Electrical Code Standard for 2 and 3 conductor cords. For cords with 4 to 6 conductors, the current rating is 80% of the values shown.

<sup>\*\*</sup>Rope Lay is several stranded groups cabled together. For example: # 12 AWG, 259 x 36 is 7 cords each consisting of 37 strands of #36 AWG.

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# FLEXIBLE COAXIAL CABLE PARAMETERS

Major							Max.		A 15 - 1 1 -
mped-		RG	١,,		Mil		Oper.		Applicable
ance Group	Imp. Ohms	No.	pf/ ft.	O.D.	Jkt. Type	Center Cond,	Volts (Rms)	Lbs./	Specifi- cation
огоар	50	5A/U	28.5	0.328	II	16S	3000		JAN-C-17A
	50	5B/U	28.5	0.328	lla l	16S	3000	8.7 8.7	MIL-C-17D
	52	8/U	29.5	0.405	l lla	7/21C	5000	10.6	JAN-C-17A
	52	8A/U	29.5	0.405	lla	7/21C	5000	10.6	MIL-C-17D
	51	9/U	30	0.420	II II	7/21S	5000	15.	
	51	9A/U	30	0.420		7/21S	5000	15.	JAN-C-17A JAN-C-17A
	50	9B/U	30	0.420	lla l	7/21S	5000	15.	MIL-C-17D
50	52	14A/U	29.5	0.545	lla	10C	7000	21.6	MIL-C-17D
50	52	17/U	29.5	0.870	"	,188C	11000	47.	JAN-C-17A
	52	17A/U	29.5	0.870	lla	.188C	11000	47.	MIL-C-17D
	52	19A/U	29.5	1.120	lla	.250C	14000	74.	MIL-C-17D
	53	21A/U	29.5	0.332	lla	16N	2700	8.7	MIL-C-17D
	58	54A/U	26.5	0.250(max.)	111	7/.0152C	3000	4.1	JAN-C-17A
	53.5	55/U	28.5	0.206(max.)	;;;	20C	1900	3.6	JAN-C-17A
	53.5	55B/U	28.5	0.206	IIIa	20S	1900	3.6	MIL-C-17D
	53.5	58/U	28.5	0.195		20S 20C	1900	2.9	JAN-C-17A
	50.5	58A/U	28.5	0.195	li l	19/.0071TC	1900	2.9	JAN-C-17A
	50	58C/U	28.5	0.195	lita	19/.0071TC	1900	2.9	MIL-C-17D
	50	122/U	29.3	0.160	Ila	27/36TC	1900	2.5	MIL-C-17D
	50	174/U	30.4	0.100		7/34CW	1500	0.8	BuShips
	*50	178B/U	29.0	0.075(max.)	l ix l	7/38SCW	1000	0.6	
	•50	188A/U	29.0	0.110(max.)	l Vîr l	7/.0067SCW	1200	1.3	MIL-C-17D
	•50	196A/U	29.0	0.080(max.)	l vii l	7/38SCW	1000	0.7	MIL-C-17D MIL-C-17D
	50	213/U	29.5	0.405	lla	7/.0296C	5000	10.6	MIL-C-17D
	50	214/U	30	0.425	lia	7/.0296S	5000	15.	MIL-C-17D
	50	217/U	29.5	0.545	lla	.106C	7000	21.6	
	50	218/U	29.5	0.870	Ha	.195C	11000	49.1	MIL-C-17D MIL-C-17D
	50	223/U	29.5	0.216	lla	.0358	1900	3.6	MIL-C-17D
	75	6A/U	20	0.332	lla	21CW	2700	-	
	75	11/U	20.5	0.405	l la			8.2	MIL-C-17D
	75	11A/U	20.5	0.405		7/26TC	5000	9.6	JAN-C-17A
	74	13/U	20.5		lla	7/26TC	5000	9.6	MIL-C-17D
75	75	34B/U	21.5	0.420	!.	7/26TC	5000	12.6	JAN-C-17A
/5	73	59/U		0.630	lla	7/.0249C	6500	22.4	MIL-C-17D
	75		21	0.242	1.	22CW	2300	3.2	JAN-C-17A
	78	59B/U	21	0.242	lla	.023CW	2300	3.2	MIL-C-17D
	/6	108A/U	24.5	0.235	lla	2-7/28TC	1000	2.9	MIL-C-17D
		140/11	(max.)			(twin)			
	*75	140/U	21	0.233	V	.025SCW	2300	4.5	MIL-C-17D
	95	22/U	16	0.405	1	2-7/.0152C	1000	15.1	JAN-C-17A
						(twin)			
	95	22B/U	16	0.420	IIa	2-7/.0152C	1000	15.1	MIL-C-17D
						(twin)			
93	93	62/U	13.5	0.242	1	22CW	750	3.8	JAN-C-17A
	93	62B/U	13.5	0.242	Ita	7/32CW	750	3.8	MIL-C-17D
	93	71/U	14.5 (max )		311	22CW	750	4.6	JAN-C-17A
	93	71B/U	14.5 (max)	0.250(max.)	Illa	22CW	750	4.6	MIL-C-17D
	*95	180B/U	15.5	0.145(max.)	IX	7/38SCW	1500	2.2	MIL-C-17D
	*95	195A/U	15.5	0.155(max.)	VII	7/38SCW	1500	2.5	MIL-C-17D
125	125	63/U	10	0.405	1	22CW	1000	8.3	JAN-C-17A
	125	63B/U	10	0.405	lla	22CW	1000	8.3	
185	185	114/U	6.5	0.405	_				MIL-C-17D
100	185	, —				33CW	1000	8.7	JAN-C-17A
	100	114A/U	6.8(max.)	IV.4U5	lla	.007CW	1000	8.7	MIL-C-17D

# **JACKETS**

	JACKE	13
Jacket Type	Description	Temp. Range
1	Black Vinyl	-40°C to 80°C
11	Gray Vinyl (non- contaminating)	-55°C to 80°C
lla	Black Vinyl (non- contaminating)	-55°C to 80°C
111	Clear Polyethy- lene)	-55°C to 80°C
IIIa	Black Polyethy- lene)	-55°C to 80°C
V	Fiberglass, silicone impregnated varnish	–55°C to 250°C
VII	White TFE Teflon*	-70°C to 200°C
IX	Brown FEP Teflon*	−70 <sup>0</sup> C to 200 <sup>O</sup> C

<sup>\*</sup>Registered trademark of DuPont.

Abbreviations: C = Bare Copper, CW = Copperweld, N = Nichrome, pf = picofarad, RMS = Root Mean Square, S = Silver coated copper, SCW = Silver coated copperweld, TC = Tinned Copper.

# SUGGESTED AWG SIZE FOR LONG POWER SUPPLY CORDS\*

Cord											Cur	rent	(amp	o) _										
Length (ft)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16 17	18	19	20	21	22	23	24	25
25	18	18	18	18	18	18	18	18	18	18	16	16	16	14	14	14 14	14	12	12	12	12	12	12	12
50	18	18	18	18	18	18	18	18	18	18	16	16	16	14	14	14 14	14	12	12	12	12	12	12	12
75	18	18	18	18	18	18	18	18	18	18	16	16	16	14	14	14 14	14	12	12	12	12	12	12	12
100	18	18	18	18	18	18	18	16	16	16	16	16	14	14	14	14 14	14	12	12	12	12	12	12	12
125	18	18	18	18	18	18	16	16	16	14	14	14	14	14	14	12 12	12	12	12	12	12	12	12	12
150	18	18	18	18	18	16	16	16	14	14	14	14	14	12	12	12 12	12	12	12	10	10	10	10	10

<sup>\*</sup>Rubber and plastic cords, but not including heater cords. Based on a 115-v supply and a maximum voltage drop (loss) of 10v when cord carries rated current. To determine correct AWG, refer to the cord length in the table and the current nearest the current rating on the nameplate of the appliance.



# 35mm PROJECTION CHARTS

DOUBLE FRAME SLIDES (1.34" Aperture Width)

Because focal length tolerances and lens construction vary from model to model, a general projection chart assumes that the projection distance can be varied by at least (plus or minus) six inches. (Refer to Buhl pertaining to special charts for internal mirrors.)

FOCAL	LENC	STHS	from	1.4**	to 5.0	)* *												SCREE	N WII	OTHS	from	12" t	o 12.0
									CREE	TOIW	'HS in I	NCHES	and (DE	ECIMAL	S) FEE	T							
FOCAL LENGTH	12"	18"	24"	30"	36''	42"	48"	54"	60''	66''	72"	78''	84"	90"	96"	102"	108"	114"	10.0'	10.5"	11.01	11.51	12.0'
(inches)	_						= Appro	oximate	Distant	es fron	n Film P	lane to	Screen i	n Inche	s and (d	lecimals	) Feet						
1.4"	19"	26"	32''	39''	45"	52"	58"	65''	71"	78''	84''	91"	97"	104"	110"	116"	10.2	10.8	11.3	11.9′	12.4	13.0'	13.5′
1.7"	23"	30"	38"	46''	53''	61"	68"	76"	84"	91"	99''	106"	114"	10.11	10.8	11.4"	12.0'	12.7'	13.3'	13.9'	14.6′	15.2	15.8′
1.8"	24"	32	40"	48''	56"	64"	72''	80''	88"	96"	104"	112"	10.0	10.7	11.41	12.11	12.7'	13.4'	14.11	14.71	15.41	16.1′	16.8'
2.0"	24"	33''	41''	50''	58''	67''	75"	84''	92"	101"	109"	118"	10.5′	11.2'	11.9'	12.6'	13.3'	14.11	14.8'	15.5	16.2	16.91	17.6′
2 5''	32"	43''	54''	65"	76''	87"	99"	110"	10.1′	11.0	11.9	12.91	13.8'	14.7'	15.7	16.61	17.5'	18.51	19.4	20.3	21.31	22.2'	23.11
3.0"	34"	47''	60''	74''	87''	101"	114"	10.6′	11.7	12.9	14.0	15.11	16.21	17.3	18.5	19.6′	20.7′	21.8	22.9'	24.11	25.2	26.31	27.4
3.6"	40"	56''	72''	88"	105"	10.1	11.4'	12.7'	14.11	15.4	16.8′	18.1′	19.51	20.8'	22.1′	23.5'	24.8	26.2	27.5	28.91	30.2	31.5'	32.91
4.0"	45"	63"	81"	99"	117"	11 2'	12.7	14.2'	15.7′	17.2	18 7	20.2	21.7	23.11	24.6	26.1	27.6	29.11	30.6	32.11	33.6*	35.1′	36.6'

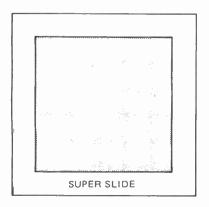
5 0"	4.7'	6.5"	8.4	10.2	2' 12	511 1	13 9'	15.8	17 7	19.5	5' 21	.41 2	3.3'	25.11	27.0	28.	9. 30	).7' 3	2.6'	34.51	36.3	38.2	40	1' 4	1.91	43.8'	45.7′
ZOOM L	ENSE		FOC	AL L	ENG	THS	from	2.4"	' to 6	5.0′′											CRE	EN W	DTH	S fr	om 3	6" to	o 16.0
											EEN	WIDTH	4S in I	NCHE:	and (	DECI	MALS	FEE1	r								
FOCAL LENGTH	36"	42	4.0'	4 5'	5.0'	5.5'	6 0	6.5	7 0'	7 5	8.0	8 5'	9 0.	9.5	10 0'	10 5	11.0	11.5	12 0'	12.5′	13 0'	13.51	14.0"	14.5′	15.0	15.5	16.0′
(inches)									_ Appr	oxima	te Dis	tances	from	Film Pl	ane to	Scree	n in ¹d	ecimal	s) Feet			_					
2.4"	5.8	6.7	7.6	8.5	9.4	10.3	11.2	12.1′	13 0'	13 9'	14.8	15 7	16 6	17.5	18.41	19.2	20.1	21.0	21.91	22.81	23.7	24.6	25.5'	26.41	27.3	28.21	29.11
10 3.6"	8.7	10.1	11 4'	12 7'	14 1'	15.4	16.8	18.1	19.5	20.8'	22.1	23.5	24 81	26 2'	27 5'	28.9	30.2	31.5	32 9'	34.2	35.61	36.91	38.3′	39.61	40.91	42.3	43.6′
3.2"	7 7'	8 9'	10 1'	11 3'	12 5'	13.7	14 9	16 1	17 3'	18.5	19.7	20 9'	22 1	23 3′	24.5	25.7	26.8	28.01	29.2	30.41	31.61	32.81	34.0′	35.2	36.41	37.6	38.8'
to 4.8"	11 6'	13.4	15.2	17.0	18.8	20.6	22 3	24.1	25.9'	27.7	29.5	31 3	33 1	34 9'	36.71	38.5	40.2	42.0	43.8'	45.6	47.41	49.2	51.0′	52.8	54.6	56.41	58.2'
4.0"	9.7	11.2	12.7	14.1′	15.6	17 1	18.6	20.1	21.6	23.11	24.6	26.1	27.6	29.11	30.61	32.1	33.5	35.0	36.5	38.01	39.51	41.01	42.5′	44.0′	45.5	47.0°	48.5'
to 6.0"	14.5	16 7	19.0'	21.2	23.4	25.7	27 9	30 2'	32.4	34.6'	36.9	39.1	41.3	43.61	45.8'	48 1	50.3	52.5	54.8'	57.0	59.3	61.5	63.7′	66.0	68.2	70.4	72.71

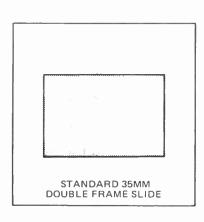
FOCAL	LEN	GTH	S fr	om 4	.0"	to	15.5														SCR	EEN 1	NIDTI	1S fr	om <u>36</u>	5" to	16.0
FOCAL												EEN W															
LENGTH	36"	42"	48'	54"	60''	66	72"	78''	84''	-									12.0		13.0'	13.5	14.0′	14.5'	15.0	15.5	16.0'
(inches)	-		_		-			-											nels) F								
4.0"	9 7	11.2	12.7	14.1	15.6	17.1	18.6	20.1	21.6	23.1	24.6	26.11	27.6	29.11	30.6′	32.1	33.51	35.0′	36.51	38.01	39.51	41.0'	42.5"	44.0'	45.5'	47.0′	48.51
5.0"	12 1	13.9	15.8	17 7	19.5	21 4	V 23.3	25 1	27.0	28.9	30.7	32.6	34.5	36 3'	38.2	40 1	41.91	43 8′	45.71	47.5	49.41	51.3	53.11	55.0	56.8	58.7	60.6
*6.0"	14.5	16.7	19.0	1 21.2	23.4	25.7	7 27 9	' 30.2'	32.4	34.6	36.9	39.11	41 3'	43.6	45.8	48 1	50.3	52.5	54.81	57.0	59.3'	61.5	63.7	66.0′	68.2	70.4	72.7
7.0′′	17.0	19.6	22 2	24.8	27 4	30 (	32.6	135.2	37.9	40.5	43.1	45.7	48 3	50.91	53 5	56.1	58.8	61.4	64.0	66.6	69.2	71.8′	74.4	77.0′	79.6′	82.3	84.9
7.5"	18.2	21.0	23.8	26.6	29.4	32.2	2′ 35.0	37.8	40.6	43.4	46.2	48.9	51.7	54.5	57.3	60.11	62.91	65.7	68.5	71.3	74.1′	76.9	79.7	82.5	85.3	88.1	90.9
8.0"	19.4	22.4	25.4	28.3	131.3	34.0	31 37.3	40.3	43.3	46.2	49.2	52.2	55.2	58.2	61.2	64.2	67.1	70.1	73.1	76.1	79.1	82.11	85.0	88.01	91.0	94.0	97.0
8.5**	20.6	'23.8	126.9	1130.1	133.3	'36.	1*39.6	42.8	46.0	49.1	*52.3*	55.5'	58.6	61.8	65.0	68.2	71.3	74.5	77.7	80.8	84.0	87.2°	90.4	93.5	96.7	99.9	<b>1</b> 03.0
9.0''	21.8	25.2	28.5	31 9	35.2	38.0	6′ 41 9	45.3	48 7	52.0	55.4	58.7	62.1	65.4	68.8	72.2	75.5	78.9	82.2	85.6	88.91	92.3	95.7	99.01	102.4	105.7	1.109.11
9.5"	23.0	26.5	' 30.1	33.6	37.2	40.	7′ 44.3	47.8	51.3	54.9	58.4	62.0	65.5	69.1	72.6	76.2	79.7	83.2	86.8	90.3	93.9	97.4	101.0	104.5	108.1	111.6	′ 115.1′
10"	24.3	28.0	31.	7 35.4	39.2	42.	9' 46.6	50.4	54.1	57.8	61.5	65.3	69.0	72.7	76.5	80.2	83.9	87.7	91.4	95.1	98.9	102.6	106.3	110.0	113.8	117.5	121.2
11"	26.7	30.8	1 34.9	39 0	1 43.1	47.	2' 51.3	55.4	59.5	63.6	67.7	71.8	75.9	80.0	84.1	88.2	92.3	96.4	100.5	104.6	108.7	112.8	116.9	121.0	125.1	129.2	133.3
12"	29.1	133.5	38.0	) 42.5	47.0	151.	4' 55.9	60.4	64.9	69.3	3' 73.8'	78.3	82.8	87.3	91.7	96.2	100.7	105.2	109.6	114.1	118.6	123.1	127.5	132.0	136.5	141.0	145.5
12.5"	30.3	′ 34.9	1 39.6	6' 44.3	48.9	53.	6′ 58.2	62.9	67.6	72.2	?' 76.9'	81.6	86.2	90.9	95.5	100.2	104.9	109.5	114.2	118.9	123.5	128.2	132.9	137.5	142.2	146.8	151.5
13"	31.5	36.3	41.	2' 46.0	50.9	r 55.	7' 60.6	65.4	70.3	75.1	180.0	84.8	89.7	94.5	99.4	104.2	109.1	113.9	118.8	123.6	128.5	133.3	138.2	143.0	147.9	152.7	157.6
14"	33.9	1 39.1	44.	31 49.5	54.8	60.	0' 65.2	2′ 70.4	75.7	1 80.9	86.1	91.3	96.5	101.8	107.0	112.2	117.4	122.7	127.9	133.1	138.3	143.6	148.8	154.0	159.2	164.4	169.7
15.5"	37.5	7 43.3	49.	11 54.9	n° 60.7	" <b>66</b> .	4' 72.2	2' 78.0	83.8	89.6	s <sup>,</sup> 95.3	101.1	106.9	112.7	118.5	124.3	130.0	135.8	141.6	147.4	153.2	159.0	164.7	170.5	176.3	182.1	187.9

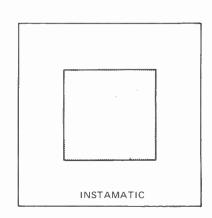
<sup>\*</sup>Use Available as 4.0" to 6.0" Zoom Lens

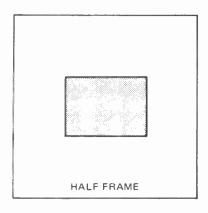


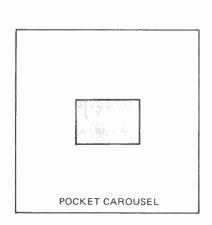
# DESIGNER'S PROJECTION CHARTS 2"x 2" and Lantern Slide Sizes

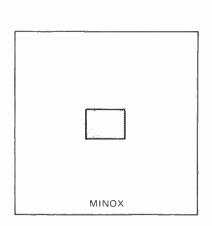








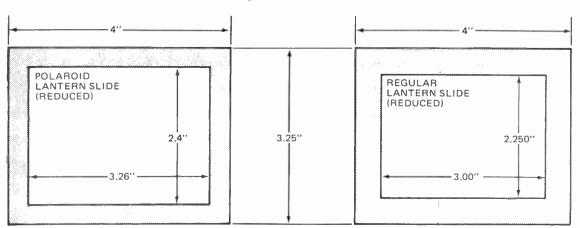




### CONSIDERATIONS WHEN FIGURING IMAGE AND SCREEN SIZES

If the slide is rectangular, will it be projected in both vertical and horizontal formats?

A rectangular slide projected to the same image size in both vertical and horizontal position will require a square screen but will not have a square image.





# TECHNICAL INFORMATION SHEET Projection Format Focal Length Formulas

DESCRIPTION	APERTU WIDTH (INCHE	1	APERTU HEIGH (INCHE	Т	ASPECT RATIO WIDTH/HEIGHT (INCHES)
8mm Motion Picture	.172		.129		1.33
Super 8 Motion Picture	.211		.158		1.33
16mm Motiom Picture*	.380		.284		1.33
16mm Cinemascope	.380×2	(A)	.284		2.66
126 Insta-Load Slides	.669		.500		1.34
35mm Motion Picture	.825		.600		1.375
35mm Cinemascope		(B)		(B)	2.34
35mm Filmstrip	.885		.668		1.32
2×2 Half Frame	.902		.626		1.44
2×2 Standard 35mm Double Frame Slide*	1.34	(C)	.902		1.49
2 x 2 Instamatic	1.043		1.043		1,00
2 x 2 Superslides	1.500		1.500		1,00
2¼ x 2¼ Slides	2.030		2.030		1.00
3% x 4 Lantern Slides	3.000	(C)	2.250	(C)	1.33
3¼ x 4 Polaroid	3.260		2.400		1.36
4×5	4.500		3.500		1.28
Overhead Projector	10.000		10.000		1.00
Overhead Projector	9.500	(D)	7.500	(D)	1.26
Television Projectors					1.33

### **ASPECT RATIO**

Aspect ratio is a convenient way to relate image width to image height.

Example: If you want to know the height of a 16mm image that is 5 feet wide, divide 5 by 1.33 (the aspect ratio) to get an image height of 3.76 feet. Or, if you had a 4 foot high screen to fill with a 16mm image and wanted to know how wide the screen must be, multiply 4 by 1.33 (the aspect ratio) to get an image width of 5.32 feet.

# DETERMINING FOCAL LENGTH

To determine the focal length of the lens required, given the projection distance and desired image width, use existing projection charts or use the simplified formula shown at the right. However, keep in mind that most projection charts and this formula are approximations; also that the distance is measured from some vague point called the "front of the lens". In very short throw situations, or with projectors using long focal length lenses, such as overhead projectors, slightly more sophis-

ticated formulas are needed.

If there is any problem in keeping inches and feet straight, simply convert both the image width and the distance into inches. Determined focal length will then be in inches too.

After calculating the required focal length you will probably find that it is a non standard lens. Choose the nearest lens and use the formulas at the right for recalculating the distance.

### (A) ANAMORPHIC

When calculating prime lens focal length for 16MM Cinemascope, use the value .760 as the aperature width. The actual width is .380, but the anamorphic attachment doubles the picture width without affecting the height.

### (B) 35MM MOTION PICTURES

35MM Motion Picture wide screen formats vary. The aspect ratio of 2.34 is most common. Check with Buhl for detailed data when 35mm motion pictures are involved.

### (C) 2x2 AND LANTERN SLIDES

Lantern slides and 2x2 slides are commonly described by the outside dimensions of the slide mount. But the actual projected opening can be one of several sizes. Be sure to work with the correct slide opening. With 2x2 slides consider whether both horizontal and vertical formats will be used.

### (D) OVERHEAD PROJECTORS

Overhead projectors are commonly a 10"x10" opening, but frequently use transparencies with a 7.5"x9.5" opening, usually only in the horizontal position.

Image Width = Image Height X Aspect Ratio

Image Height = Image Width Aspect Ratio

F = Focal Length
Of Lens In
Inches

D = Projection
Distance
In Feet

D =  $\frac{FXW}{A}$ A = Aperature
Width In
Inches

W =  $\frac{DXA}{F}$ W = Image Width
In Feet

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# 16mm PROJECTION CHART

FOCAL LENGTHS from .375" to 2.5" SCREEN WIDTHS from 24" to 14.5"

									SCR	EEN	WIDT	H in I	NCHE	S and	(DE	CIMA	LS) F	EET								
FOCAL LENGTH (INCHES)	24	30	36	42	48	54	60	66	72	78	84	90	96				10.0						13.0	13.5	14.0	14.5
0.375	24	30	36	41	47	53	59	65	71	77	83	89				,							12.9	13.4	13.9	14.4
0.500	32	39	47	55	63	71	79	87	95																	19.1
0.586	37	46	56	65	74	83		-	111																	- I
																										22.4
0.625	39	49	59	69	79	89	99	109	118	10.7	11.6	12.4	13.2	14.0	14.8	15.7	16.5	17.3	18.1	19.0	19.8	20.6	21.4	22.2	23.1	23.9
0.720	45	57	68	80	91	102	114	10.5	11.4	12.4	13.3	14.3	15.2	16.1	17.1	18.0	19.0	19.9	20.9	21.8	22.8	23.7	24.7	25.6	26.6	27.5
0.750	47	59	71	83	95	107	118	10.9	11.9	12.9	13.9	14.8	15.8	16.8	17.8	18.8	19.8	20.8	21.8	22.7	23.7	24.7	25.7	26.7	27.7	28.7
0.875	55	69	83	97	111	10.4	11.6	12.7	13.9	15.0	16.2	17.3	18.5	19.6	20.8	21.9	23.1	24.2	25.4	26.5	27.7	28.8	30.0	31.1	32.3	33.4
0.900	57	71	85	99	114	10.7	11.9	13.1	14.3	15.4	16.6	17.8	19.0	20.2	21.4	22.5	23.7	24.9	26.1	27.3	28.5	29.6	30.8	32.0	33.2	34.4
1.000	63	79	95	111	10.6	11.9	13.2	14.5	15.8	17.1	18.5	19.8	21.1	22.4	23.7	25.0	26.4	27.7	29.0	30.3	31.6	32.9	34.3	35.6	36.9	38.2
1.100	69	87	104	10.2	11.6	13.1	14.5	16.0	17.4	18.9	20.3	21.8	23.2	24.6	26.1	27.5	29.0	30.4	31.9	33.3	34.8	36.2	37.7	39.1	40.6	42.0
1.250	79	99	118	11.6	13.2	14.8	16.5	18.1	19.8	21.4	23.1	24.7	26.4	28.0	29.6	31.3	32.9	34.6	36.2	37.9	39.5	41.2	42.8	44.4	46.1	47.7
1.500	95	118	11.9	13.9	15.8	17.8	19.8	21.8	23.7	25.7	27.7	29.6	31.6	33.6	35.6	37.5	39.5	41.5	43.5	45.4	47.4	49.4	51.4	63.3	55.3	57.3
1.750	111	11.6	13.9	16.2	18.5	20.8	23.1	25.4	27.7	30.0	32.3	34.6	36.9	39.2	41.5	43.8	46.1	48.4	50.7	53.0	55.3	57.6	59.9	62.2	64.5	66.8
2.000	10.6	13.2	15.8	18.5	21.1	23.7	26.4	29.0	31.6	34.3	36.9	39.5	42.1	44.8	47.4	50.0	52.7	55.3	57.9	60.6	63.2	65.8	68.5	71.1	73.7	76.4
2.250	11.9	14.8	17.8	20.8	23.7	26.7	29.6	32.6	35.6	38.5	41.5	44.4	47.4	50.4	53.3	56.3	59.3	62.2	65.2	68.1	71.1	74.1	77.0	80.0	82.9	85.9
2.500	13.2	16.5	19.8	23.1	26.4	29.6	32.9	36.2	39.5	42.8	46.1	49.4	52.7	56.0	59.3	62.5	65.8	69.1	72.4	75.7	79.0	82.3	85.6	88.9	92.1	95.4

Because focal length tolerances and lens construction vary from model to model, a general projection chart assumes that the projection distance can be varied by at least (plus or minus) six inches.

When more precise measurements are required, Buhl will prepare a special detailed film plane-to-screen chart for a specific Buhl lens or lenses. Buhl is also prepared to specially select lenses to meet very exact screen width/distance relationships . . . query us for details.

# **NOTES:**



# Lens - Screen Size Charts

Tables prepared according to ANSI PH 7.6.

- Overhead and Opaque projection distances are measured from lens to screen.
- 2. All other projection distances are measured from film to screen.
- 3. Because of lens manufacturing tolerances, projection distances shown may vary 6 inches either way.

# HOW TO FIND EXACT SCREEN SIZE:

Aperture Width x Projection Throw in inches  $\div$  Lens Focal Length = width of screen needed. For example: Aperture .380" (16mm movie projector) x 320" (projection throw...desired distance from screen)  $\div$  2" (lens focal length) = a 60" screen.

WHR % width to height ratio 1 mm = .03937 inches 1 inch = 25.4 mm

16 mm MOTION P	ICTU	JRES	- APE	RTUR	E: .38	0" W	x .286	" H		SCI	WHR	: 1.33 /IDTH							
LENS FOCAL Length		40"	50"	60"	70″	84"	96"	9′	10′	12'	14'	16′	18′	20′	22′	24'	26'	28'	30′
12.7 mm - ½"		4.5	5.7	6.7	7.8	9.3	10.6	11.9	13.2	15.9	18.5	21.1	23.8	26.4	29.0	31.7	34.3	36.9	39.6
15.875 mm - 5/8"		5.6	7.0	8.3	9.7	11.6	13.3	14.9	16.6	19.8	23.1	26.4	29.7	33.0	36.3	39.6	42.9	46.2	49.4
19 mm - 3/4"	8	6.7	8.3	10.0	11.6	13.9	15.9	17.9	19.9	23.8	27.8	31.7	35.7	39.6	43.5	47.5	51.4	55.4	59.3
25.4 mm - 1"	.E	8.9	11.1	13.3	15.5	18.6	21.2	23.9	26.5	31.7	37.0	42.3	47.5	52.8	58.1	63.3	68.6	73.9	79.1
38.1 mm - 1½"	DC 8	13.4	16.7	20.0	23.3	27.9	31.8	35.8	39.7	47.6	55.5	63.4	71.3	79.2	87.1	95.0	102.9	110.8	118.7
50.8 mm - 2"	)1STB	17.9	22.3	26.7	31.0	37.2	42.4	47.7	53.0	63.5	74.0	84.5	95.1	105.6	116.1	126.6	137.2	147.7	158.2
63.5 mm - 2½"	160	22.3	27.8	33.3	38.8	46.5	53.0	59.6	66.2	79.4	92.5	105.7	118.8	132.0	145.2	158.3	171.5	184.6	197.8
69.85 mm - 23/4"	ecti	24.6	30.6	36.6	42.7	51.1	58.4	65.6	72.8	87.3	101.8	116.2	130.7	145.2	159.7	174.1	188.6	203.1	217.6
76.2 mm - 3"	9	26.8	33.4	40.0	46.6	55.8	63.7	71.6	79.4	95.2	111.0	126.8	142.6	158.4	174.2	190.0	205.8	221.6	237.3
88.9 mm - 3½"		31.3	39.0	46.6	54.3	65.1	74.3	83.5	92.7	111.1	129.5	148.0	166.4	184.8	203.2	221.6	240.1	258.5	276.9
101.6 mm - 4"		35.8	44.5	53.3	62.1	74.4	84.9	95.4	105.9	127.0	148.0	169.1	190.1	211.2	232.2	253.3	274.4	295.4	316.5

SUPER 8mm MO	TI	ON P	ICTU							′ H
LENS FOCAL Length		40"	50″	60"	5CRE	84"	96"	9'	1.33 10'	12′
12.7 mm - ½"		8.1	10.1	12.0	14.0	16.8	19.2	21.6	24.0	28.7
14:88 mm - %6"	~	9.0	11.3	13.5	15.7	18.9	21.5	24.2	26.9	32.3
17 mm - 41/4"	P.	10.8	13.5	16.1	18.8	22.6	25.8	29.0	32.2	38.6
18.5 mm - 4%4"	in e	11.8	14.7	17.6	20.5	24.6	28.1	31.6	35.1	42.0
19 mm - 3/4"	tanc	12.1	15.1	18.1	21.1	25.2	28.8	32.4	36.0	43.2
22 mm - 55/4"	Dis	14.0	17.5	21.0	24.4	29.3	33.5	37.6	41.8	50.1
25.4 mm - 1"	tion	16.1	20.1	24.1	28.1	33.7	38.4	43.2	48.0	57.6
27 mm - 11/4"	roje	17.1	21.3	25.5	29.8	35.7	40.8	45.8	50.9	61.0
28 mm - 13/2"	4	17.7	22.1	26.5	30.9	37.0	42.3	47.6	52.8	63.3
32 mm - 11/4"		20.3	25.3	30.4	35.4	42.4	48.4	54.5	60.5	72.6

	2″x 2″ 1	126			S	LIDES				W x 1.0	
- 1	LENS FO	CAL				SQUA	RE SC	REEN S	SIZE W	HR: 1.0	)
- 1	LENGTH		40"	50″	60′′	70′′	84"	96"	9'	10'	12'
-	1.4"		4.7	5.8	7.0	8.1	9.7	11.0	12.4	13.7	16.4
	2"		6.7	8.4	10.0	11.6	13.8	15.7	17.6	19.6	23.4
	3"		10.1	12.5	14.9	17.3	20.7	23.6	26.5	29.3	35.1
	4"		13.5	16.7	19.9	23.1	27.6	31.4	35.3	39.1	46.8
	5"	Fee	16.9	20.9	24.9	28.9	34.5	39.3	44.1	48.9	58.5
	6.5"	ii.	21.9	27.1	32.3	37.5	44.8	51.1	57.3	63.6	76.1
	7"	Distance	23.6	29.2	35.0	40.4	48.3	55.0	61.7	68.5	81.9
	8.5"		28.7	35.5	42.3	49.1	58.6	66.8	75.0	83.2	99.5
	9"	Projection	30.4	37.6	44.8	52.0	62.1	70.7	79.4	88.0	105.4
•	10"	roje	33.7	41.8	49.8	57.8	69.0	78.6	88.2	97.8	117.1
- '	11"	Δ.	37.1	45.9	54.7	63.5	75.9	86.5	97.0	107.6	128.8
	12.5"		42.2	52.2	62.2	72.2	86.2	98.3	110.3	122.3	146.3
	15.5"		52.3	64.7	77.1	89.5	106.9	121.8	136.7	151.6	181.4
	20"		67.5	83.5	99.5	115.5	138.0	157.2	176.4	195.7	234.1

2"x 2" D	001	BLE F	RAM	E — 3	35mn	n SLID	ES - A	PERTU	RE: 1.35	5" W x	.902" F	1		
LENS FOC	ΔI						SI	CREEN	WIDTH	WHR	: 1,49			
LENGTH		40"	50"	60"	70"	84"	96"	9'	10'	12'	14'	16'	18'	20′
1"		2.6	3.3	3.9	4.5	5.4	6.1	6.8	7.6	9.1	10.5	12.0	13.5	15.0
1.4"		3.7	4.6	5.4	6.3	7.5	8.5	9.6	10.6	12.7	14.8	16.8	18.9	21.0
2"		5.3	6.5	7.7	9.0	10.7	12.2	13.7	15.2	18.1	21.1	24.0	27.0	30.0
3"		7.9	9.8	11.6	13.5	16.1	18.3	20.5	22.7	27.2	31.6	36.1	40.5	44.9
4"		10.6	13.0	15.5	18.0	21.4	24.4	27.3	30.3	36.2	42.2	48.1	54.0	59.9
5"		13.2	16.3	19.4	22.4	26.8	30.5	34.2	37.9	45.3	52.7	60.1	67.5	74.9
5.5"	Feet	14.5	17.9	21.3	24.7	29.4	33.5	37.6	41.7	49.8	58.0	66.1	74.3	82.4
6"	Ē	15.8	19.5	23.2	26.9	32.1	36.6	41.0	45.5	54.3	63.2	72.1	81.0	89.9
6.5"	ance	17.1	21.2	25.2	29.2	34.8	39.6	44.4	49.2	58.9	68.5	78.1	87.8	97.4
7"	Dista	18.5	22.8	27.1	31.4	37.5	42.7	47.8	53.0	63.4	73.8	84.1	94.5	104.9
7.5"		19.8	24.4	29.0	33.7	40.2	45.7	51.3	56.8	67.9	79.0	90.1	101.3	112.4
8"	Projection	21.1	26.0	31.0	35.9	42.8	48.7	54.7	60.6	72.5	84.3	96.2	108.0	120.0
8.5"	9.	22.4	27.7	32.9	38.2	45.5	51.8	58.1	64.4	77.0	89.6	102.2	114.8	127.4
9"		23.7	29.3	34.8	40.4	48.2	54.8	61.5	68.2	81.5	94.8	108.2	121.5	134.8
9.5"		25.1	30.9	36.8	42.6	50.9	57.9	64.9	72.0	86.0	100.1	114.2	128.3	142.3
10"		26.4	32.6	38.7	44.9	53.5	60.9	68.3	75.8	90.6	105.4	120.2	135.0	149.8
12.5"		33.0	40.7	48.4	56.1	66.9	76.2	85.4	94.7	113.2	131.7	150.2	168.8	187.3
15.5"		40.9	50.5	60.0	69.6	83.0	94.4	105.9	117.4	140.4	163.3	186.3	209.3	232.2
20"		52.8	65.1	77.4	89.8	107.1	121.9	136.7	151.5	181.1	210.8	240.4	270.0	299.7

2"x 2" S	UPE	r sli	DES -	- APE	RTURE	: 1.5"						WHR: 1.0			
LENS FOC	AL						SQU		REEN						
LENGTH		40"	50"	60"	70"	84"	96"	9'	10′	12′	14'	16'	18'	20′	
1"		2.4	2.9	3.5	4.1	4.8	5.5	6.2	6.8	8.2	9.5	10.8	12.2	13.5	
1.4"		3.3	4.1	4.9	5.7	6.8	7.7	8.6	9.6	11.4	13.3	15.2	17.0	18.9	
2"		4.8	5.9	7.0	8.1	9.7	11.0	12.3	13.7	16.3	19.0	21.8	24.3	27.0	
3"		7.2	8.8	10.5	12.2	14.5	16.5	18.5	20.5	24.5	28.5	32.5	36.5	40.5	
4"		9.6	11.8	14.0	16.2	19.3	22.0	24.7	27.3	32.7	38.0	43.3	48.7	54.0	
5"		12.0	14.7	17.5	20.3	24.2	27.5	30.8	34.2	40.8	47.5	54.2	60.8	67.5	
5.5"	E	13.2	16.2	19.3	22.3	26.6	30.3	33.9	37.6	44.9	52.3	59.6	66.9	74.3	
6"	Ē	14.4	17.7	21.0	24.3	29.0	33.0	37.0	41.0	49.0	57.0	65.0	73.0	81.0	
6.5"	Distance	15.6	19.2	22.8	26.4	31.4	35.8	40.1	44.4	53.1	61.8	70.4	79.1	87.8	
7"	) at	16.7	20.6	24.5	28.4	33.8	38.5	43.2	47.8	57.2	66.5	75.8	85.2	94.5	
7.5"		17.9	22.1	26.3	30.4	36.3	41.3	46.3	51.3	61.3	71.3	81.3	91.3	101.3	
8"	Projection	19.1	23.6	28.0	32.5	38.7	44.0	49.3	54.7	65.3	76.0	86.7	97.3	108.0	
8.5"	5	20.3	25.0	29.8	34.5	41.1	46.8	52.4	58.1	69.4	80.8	92.1	103.4	114.8	
9"		21.5	26.5	31.5	36.5	43.5	49.5	55.5	61.5	73.5	85.5	97.5	109.5	121.5	
9.5"		22.7	28.0	33.3	38.5	45.9	52.3	58.6	64.9	77.6	90.3	102.9	115.6	128.3	
10"	1	23.9	29.5	35.0	40.6	48.4	55.0	61.7	68.3	81.7	95.0	108.3	121.7	135.0	
12.5"	1	29.9	36.8	43.8	50.7	60.4	68.8	77.1	85.4	102.1	118.8	135.4	152.1	168.8	
15.5"	1	37.1	45.7	54.3	62.9	74.9	85.3	95.6	105.9	126.6	147.3	167.9	188.6	209.3	
20"		47.9	58.9	70.1	81.2	96.7	110.0	123.4	136.7	163.4	190.0	216.7	243.4	270.0	

21/4"x21/4" SLIDES - APERTURE: 2.1875" W x 2.1875" H							WHR: 1.0							
ENS FOO	CAL	SQUARE SCREEN SIZE 40' 50' 60' 70' 84" 96" 9' 10' 12' 14'											18'	20′
LENGTH		40′′	50′′	60′′	70.	94	30	3.	10	12	14	16′	10	-20
5"		8.5	10.4	12.3	14.2	16.8	19.1	21.4	23.7	28.3	32.8	37.4	42.0	46.6
6.5"		11.0	13.5	16.0	18.4	21.9	24.9	27.8	30.8	36.8	42.7	48.6	54.6	60.5
7"	=	11.9	14.5	17.2	19.9	23.6	26.8	30.0	33.2	39.6	46.0	52.4	58.8	65.2
8.5"	tion in Feet	14.4	17.6	20.9	24.1	28.6	32.5	36.4	40.3	48.1	55.8	63.6	71.4	79.1
10"		17.0	20.8	24.6	28.4	33.7	38.3	42.8	47.4	56.5	65.7	74.8	84.0	93.1
12.5"	Project	21.2	25.9	30.7	35.4	42.1	47.8	53.5	59.3	70.7	82.1	93.5	100.8	116.4
15.5"	õ	26.3	32.2	38.1	44.0	52.2	59.3	66.4	73.5	87.6	101.8	116.0	130.1	144.3
20"		33.9	41.5	49.1	56.7	67.4	76.5	85.7	94.8	113.1	131.4	149.6	167.9	186.2
24"		40.7	49.8	58.9	68.1	80.9	91.8	102.8	113.8	135.7	157.6	179.6	201.5	223.4

35m LENS			FRA	ME F	ILM :	STRIF			URE: .	885" W	/ x .668 HR: 1.3			
LENG		40"	50"	60"	70"	84"	96"	9′	10′	12'	14'	16'	18'	20′
3"		11.8	14.6	17.5	20.3	24.2	27.6	31.0	34.4	41.2	48.0	54.7	61.5	68.3
4"	. 8	15.7	19.5	23.3	27.0	32.3	36.8	41.3	45.9	54.9	63.9	73.0	82.0	91.1
5"	c io	19.7	24.4	29.1	33.8	40.4	46.0	51.7	57.3	68.6	79.9	91.2	102.5	113.8
5" 6" 7"	961	23.6	29.3	34.9	40.6	48.5	55.2	62.0	68.8	82.4	95.9	109.5	123.0	136.6
7"	품	27.5	34.1	40.7	47.3	56.5	64.4	72.4	80.3	96.1	111.9	127.7	143.5	159.4
8"		31.5	39.0	46.5	54.1	64.6	73.7	82.7	91.7	109.8	127.9	146.0	164.0	182.1

ENS FOO	CAL						SCRE	EN W	IDTH				
ENGTH		50"	60"	70"	84"	96"	9′	10′	12'	14'	16'	18'	20′
6"		9.4	11.0	12.7	15.0	17.0	19.0	21.0	25.0	29.0	33.0	37.0	41.0
6.5"		10.1	11.9	13.7	16.3	18.4	20.6	22.8	27.1	31.4	35.8	40.1	44.4
8"		12.5	14.7	16.9	20.0	22.7	25.4	28.0	33.3	38.7	44.0	49.3	54.7
8.5"		13.3	15.6	18.0	21.3	24.1	26.9	29.8	35.4	41.1	46.8	52.4	58.1
10"	=	15.6	18.4	21.1	25.0	28.4	31.7	35.0	41.7	48.4	55.0	61.7	68.3
12"	in Feet	18.7	22.1	25.4	30.0	34.0	38.0	42.0	50.0	58.0	66.0	74.0	82.0
12.5"	ii.	19.5	23.0	26.4	31.3	35.4	39.6	43.8	52.1	60.4	68.8	77.1	85.4
14"	Distance	21.9	25.7	29.6	35.0	39.7	44.4	49.0	58.4	67.7	77.0	86.3	95.7
15"	Ď	23.4	27.6	31.7	37.6	42.5	47.5	52.5	62.5	72.5	82.5	92.5	102.5
15.5"	Projection	24.2	28.5	32.8	38.8	44.0	49.1	54.3	64.6	74.9	85.3	95.6	105.9
16"	90	25.0	29.4	33.8	40.1	45.4	50.7	56.0	66.7	77.4	88.0	98.7	109.3
18"	-	28.1	33.1	38.1	45.1	51.0	57.0	63.0	75.0	87.0	99.0	111.0	123.0
20"		31.2	36.8	42.3	50.1	56.7	63.4	70.1	83.4	96.7	110.0	123.4	136.7
22"		34.3	40.4	46.5	55.1	62.4	69.7	77.1	91.7	106.4	121.0	135.7	150.4
24"		37.5	44.1	50.7	60.1	68.1	76.1	84.1	100.0	116.0	132.0	148.0	164.0
26"		40.6	47.8	55.0	65.1	73.7	82.4	91.1	108.4	125.7	143.0	160.4	177.7

ENS FOC	AL.						SCREE		DTH		: 1.19		
LENGTH		50"	60"	70"	84"	96"	9′	10′	12'	14'	16'	18'	20′
10.5"		5.5	6.4	7.3	8.6	9.7	10.8	11.9	14.1	16.3	18.6	20.8	23.0
12.0"		6.3	7.3	8.4	9.8	11.1	12.4	13.6	16.2	18.7	21.2	23.7	26.3
12.5"	T a	6.5	7.6	8.7	10.3	11.6	12.9	14.2	16.8	19.5	22.1	24.7	27.4
12.75"	.E	6.7	7.8	8.9	10.5	11.8	13.1	14.5	17.2	19.8	22.5	25.2	27.9
13.5"	IICB	7.0	8.2	9.4	11.1	12.5	13.9	15.3	18.2	21.0	23.9	26.7	29.5
14.0"	Dista	7.3	8.5	9.8	11.5	13.0	14.4	15.9	18.9	21.8	24.7	27.7	30.6
15.5"	26	8.1	9.5	10.8	12.7	14.4	16.0	17.6	20.9	24.1	27.4	30.7	33.9
16.0"	Projection	8.3	9.8	11.2	13.1	14.8	16.5	18.2	21.5	24.9	28.3	31.7	35.0
22.0"	9	11.5	13.4	15.3	18.0	20.4	22.7	25.0	29.6	34.2	38.9	43.5	48.1
40.0"		20.9	24.4	27.9	32.8	37.0	41.2	45.4	53.9	62.3	70.7	79.1	87.5
50.0"		26.1	30.5	34.9	41.0	46.3	51.5	56.8	67.3	77.8	88.4	98.9	109.4

OPAQUE		TION	l— AP				10" H		٧	/HR: 1.0
LENS FOO	AL	50′′	60"	70"			8	10'	12'	
18"	58-	9.0	10.5	12.0	14.1	15.9	17.7	19.5	23.1	
22"							21.6			
26"	50.0	13.0	15.2	17.3	20.4	23.0	25.6	28.2	33.4	

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One of the best ways to lose audience attention during an audiovisual presentation is to project material that is not legible to the entire audience. If a speaker has to say, "You probably can't read this from where you're sitting, so I'll read it to you," the presentation suffers from too little advance planning.

# Planning Legibility of Projected Artwork

Once the objectives and the strategy of a talk have been planned, consideration can be given to the size of the anticipated audience, as well as to any unusual features of the projection facilities. Only then, should the artwork be designed. If a presentation is to be successful, original art must be prepared with the people in the rear seats in mind!

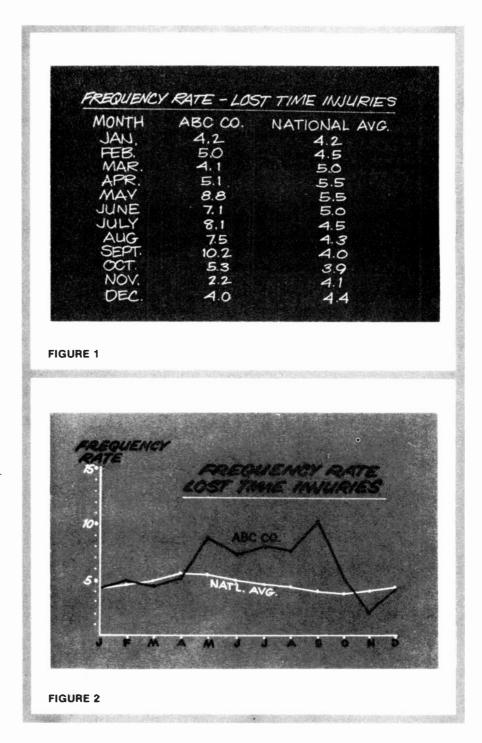
Experience has shown that:

- 1. Artwork can be planned and executed to permit the visuals to be legible when projected.
- 2. There are worthwhile advantages in establishing uniform sizes for artwork and making these sizes standard.
- 3. Although the letter height can ordinarily be a *minimum* of 1/50 the height of the information area, the use of a larger letter height (1/25 or larger) is strongly encouraged.
- 4. The use of a Legibility Calculator provides an easy way to determine the minimum artwork letter height needed for legibility at various viewing distances.

### **LEGIBILITY REQUIREMENTS**

To be legible, lines, letters, and symbols should contrast adequately with the background, there must be distinct separation of tones, and the colors selected should be strong and attractive. Tonal contrast is particularly important when preparing artwork for television where the television receiver may display the colored artwork in a black-and-white mode. Additional comments on this format are in the television section.

# LEGIBILITY—ARTWORK TO SCREEN



Letters and symbols should be bold and simple, with no small openings that will tend to fill in when projected. All elements such as lines, letters, symbols, and figures require a size big enough to be seen easily by everyone in the audience. Therefore, these elements have to be at least a certain minimum size on the screen, the size depending on the height of the artwork area in relation to its distance from the farthest viewer.

In typical viewing situations—screen-to-viewer distances ranging from short (in small conference rooms or in homes), through medium (in class and meeting rooms), to long



(in large auditoriums and theaters) the maximum viewing distance should be about 8 times the height of the projected image. To put it another way, if the projected material is legible for the farthest viewer. who is seated 8 times the projected image height from the screen, it will be legible for all other members of the audience. This maximum viewing distance (expressed as 8H) can be used in determining the minimum size of significant detail in the material to be projected.

# **Testing Existing Material** for Legibility

When material that was not designed for projection (printed graphs, charts, etc) is to be converted to a

projected visual, remember that contrast, colors, and viewing distance may change, but the requirements for legibility will remain the

Note that 8H viewing is a generally accepted standard. If the letter size suggested for 8H viewing is doubled. the projected image will be legible from twice the distance or 16H. The 8H concept also assumes average or slightly lower than average eyesight of the viewer. For 8H viewing, legibility can be judged by an average viewer by looking at the material to be copied from a distance 8 times its height. For example, consider a printed table that is to be photographed for projection. If the table is 3½ inches (88 mm) high, it should be viewed from 8 times that height (28 inches or 0.7 m) to see if it is readable. If it is, the type size will be suitable for copying and projection.

The same principle applies to larger work. A wall chart or a map 4 feet (1.2 m) high requires legibility at a distance of 32 feet (9.6 m) if it is to be acceptable as a projected image for 8H viewing (4 feet x 8H = 32 feet). If the material is not legible at the test distance, it should either be redrawn or discarded.

Subject content as well as image size affects legibility. If the work you are photographing is complex, reduce the information to the essential elements, limit the text, and enlarge the letter size. Rearranging the information can help define the point you are making for the audience. Notice the greater visual clarity of Figure 2, compared to Figure 1.

It is a mistake to believe that enlarging the physical dimensions of a transparency improves legibility at practical viewing distances. Transparency size is not a determining factor; it is the size of the detail on the screen that is significant. This is shown in Figure 3.

If letters are to be legible at an 8H viewing distance of 32 feet, a projected image 1 inch (25 mm) high on the screen is required whether projection is from a 2 x 2-inch (50 x 50 mm) slide or a 10-inch (250 mm) wide transparency on an overhead projector, regardless of the overall projected image size.

# BOTH PROJECTED IMAGES ARE 48 INCHES (1.2 m) HIGH 6.7" (170 mm) \*\*\*\*\*\*\*\*\*\* 6" (15 mm) MAXIMUM MAXIMUM LEGIBILITY LEGIBILITY DISTANCE DISTANCE 222 ft (6 m) (68 m) The letter "R" on each transparency is 1/8" (3 mm) high 135 SLIDE 10 x 10 inch (250 x 250 mm) OVERHEAD PROJECTOR LIGHT PROJECTION SOURCE TRANSPARENCY PROJECTOR LIGHT SOURCE FIGURE 3 COMPARISON OF LEGIBILITY DISTANCE OF SAME SIZE

# LETTER ON DIFFERENT SIZE TRANSPARENCIES

# **ADVANTAGES OF STANDARDIZATION**

# Layout and Preparation

We have indicated that a minimum size for lettering has been established to meet legibility requirements. But legibility is not the only requirement for effective communication; flexibility to allow emphasis and pleasing design are also important. Therefore, it will be wise to standardize on at least three letter sizes to provide proper treatment and a variety of titles-primary, secondary, and tertiary. The use of more than three sizes, all larger than the recommended minimum. allows even greater variety in artistic freedom. Of course, standardization of letter sizes is practical only when the format and overall size of the artwork are also standardized.



### **Cost Reduction**

The cost per hour of skilled professionals, such as artists and photographers, far outweighs the cost of materials. Therefore, the largest savings to be realized in the preparation of a visual presentation lies in reducing the time required to complete it. The standardization of format and size of artwork will pay the greatest dividends toward reducing costs. There are other benefits to standardization. One advantage is that the artist can work with a few standard, readily available pens, brushes, guides, and sizes of type. A feel for the size of lettering and artwork elements that will produce legibility can quickly be developed. Therefore, standardsize artwork becomes easier and faster to prepare than the alternative—an assortment of various sizes and shapes. Standard sizes simplify the stocking of mounting boards and paper stock. Making the artist's and photographer's jobs less time-consuming can increase productivity without increasing cost.

A standard field size for artwork and a specified location for the working area on the artwork can speed the photography and consequently increase the photographer's output. When working with artwork of random sizes and formats, the photographer must repeatedly adjust the camera-to-artwork distance, the focus, and the exposure settings. Conversely, it will be possible for the photographer to set lights, camera distance, focus, and exposure, only once for each complete assignment rather than once for each individual piece of artwork if the following conditions are met:

- 1. The artwork is all the same size.
- The working area of the artwork is of the same dimensions on every piece of art.
- 3. The working area is in an identical location on each piece of art.
- Provision is made for placing each piece of artwork in the same position on the copy stand.

# Storage and Retrieval

Adopting a uniform 10 x 12-inch (250 x 300 mm) artwork size—see below—offers savings in cost and

time. Storage of this size requires no expensive equipment of odd dimensions; letter-size office filing cabinets or desk drawers will serve. Artwork can be stored on edge, and segregated into categories with standard separators. The material is readily accessible; the possibility of damage or loss is reduced.

### ARTWORK SIZES AND FORMATS

It is possible to specify a single standard size for most artwork. If it is necessary to produce a larger or smaller piece of artwork, a different working area or "field size" will be needed. For example, if an existing drawing is to be used in a piece of art and it is too large to fit into the standard 6 x 9-inch (150 x 225 mm) working area, it is suggested that a larger working area be selected having the same height-to-width ratio as indicated in the format chart. The lettering will also have to be enlarged to meet the 1/50 rule. For example, if the working area is enlarged to 8 x 12 inches (200 x 300 mm), the letter size should be a minimum of 5/32 (4 mm) of an inch. For more unusual enlargements, consult the legibility calculator.

# **Mount Size**

The recommended primary standard for the artwork is 10 x 12 inches (250 x 300 mm). The working area sizes suggested in this pamphlet and the formats we suggest for typewritten copy (page 6) will fit this size mount. It accepts the common 8 x 10-inch (200 x 250 mm) photographic print. The mount allows a margin outside of the suggested working area to provide for safe handling, pin registration holes or field marks for camera alignment, production notations, and attachment of acetate cels or other types of overlays.

The usable area of the artwork, including the background, must fill a space somewhat larger than the information areas, if background edges are not to show when the visual is photographed. It is good practice to extend the usable area at least 1/2 inch (13 mm) beyond the information area on all sides. A better practice is to extend the usable area 1 inch (25 mm) beyond the information area.

# Construction and Use of the Artwork Template

To prepare the template, which will be used for each format, start with a 10 x 12-inch (250 x 300 mm) piece of lightweight card stock or heavy paper. Keeping the area centered within this card stock, mark off the dimensions of the section to be removed for the particular format that will be used, i.e., 6 x 9 inches (150 x 225 mm) for 35 mm slides. If artwork for more than one format is to be created, this is a good time to make a template for each one. To consistently align the artwork in the proper position for photography, construct an L-shaped guide against which the artwork can be placed. See Figures 4, 5, and 6. If these format/ size recommendations are adopted, it is necessary to observe only one minimum size requirement: for legibility of letters and of any significant artwork detail at 8H viewing distance, the letter or detail within the format area should have a minimum size of 1/50 of the information area

IMPORTANT: When using certain types of equipment such as the KODAK EKTAGRAPHIC Visualmaker or the copying stand mentioned in Kodak Pamphlet No. T-43, A Simple Wooden Copying Stand for Making Title Slides and Filmstrips, use the artwork area dimensions suggested for the apparatus at hand. The principles of legibility mentioned in this pamphlet, Legibility—Artwork to Screen, will still be



Typical materials for the three formats:

Figure 4 (height/width ratio 1:1)—2 x 2 slides with a square mask opening (26.5 mm, 30 mm, 38 mm, etc); 2%-inch square slides for 2%-inch square transparencies; and 3% x 4-inch slides with a 2% or 3-inch square mask opening.

Figure 5 (height/width ratio 2:3)—2 x 2 slides in a horizontal format made with a conventional camera, using 135 film (22.9 x 34.2 mm slide mask opening).

Figure 6 (height/width ratio 3:4)—motion pictures (super 8, 8 mm, 16 mm); size 110 slides ( $30 \times 30 \text{ mm}$  outside dimension and a 12 x 15.8 mm mask opening).



# Sizes of Letters, Symbols, and Lines

Letter size of lowercase characters is specified as the height of the letter excluding ascenders or descenders (the "tails" on p's, q's, b's, etc). When determining letter size or specifying it for artwork, measure the smallest letter to be used. Since the artwork height in Figures 4, 5, and 6 is 6 inches, letter height for 4H viewing is 1/16 inch (1.5 mm), for 8H viewing 1/8 inch (3 mm), and for 16H viewing 1/4 inch (6 mm).

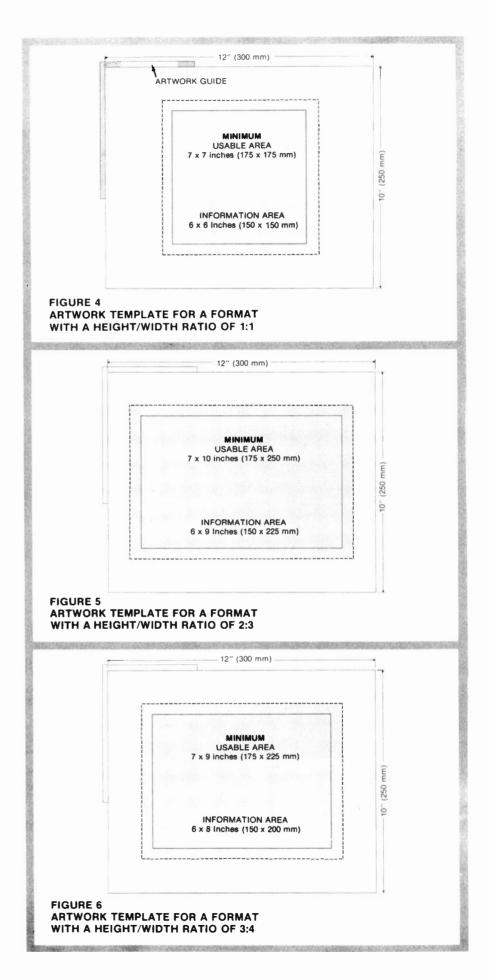
In no case should the specified minimum size be construed as a restriction on the use of larger sizes. Bolder or bigger treatment is often advantageous, e.g., to increase emphasis and strengthen impact.

When printer's type is being considered or specified, characters on a printed proof should be measured. Point sizes can be misleading; 18-point type may be suitable for capitalletter copy, but the same copy in lowercase can require the use of 24-point type. Typefaces also vary; 9-point might be suitable in one style, but not in another. Different point sizes of one type style are shown in Figure 7.

Dry-transfer lettering systems (Deca-Dry, Letraset, Prestype, etc) are sheets of letters that can be transferred to the artwork by burnishing. A wide selection of type styles is available in different point sizes, and most art supply stores have catalogs showing the letters in actual size.

# Legibility of Typewritten Copy

A typewriter offers one of the simplest and quickest means for producing legible copy. All that is required is the use of a smaller information area and close-up photography to include only this area. If the artwork information area to be used is 3 inches (75 mm) high and the legibility requirement is for 8H viewing, elite type in all capital letters is the smallest acceptable size. It is recommended that typewritten copy be restricted to the





information areas shown in Figure 8. As with other types of artwork the minimum usable area should extend somewhat beyond the information area. In the case of typewritten material a minimum usable area of at least an additional 1/4 inch (shown with dotted lines in Figure 8) on all four sides can be obtained by simply including more of the paper on which the message is typed. The 3-inch height provides 8H legibility for all copy from standard typewriters, including elite and pica type; yet it offers a large enough area for direct artwork for simple charts, graphs, and diagrams.

For the 3-inch-high (75 mm) format, copy should be limited to 9 double-spaced lines.

### SPECIAL APPLICATIONS

# Long-Distance Viewing (Large H Factors)

Material for small rear-projection cabinets, used in exhibits or point-of-sale situations, often is viewed from greater than normal distances. For applications of this type, a projected image as small as 8 inches (200 mm) in height may need to be readable at distances up to 20 or 25 feet (6 or 7.5 m), approximately 30H. It may be necessary to enlarge the size of lettering proportionally. In such a case, lettering should be at least four times larger than the mini-

### **8 POINT**

Printing has performed a role of achievement unparalleled in the revelation PRINTING HAS PERFORMED A ROLE OF ACHIEVEMENT UNPARALLELED Printing has performed a role of achievement unparalleled in the revelation PRINTING HAS PERFORMED A ROLE OF ACHIEVEMENT UNPARALLELED Printing has performed a role of achievement unparalleled in the revelation PRINTING HAS PERFORMED A ROLE OF ACHIEVEMENT UNPARALLELED

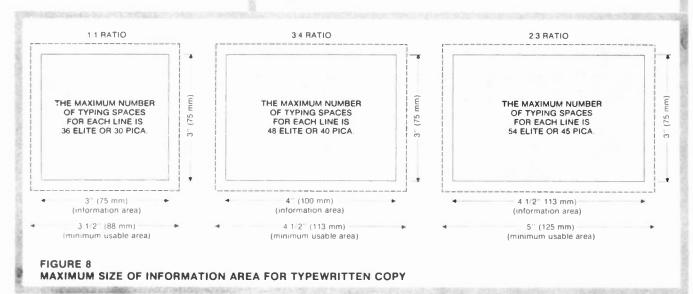
# 16 POINT

Printing has performed a role of achiev PRINTING HAS PERFORMED A ROLE Printing has performed a role of achiev PRINTING HAS PERFORMED A ROLE Printing has performed a role of achiev PRINTING HAS PERFORMED A ROLE

24 POINT

Printing has performed a PRINTING HAS PERFOR Printing has performed a PRINTING HAS PERFOR Printing has performed a PRINTING HAS PERFOR

FIGURE 7





mum for 8H viewing. For an artwork information area 6 inches (150 mm) high, the minimum letter height should be 1/2 inch (13 mm). Remember, however, that rear-projection cabinets used in study carrels may be viewed at only two or three times the screen height and that artwork for these situations can be sized to 2H or 3H requirements.

### **Television**

Television images are frequently viewed at distances greater than 8H. For example, an image only 12½ inches high (315 mm) on a 21-inch (533 mm) picture tube may often be viewed from 20—30 feet (7—9 m) in the home or in a classroom. Therefore, when material is being prepared for such use, legibility requirements for comparatively great viewing distances must

be considered as shown in Figure 9.\*

In addition, some area of the original transparency will be lost in the television chain and in the receiver. Figure 10 illustrates the 6 x 9-inch (150 x 225 mm) artwork area of a 35 mm slide with a safe title area mask for television placed over it. From this illustration it is clear how much visual area (shaded portion) may be lost in the television system. The amount lost is not always the same; it will vary with such things as receiver adjustment and line voltage. To help provide minimum loss, any essential information must be confined to a central area, as indicated in Figure 10. Even so, the usable portion of the art should extend to a minimum area of 7 x 10 inches (175 x 250 mm). Minimum letter height (lowercase character less ascender or descender) can be 1/4-3/8-inch (6-9 mm) shown in Figure 9. These letter heights allow 16H-24H viewing and provide legibility at distances of 18-24 feet  $(5.5-7.3 \,\mathrm{m})$ , 21-27 feet  $(6.4-8.2 \,\mathrm{m})$ .

and 23—30 feet (7—9.1 m) respectively from a 17-, 21-, or 25-inch (432, 533, or 635 mm) picture tube.

Where possible, it is recommended that the finished artwork be reviewed both in color and black-and-white on the telecine chain before being broadcast. This procedure will indicate any changes in the artwork (contrast, separation of tones, letter height, and color) needed to make it acceptable for broadcasting. If it is not practical, the artwork must be created to take these elements (of the artwork) into account. One color that reflects or transmits the same amount of light as another color will cause the two colors to appear as the same neutral tone on a black-and-white television receiver.

If the artwork is to be used for both TV transmission and regular projection, the lettering and title area

\*SMPTE Recommended Practice RP 27.3-1972, "Specifications for Safe Action and Safe Title Areas Test Pattern for Television Systems."

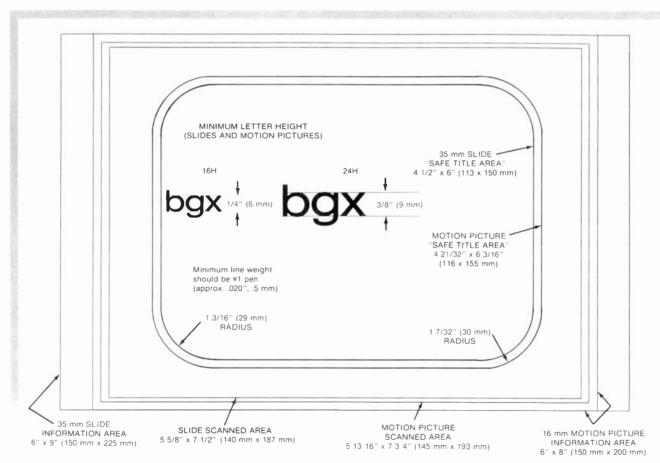


FIGURE 9
DIMENSIONS OF ARTWORK TEMPLATES FOR MATERIALS
USED IN THE TELEVISION SYSTEM

This illustration, which was drawn to scale, can be photographically enlarged and used for artwork templates



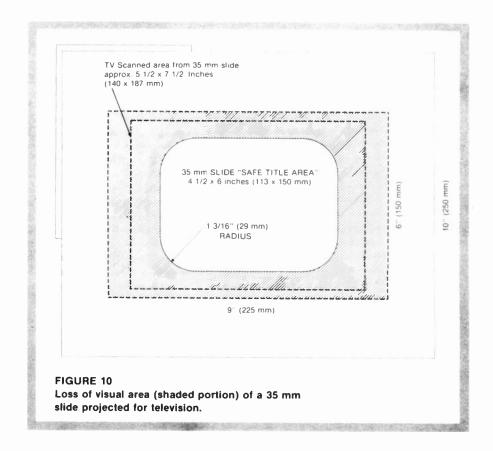
should be designed to meet the TV requirements. When the material is being photographed for a projection slide, an extreme close-up can be made so that unnecessary background will be eliminated.

# Legibility Calculator

The calculator is designed to help provide legibility of slides for the oft-forgotten person in the last row. It is based on the average legibility requirements and the standardization of artwork sizes as explained in the preceding pages.

Assembly of the calculator is a simple task. It is suggested that the entire page be dry-mounted or cemented to card stock before trimming. (A manila file folder is an example of suitable card stock.) Use care to trim the dial accurately and be sure the centers are aligned perfectly before you secure the dial to the base. If an eyelet grommet machine is not available to provide the center pivot, a tie tack or lapel pin would make a good substitute.

You will find the calculator a useful tool in determining the minimum artwork letter size that will be legible for the entire audience. Or the calculator can help to determine the proper screen size or farthest acceptable viewing distance when slides must be produced from existing artwork. For example, if you are utilizing a 6 x 9-inch working area and wish to fill a 4-foot-high screen that will be viewed from 64 feet-the distance from the screen to the last row in the auditorium-set a "Total Projected Image Height" of 4 feet at the 64-foot mark on the "Distance of Farthest Viewer" scale. You will notice that the "Minimum Artwork Letter Height" that lines up with 6 inches on the "Artwork Working Area Height" is 1/4 inch. If both upper- and lowercase letters are being used, the minimum height of the main body of the lowercase letters will therefore have to be at least 1/4 inch to be legible from the last row, as shown in Figure 11.



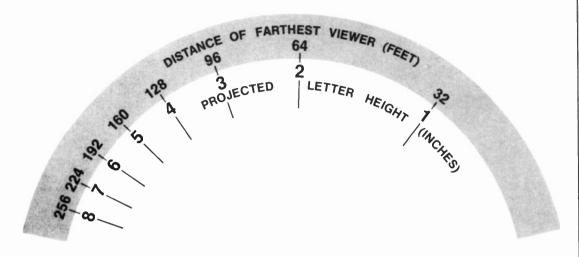
Another use of the calculator is to determine acceptable screen height when you are required to use existing art.

Assume you have a 6 x 9-inch (150 x 225 mm) piece of artwork on which the height of the lettering is only 1/8 inch (3 mm). Set the 1/8-inch mark at the 6-inch mark on the lower scale. Note that a screen image 8 feet high would be required for proper legibility from the last row of this same auditorium. Or, using a 4-foot-high screen, the farthest viewing distance would have to be limited to 32 feet (10 m), as shown on the "Distance of Farthest Viewer" scale

# 1/4" a=b=c=d == p=q=r=s=t 6" (6 mm) (150 mm) (225 mm) FIGURE 11

### More Information

Eastman Kodak Company supplies a variety of publications including several that contain helpful information on the subject of the preparation of effective audiovisual presentations. One device that may be particularly helpful is the *Television Graphics Production Template*, H-42. This template is based on SMPTE Recommended Practice RP27.3-1972 and is designed specifically for making slides and motion pictures or animation sequences from original artwork.



 $\bigoplus$ WORKING AREA HEIGHT

**Artwork Working Area** for 35mm Slides (6 x 9) Working Area for Typewritten Copy (Height 3 inches)



S TOTAL LEGIBII IT

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 $\oplus$ ELITE TYPEWRITER

Cut off page at fold. After mounting, cut at line and trim dial above CAREFULLY! See instructions.

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# **Acoustical Coupling**

There are two basically different methods of coupling sound from a headphone to the ear. The circumaural system requires a sound-tight seal around the whole outer ear, while the supraaural headphone rests loosely against the ear (Open-Aire Principle).

# Audio Frequency Condenser Microphone

Electret microphones from Sennheiser operate according to the audio frequency condenser microphone principle. A bias voltage of more than 100 V is "frozen" into the diaphragm permanently. This constant charge results into an alternating current, when the diaphragm is moved by impinging sound. An FET in the microphone amplifies the generated electrical signal and changes the impedance to a lower value. The audio output may now be processed in the same way as with a dynamic microphone.

# **Audio Frequency Range**

The human ear can register sound between approximately 16 Hz and 16,000 Hz. Ultrasound is the range above, infrasound below this spectrum. The conversion of sound vibrations into electrical signals is performed by transducers. Their characteristics should be even throughout the frequency range of interest.

# **Balanced Microphone Circuit**

Most professional sound equipment takes advantage of the balanced microphone connection technique. Both conductors from the microphone are symmetrical versus ground allowing long cable runs with only moderate shielding. Interference signals induced in the cable, such as hum and switching clicks will cancel in the input transformer of the following amplifier.

# **Cardioid Pattern**

A unidirectional microphone with a directional pattern resembling a heartshape, is called a cardioid microphone.

# dB Scale

To interpret a frequency response curve it is necessary to be able to

assess quickly the various ratios of measured values at different frequencies. In electroacoustics a logarithmic scale is used for this purpose. The unit is the Decibel (dB). For instance, two voltages having a ratio of 1:2 are said to be different by 6 dB. In our data sheets, all frequency response curves are registered on graph paper with a total hight of 50 dB, thus each step between lines represents 2 dB.

# **Directional Characteristic**

The directional characteristic of a microphone is the variation in response for different angles of sound incidence. The illustration on page 7 shows several typical Sennheiser microphones and their specific patterns. These are various types of directional microphones, those with a cardioid characteristic, those with supercardioid characteristic, the bidirectional microphone with its figure-8 pattern. In another design an interference tube is fitted in front of the microphone diaphragm. This results in a very directional microphone with an almost cone-shaped directional pattern (shotgun microphone). And then, there is of course the most basic type, the non-directional microphone, mostly called omni-directional.

# **Directivity Coefficient**

To facilitate the comparison between various microphones, the directivity coefficient was introduced. It states the relation between the power output of a non-directional microphone and a directional microphone of equal sensitivity in a diffuse sound field. For instance, an ideal cardioid microphone has a directivity coefficient of 3. Since the intensity of sound decreases as the square of the distance it follows that the cardioid microphone may be used at a distance of  $\sqrt{3} = 1.7$  times further than the non-directional microphone for the same amount of disturbing ambient noise.

### Directivity

To help in evaluating a microphone without the help of a polar pattern, the directional characteristic is often stated in form of a rejection figure. This figure in dB units indicates the

attenuation of sound inciding from an angle relative to the zero position. For supercardioid microphones the angel of best sound rejection is at 235°, for a cardioid microphone at 180°.

# Dynamic Microphone Dynamic Headphone

A dynamic microphone employs a diaphragm with an attached voice coil, moving in a strong permanent magnetic field. Sound waves striking the surface of the microphone cause the coil to be moved in the magnetic field, which generates a voltage corresponding to the sound pressure at the surface of the diaphragm.

All dynamic Sennheiser microphones have model numbers starting with MD.

In a dynamic headphone, the electrodynamic principle is reversed. An audio signal applied to the coil builds up a magnetic field which reacts with the permanent magnetic field, causing the diaphragm to move in and out correspondingly.

Dynamic headphones from Sennheiser have the letters HD in front of their model number.

# **Effective Output Level**

The microphone sensitivity rating is defined as the ratio in dB of the power available from the microphone relative to 0,001 Watt at a sound pressure level of 10 dynes per square centimeter.

# **Electret Condenser Microphone**

Electret microphones utilize the audio frequency condenser microphone principle. The basic difference to the conventional microphone of this type is that the electret microphone does not need an outside source for its bias. The flexible diaphragm consists of a metalized plastic foil with a permanent electrostatic charge, similar to a magnet having a permanent magnetic charge. Hence the name electret.

# **Electroacoustical Transducers**

Several different principles are used in microphones to convert acoustical into electrical energy:

 Resistance Control (carbon microphone)

- 2. Piezoelectric (ceramic and crystal microphone)
- 3. Electromagnetic (magnetic microphone)
- 4. Electrodynamic (dynamic microphone)
- 5. Electrostatic (condenser microphone)

Each one of these microphone types has its own merits and application. For example, the carbon microphone is still used in almost every telephone. On the other end of the spectrum is the condenser microphone, mainly employed in professional sound recording. Sennheiser manufactures magnetic, dynamic and condenser microphones.

# **Equivalent Noise**

A microphone in a completely quiet room will still generate some residual noise. With dynamic microphones this noise will be caused by thermal movements of electrons in the voice coil material. Condenser microphones have several different noise sources. The microphone's generated noise can be measured. Usually, a peak measuring instrument and a weighting filter are employed (DIN 45 405) to put the right emphasis on the most disturbing components of the composite noise. The so-called "equivalent noise" is now figured by taking the microphone's sensitivity into consideration and relating the value to the hearing threshhold of 2 x 10-4 μbar. The equivalent noise figure allows to compare different microphones directly without regard to the sensitivity. A more common way of evaluating the noise characteristics of a microphone is by stating the signal-to-noise ratio. Please refer to the paragraph Noise Voltage and S/N-Ratio.

# Free-Field Response (Microphone)

The free-field response of a microphone is defined as the open circuit voltage in mV generated by the microphone at its accessible terminals per undisturbed sound pressure in dyne/cm² at the specified frequency. The measurement is taken in a progressive plane sound wave at the microphone position prior to the introduction of the microphone, the microphone being placed at a specified angle with respect to the wave front. Recently it has become custom-

ary to relate the output voltage to 1 Newton/meter<sup>2</sup> = 1 Pa instead of to 1 dyne/cm<sup>2</sup>. The conversion is simple since 1 mV/dynes/cm<sup>2</sup> equals 10mV/Pa.

The free-field response value has little practical significance unless accompanied by a statement of the electrical impedance of the microphone.

# Frequency Range

Headphones and microphones have upper and lower frequency limits for their transducing capabilities. The useful frequency range is indicated in the technical data for each item.

# **Harmonic Distortion**

Sound reproducing devices such as loudspeakers and headphones may display certain inaccuracies with which the diaphragm follows the electrical audio signal. This causes new and undesirable overtones which are measured in percent distortion. For headphones, the distortion shall not exceed 1% at a sound pressure level of 94 dB SPL (DIN 45 500).

### **Headband Tension**

The wearing comfort of a headphone is mainly influenced by the weight of the headphone and even more by the mechanical pressure of the ear pads against the ears. This pressure is a function of the headband tension, expressed in ounces.

# Interference Transducer

Maximizing the directional coefficient of cardioid and supercardioid microphones is limited for physical reasons. For a further improvement of directional characteristics, it is however possible to attach an interference tube in front of the microphone's diaphragm. This tube has a large number of sound inlets distributed over the length of the tube. Each inlet is dampened in a specific way and this arrangement causes partial cancellation of the sound within the tube, depending on the angle of sound incidence. The microphones MKH 815 an MKE 801 employ such an interference tube and a directivity coefficient of 4 to 11 is achieved troughout the frequency range

# Magnetic Interference Rejection Strong magnetic fields may induce

undesirable voltages in the voice coil of dynamic microphones. The disturbing fields can mostly be found in the vicinity of power lines and power transformers. All Sennheiser dynamic studio microphones contain compensation coils for an effective cancellation of the induced noise voltages. The technical data contain a statement of the remaining incuced noise voltage when the microphone is placed in a strong magnetic field of  $5\mu$  Tesla at 50 Hz.

# **Magnetic Microphone**

Small an light microphones for the frequency range of the human voice can be built by attaching an armature of magnetically conductive material to a diaphragm. The armature is part of a magnetic circuit and changes the resistance of this circuit with the deflections of the diaphragm. The changing magnetic flux induces a signal voltage in a coil, surrounding the magnetic circuit. Magnetic microphones are mostly used in hearing aids.

# Microphone Connection Primer

This booklet is available on request and shows all cables and adaptors necessary to connect our microphones to European-made tape recorders.

# Microphone Impedance

The microphone impedance must be known for proper matching to amplifier or tape recorder inputs. The impedance is usually stated in Ohms for a frequency of 1,000 Hz. Dynamic microphones have mostly an impedance of 200 Ohms.

# Minimal Load Impedance

Microphones with built-in amplifiers can work into any load higher or equal to the minimal load impedance. In contrast to power amplifiers, the microphone will not be damaged by a short across its output terminals, but the frequency response will be impaired if the microphone has to work in a load lower than the minimum load impedance. Also dynamic microphones have a lower limit with regard to the load impedance.

# Noise Voltage and S/N Ratio

If you bring a microphone into a completely noisefree room and connect it to a very good amplifier, you will



notice a hiss or rustling sound which originates from the microphone. In dynamic microphones this noise is caused by the thermal agitation of electrons in the resistance of the moving coil of the microphone. In condenser microphones this noise derives from several sources.

The noise output of a microphone can be measured with a voltmeter and a weighting network to the DIN standard 45 405. The weighting network is an equalizer which has a frequency response which simulates the response of the human ear to attenuate sounds and enables the measuring instrument to give an indication of the subjective effect of the noise. The DIN standard requires the use of a peak reading measuring instrument to follow the weighting network.

Another method is given in IEC 179. Here the noise is measured with filter A and given as rms-voltage. This value is related to 94 dB SPL.

# **Nominal Frequency Response**

The nominal frequency response for each microphone is shown as a graph in the following technical descriptions. An individual microphone may have small deviations from the nominal frequency response, as indicated by the dashed lines for the maximum and the minimum of the output voltage versus the frequency.

# **Nominal Impedance**

For headphones, the nominal impedance is given for a frequency of 1,000 Hz. According to a standard classification (DIN 45 000), a headphone should have either  $8\Omega$ ,  $16\Omega$ ,  $200\Omega$ ,  $400\Omega$ ,  $600\Omega$ ,  $1,000\Omega$ ,  $2,000\Omega$  or  $4,000\Omega$ . The actual impedance shall not differ more than  $\pm$  30 % of the nominal values.

# **Nominal Load Impedance**

The nominal load impedance for a microphone indicates the optimum matching load which will utilize the microphone's characteristics to the fullest extent. In Europe most manufacturers develop their microphones for no-load-operation. In USA also power-matching is usual.

# **Output Level**

The reproduction volume of a head-B-246 phone is measured with a Type 4153 Bruel an Kjaer coupler with a power of 1 mW at 1,000 Hz into the headphone. According to DIN 45 500, the output level must exceed 94 dB SPL.

# **Overload Level**

Condenser microphones operate in a linear fashion up to a certain sound pressure (overload level) above which they will cause harmonic distortion. Dynamic microphones cannot be overload in practical applications.

# **Phasing**

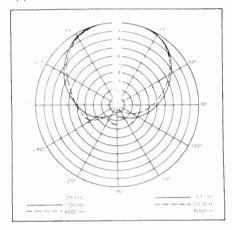
Correct phasing is important to the operation of any system employing, simultaneously, more than one microphone. Of the two terminals of a microphone transducer, the inphase terminal is the one which acquires a positive potential with respect to the other when the front of the microphone is subjected to a positive sound pressure wave. The inphase terminal is pin 2 on microphones equipped with XLR connector and pin 1 on microphones equipped with Tuchel connectors.

### Polar Diagram

The directional properties of microphones can be demonstrated by means of a polar diagram. The polar diagram shows the shape of the directional characteristic of the microphone (omni, cardioid, etc.). A microphone is placed in a sound field in an anechoic chamber at a fixed frequency and is rotated slowly. The relative sensitivity of the microphone for sound approaching it at varying angles is recorded. The sensitivity to sound on the axis of the microphone (0°) is taken as a reference of 1.0. The sensitivity of the microphone at any given angle is shown on the polar diagram by the distance of the response curve from the centre of the diagram.

For example, let us show you the polar diagram of the studio cardioid microphone MD 421. For the sake of clarity, the diagram is shown in two halves. Instead of plotting the six response curves all together, the response for 250 Hz, 1 kHz and 4 kHz are shown on the left half of the diagram and the response for 500 Hz,

2 kHz and 8 kHz are shown on the right-hand half on the diagram. Of course, each response curve would continue as a mirror image of the opposite half of the circle.



Polar Diagram MD 421

# Pressure Buildup

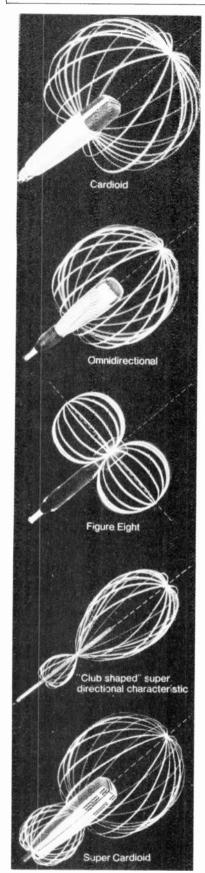
Sound impinging on the diaphragm directly from the front leads to reflections, noticeable at high frequencies, where the wave length is in the same order as the diaphragm diameter. These reflections cause a pressure buildup with a resulting broad peak in the frequency response. For sound arriving at the microphone from the side, reflections cannot build up. The picture below shows a typical frequency response for 0° and 90° incidence.

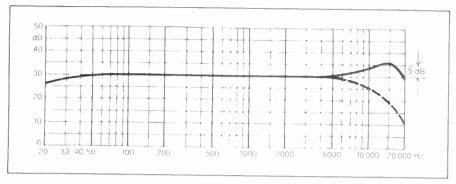
# **Pressure Gradient Transducer**

The diaphragm of a pressure gradient tranducer is moved by the resulting force of the pressure difference at the front and at the back of the diaphragm. It is therefore required to provide a path for the sound to the backside of the diaphragm. Special design procedures for the inside and outside sound passages make it possible to let the microphone react differently to sound from various directions. All unidirectional Sennheiser microphones make use of the pressure gradient principle.

# **Pressure Transducer**

The diaphragm of a pressure transducer microphone is activated directly by the sound pressure independent of the direction of sound incidence. Therefore, these microphones are sensitive to sound from all directions and display an omnidirectional characteristic.





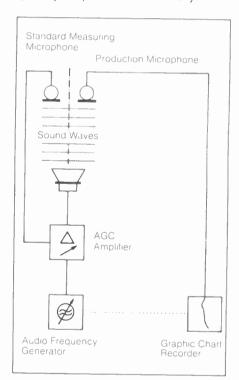
**Proximity Effect** 

This effect is not encountered in omnidirectional microphones. With pressure gradient microphones, however. an increase of low frequencies can be noted at distances of less than two feet. The pressure difference is related to the velocity which decreases with the square of the distance in the near field and directly proportional with the distance in the free field Since the distance at which the near field becomes a free field depends on the frequency, the near field is larger for low frequencies. This means practically that a pressure gradient microphone close to the mouth of a performer will be in the free field for high frequencies and in the near field for low frequencies. Thus, the low frequencies will be emphasized. Microphone models MD 421 and MD 441 contain bass controls to compensate for the proximity effect.

# **Response Curve**

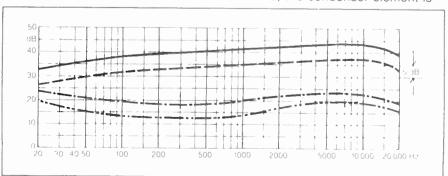
In order to record objectively a microphone's capacity to translate sound into electrical signals, a frequency response curve is drawn. It illustrates the variation of output voltage over the frequency range. The usual way of making the necessary measurements is shown in the illustration. The microphone under test is compared.

with a calibrated standard microphone in an anechoic chamber. The frequency is varied and a mechanically coupled graph recorder writes the frequency response automatically.



# RF-Condenser Microphone

Sennheiser studio condenser microphones do not use a dc-bias voltage. Instead, the condenser element is



part of a tuned RF-circuit, operating a 8 MHz. This frequency is generated inside the microphone by a crystal-controlled oscillator. The low element impedance at the high frequency and the crystal oscillator are the secret behind the unique high signal-to-noise ratio of our RF-condenser microphones.

# Response, Free-Field (Headphone)

The frequency response of a headphone is not as easily determined as compared to a microphone or loudspeaker. Although there are socalled artificial ears or couplers, measurements taken with help of these devices show little correlation to the subjective hearing sensation when wearing the headphones. For this reason, a comparison method was developed in which a group of at least eight test persons compare the volume of the headphone with known free-field sound source at different frequencies in 1/3 octave steps. This method offers reliable results between 50 and 12,000 Hz. In addition, the response as measured with a coupler, can be related to the test results obtained with the subjective method described.

# Sound Field

Near a source of sound, the sound waves travel in the shape of a sphere (near field). At a certain distance, the radius of the sphere has become so large that the sound propagation occurs in a practical parallel manner (free field). The sound pressure decreases proportional with the increasing distance from the sound source, while the velocity decreases with the square of the distance in the near field, and directly proportional in the free field.

# Sound Pressure

Any moving solid body generates air pressure waves, which are called sound pressure, if the movement happens at a rate within the audible frequency range. The sound pressure is measured in microbars which is approximately one millionth of the normal atmospheric pressure. Recent engineering standards suggest to measure the sound pressure in "Pascal" where 1 Pa equals 1 Newton per squaremeter respectively 10 microbars.

# **Super-Cardioid Characteristic**

The pressure gradient microphone with the best directivity coefficient of 4 is dubbed the hypercardioid. Its disadvantage, however, is the lack of rejection for sound coming directly from the back (180°). The rejection here is only 6 dB. Trying to optimize the directional characteristic, Sennheiser created the super-cardioid microphone with equal rejection at 90° an 180°. Still, a rather high directional coefficient of 3.86 could be obtained.

# **Unbalanced Microphone Circuit**

With this wiring arrangement, there is only one conductor, the "hot" audio lead. while the return path utilizes the cable shield, which is also grounded at the amplifier end. Sometimes there is a second conductor for the return path. This gives the advantage of making it possible to use the microphone either balanced or unbalanced. Also, the cable shield does not become part of the microphone circuit and eventual hum pickup of the shield will not lead to interference with the microphone signal.

# Velocity

This is the oscillating velocity of a given partical of the medium, with reference to the medium as the whole, due to the sound wave. The unit of measurement is centimeter per second. The velocity is not to be mistaken with the speed of sound.

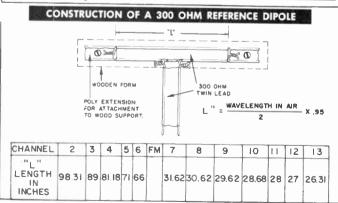
# **NOTES:**



# WIND VELOCITY VS. LOAD 80 40 40 20 40 60 80 100 120 140 WIND VELOCITY mi/h

# G HEAVY 1/2 TEMP MEDIUM 1/4 03 LIGHT 0 500

# DISTANCE TO HORIZON ANTENNA HEIGHT IN FEET ABOVE AVERAGE TERRAIN 7,000 ANTENNA HEIGHT IN FEET ABOVE AVERAGE TERRAIN 7,000 OFFICEL ABOVE AVERAGE TERRAIN 7,00



### dBm VOLTAGE CHART

	VC	DLTS		VOLTS		
dBm LEVEL	50: OHM	75 OHM	dBm LEVEL	50 OHM	75 OHM	
20	2.236	2.739	0	0.2236	0.2739	
19	1 993	2.441	- 1	0.1993	0.2441	
18	1 776	2.175	- 2	0.1776	0.2175	
17	1 583	1.939	- 3	0.1583	0.1939	
16	1 411	1.728	- 4	0.1411	0.1728	
15	1 257	1.540	- 5	0.1257	0.1540	
14	1 121	1.373	- 6	0.2110	0.1373	
13	0 9988	1.223	- 7	0.0999	0.1223	
12	0.8902	1.090	- 8	0.0892	0.1090	
11	0.7934	0.9718	- 9	0.0793	0.0972	
10	0.7071	0.8660	-10	0.0707	0.0866	
9	0 6302	0.7719	-11	0.0630	0.0772	
8	0 5617	0.6879	-12	0.0562	0.0688	
7	0 5060	0.6132	-13	0.0506	0.0613	
6	0 4461	0.5465	-14	0.0446	0.0547	
5	0.3976	0.4870	-15	0.0398	0.0487	
4	0.3594	0.4340	-16	0.0359	0.0434	
3	0.3158	0.3869	-17	0.0316	0.0387	
2	0.2815	0.3448	-18	0.0282	0.0345	
1	0.2508	0.3073	-19	0.0251	0.0307	
0	0.2236	0.2739	-20	0.0224	0.0274	

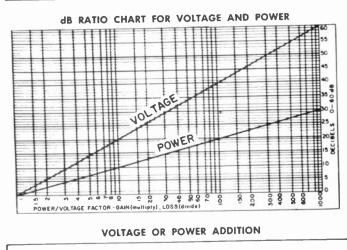
### dB TO VOLTAGE CONVERSION CHART

dB	MULTIPLY VOLTAGE BY	d8	MULTIPLY VOLTAGE BY	dB	MULTIPLY VOLTAGE BY
1	1.12	16	6.3	31	35
2	1.25	17	7	32	40
3	1.4	18	8	33	45
4	16	19	9	34	50
5	1.8	20	10	35	56
6	2	21	11	36	63
7	2.25	22	12.5	37	71
8	2.5	23	14	38	80
9	2.75	24	16	39	90
10	3 16	25	18	40	100
11	3.55	26	20	43	140
12	4	27	22.5	46	200
13	4.5	28	25	50	300
14	5	29	28	56	600
15	5.6	30	32	60	1000

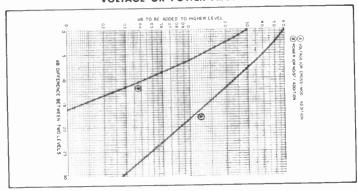
# dBmV TO VOLTAGE CONVERSION CHART REF: 0 dBmV = 1 mV measured across 75 ohms

	MEF: U G	OMA = I MA UM	pasured across /	2 ohms	
dBmV + VALUES*	VOLTAGE IN mV	dBmV +VALUES*	VOLTAGE IN mV	dBmV +VALUES*	VOLTAGE IN mV
1	1.12	16	6.3	31	35
2	1.25	17	7	32	40
3	1.4	18	8	33	45
4	1.6	19	9	34	50
5	1.8	20	10	35	56
6	2	21	11	36	63
7	2.25	22	12.5	37	71
8	2.5	23	14	38	80
9	2.75	24	16	39	90
10	3.16	25	18	40	100
11	3.55	26	20	43	
12	4	27	22.5	45	140
13	4.5	28	25		200
14	5	29	28	50	300
1.5	5.6	30		56	600
	5.5		32	60	1,000

<sup>&</sup>quot;To find negative values of dBmV, divide 1 mV by the voltage in mV.



### VOLTAGE OR POWER ADDITION



### TV CHANNEL DATA

		CA	RRIERS IN A	АНz	WAVE LENGTHS IN INCHES*			
СН	FREQ. RANGE IN MHz	VIDEO	COLOR	SOUND	AIR	JD COAX	JA COAX	
SUB-VHF	5.75-47.75	_	_	_	_	_	_	
T-7	5 75-11.75	7	10 58	11.5	_	1551	1366	
T-8	11.75-17.75	13	16.58	17.5	_	835	735	
T-9	17.75-23.75	19	22.58	23.5	_	571	503	
T-10	23.75-29.75	25	28.58	29.5	_	434	382	
T-11	29.75-35.75	31	34.58	35.5	_	350	308	
T-12	35.75-41.75	37	40.58	41.5	_	299	258	
T-13	41.75-47 75	43	46 58	47.5	-	252	222	
LO-VHF	54-88			_	_		_	
2	54-60	55.25	58 83	59.75	214	197	173	
3	60-66	61.25	64.83	65.75	193	178	156	
4	66-72	67.25	70.83	71.75	176	162	142	
5	76-82	77 25	80.83	81.75	153	141	124	
6	82-88	83 25	86.83	87.75	142	130	115	
FM	88-108	-	_	-	-	-	-	
MID-BAND	120-174	_	1 -			_		
A	120-126	121 25	124.83	125.75		89	79	
В	126-132	127 25	130 83	131.75		85	75	
Ç	132-138	133.25	136.83	137.75		81	71	
D	138-144	139.25	142.83	143.75		78	68	
E	144-150	145.25	148.83	149.75		74	65	
F	150-156	151.25	154.83	155.75		71_	63	
G	156-162	157.25	160 83	161.75		69	60	
Н	162-168	163.25	166 83	167.75	_	66	58	
1	168-174	169.25	172.83	173 75		64	56	

	FREQ.	CAR	RIERS IN N	\Hz	WAVE LENGTHS IN INCHES*			
'	RANGE					**	***	
СН	IN MHz	VIDEO	COLOR	SOUND	AIR	Polystyrene	Polyethylen	
SUP-BAND	216-300		_	-	_			
1	216-222	217.25	220.83	221.75	_	50	44	
К	222-228	223.25	226.83	227.75	_	48	42	
ı	228-234	229.25	232.83	233.75		47	41	
M	234-240	235.25	238.83	239.75	_	46	40	
N	240-246	241.25	244.83	245.75	_	45	39	
0	246-252	247.25	250.83	251.75		43	38	
P	252-258	253.25	256.83	257.75	_	42	37	
Q	258-264	259.25	262.83	263.75	_	41	36	
R	264-270	265.25	268.83	269.75	_	40	35	
s	270-276	271.25	274.83	275.75	-	39	34	
T	276-282	277.25	280.83	281.75	_	38	33.5	
U	282-288	283.25	286.83	287.75	-	38	33	
٧	288-294	289.25	292.83	293.75	-	37	33	
w	294-300	295.25	298.83	299.75	-	36	32	
UHF	470-890	-	i -	Ī —				
14	470-476	471.25	474.83	475.75	25	23	20.2	
20	506-512	507.25	410.83	511.75	23	21	18.6	
27	548-554	549.25	552.83	553.75	21.5	19.5	17.5	
35	596-602	597.25	600.83	601.75	20	18.2	16.2	
42	638-644	639.25	642.83	643.75	18.5	17	15	
50	686-692	687.25	690.83	691.75	17	15.5	13.7	
60	746-752	747.25	750.83	751.75	15.5	14	12.5	
70	806-812	807.25	810.83	811.75	14.5	13	11.7	

### TV FREQUENCY CHART

Picture   Carrier   Carr				IA LL	CECHOEL	101	CITA	<b>`</b> .		
Carrier   Carrier   Carrier   Carrier   R.F. OSC.   nel   Carrier   Carrie		81-4	Color	Sound	Receiver	Chan-	Picture	Color		
VHF TELEVISION FREQUENCIES   41   633.25   636.83   637.75   679   67.25   679.83   617.75   618.25   648.83   649.75   691   685.75   697   698.83   617.75   618.25   648.83   649.75   691   685.75   697   698.83   687.75   697   698.83   687.75   697   688.325   688.83   87.75   129   47   669.25   666.83   661.85   709   688.25   688.83   87.75   129   47   669.25   666.83   667.75   709   688.25   688.83   87.75   129   47   669.25   667.83   679.75   715.25   718.83   719.75   221   48   667.25   668.83   685.75   715   715.25   718.83   719.75   221   48   667.25   668.83   685.75   715   715.25   718.83   719.75   221   48   667.25   668.83   685.75   715   715.25   718.83   719.75   221   48   667.25   668.83   685.75   715						nel	Carrier			
## FILEVISION FREQUENCIES    2   55.25   58.83   59.75   101   42   639.25   642.83   643.75   685				Fred MH2	Freq. MHz		Freq. MHz	Freq. MHz	Freq. MHz	Freq. MHz
### TELEVISION FREQUENCIES*  2 55.25	NO.						000.05	626 02	627.75	679
2 55.25 58.83 59.75 101 43 643.25 648.83 649.75 691 4 67.25 70.83 71.75 113 45 657.25 654.83 655.75 697 5 77.25 80.83 81.75 129 46 651.25 660.83 661.85 703 6 83.25 86.83 87.75 129 47 669.25 660.83 667.75 709 6 83.25 86.83 179.75 221 47 669.25 678.83 673.75 715 7 175.25 178.83 179.75 221 48 675.25 678.83 679.75 721 8 181.25 194.83 185.75 227 49 681.25 678.83 679.75 721 9 187.25 190.83 191.75 233 50 687.25 690.83 691.75 733 10 193.25 196.83 197.75 239 51 693.25 696.83 697.75 733 11 199.25 202.83 203.75 245 52 699.25 702.83 703.75 745 12 205.25 208.83 209.75 251 53 705.25 708.83 709.75 751 13 211.25 214.83 215.75 257 547 711.25 714.83 715.75 757 14 471.25 480.83 481.75 523 58 735.25 726.83 721.75 763 16 483.25 486.83 487.75 529 59 741.25 720.83 733.75 775 17 489.25 492.83 493.75 535 60 747.25 750.83 739.75 781 18 495.25 498.83 499.75 541 61 753.25 756.83 757.75 793 18 495.25 52.83 523.75 547 62 759.25 762.83 763.75 805 20 507.25 510.83 511.75 553 63 765.25 768.83 757.75 793 18 495.25 52.83 523.75 565 67 772.25 774.83 775.75 805 21 513.25 516.83 517.75 559 67 772.25 774.83 775.75 805 22 519.25 528.83 529.75 571 66 773.25 798.83 793.75 811 23 515.25 528.83 529.75 571 66 773.25 798.83 793.75 805 24 531.25 540.83 511.75 559 67 772.25 774.83 775.75 805 25 537.25 540.83 557.75 565 67 772.25 786.83 775.75 805 26 507.25 510.83 511.75 559 67 772.25 786.83 775.75 811 27 549.25 522.83 523.75 566 67 772.25 786.83 793.75 811 28 552.55 528.83 529.75 571 66 789.25 798.83 799.75 811 29 510.25 504.83 505.75 587 667 772.25 804.83 805.75 841 20 507.25 508.83 589.75 601 71 813.25 844.83 805.75 847 21 513.25 564.83 587.75 697 22 519.25 528.83 529.75 577 67 880.25 804.83 805.75 847 23 525.25 528.83 529.75 577 67 880.83 897.75 883 33 585.25 588.83 589.75 601 71 813.25 844.83 835.75 899.75 841 34 591.25 504.83 505.75 607 72 819.25 828.83 899.75 891.35 899.75		VHF TE	LEVISION FI	REQUENCIES	1					
3 61.25 64.83 65.75 107 43 651.25 654.83 655.75 697 4 67.25 70.83 71.75 113 44 651.25 654.83 655.75 703 5 77.25 80.83 81.75 123 46 653.25 666.83 661.85 703 6 83.25 86.83 17.75 129 47 669.25 672.83 673.75 715 7 175.25 178.83 179.75 221 48 675.25 678.83 679.75 715 8 181.25 184.83 185.75 227 49 681.25 684.83 685.75 727 8 187.25 190.83 191.75 233 50 687.25 690.83 691.75 733 10 193.25 196.83 197.75 239 51 693.25 696.83 691.75 733 11 199.25 202.83 203.75 245 52 699.25 702.83 703.75 745 12 205.25 208.83 209.75 251 53 705.25 708.83 703.75 745 13 211.25 214.83 215.75 257 54 711.25 714.83 715.75 757  UHF TELEVISION FREQUENCIES 55 772.83 733.75 775 15 477.25 480.83 481.75 523 56 723.25 726.83 727.75 763 16 483.25 486.83 487.75 523 57 742.25 732.83 733.75 775 17 489.25 492.83 493.75 535 60 747.25 750.83 733.75 775 18 495.25 498.83 499.75 541 67 753.25 756.83 757.75 789 18 495.25 498.83 499.75 541 67 753.25 756.83 757.75 789 19 501.25 504.83 505.75 547 62 756.83 757.75 789 20 507.25 510.83 511.75 553 60 771.25 756.83 757.75 789 21 513.25 512.83 533.75 555 67 772.25 756.83 757.75 789 22 519.25 522.83 533.75 565 67 771.25 760.83 775.75 789 23 525.52 558.83 559.75 601 71 813.25 804.83 805.75 805 24 531.25 540.83 541.75 589 69 801.25 804.83 805.75 591.5 805 25 537.25 540.83 541.75 589 69 801.25 804.83 805.75 591.5 805 26 543.25 546.83 547.75 589 69 801.25 804.83 805.75 881 27 549.25 552.83 533.75 565 67 772.25 798.83 777.75 885 29 561.25 564.83 565.75 601 71 813.25 816.83 811.75 883 33 585.25 588.83 589.75 601 71 813.25 816.83 811.75 883 34 591.25 594.83 589.75 601 71 813.25 816.83 817.75 889 35 597.25 600.83 601.75 649 79 867.25 808.83 897.75 901 36 603.25 606.83 601.75 649 79 867.25 808.83 897.75 901 36 603.25 606.83 601.75 649 79 867.25 808.83 897.75 901 36 603.25 606.83 601.75 665 80 867.25 870.83 871.75 913 36 615.25 612.83 613.75 665 667 82 879.25 866.83 887.75 902	2	55.25	58.83	59.75	101					
4 67.25 70.83 71.75 113 45 657.25 660.83 661.85 703 5 77.25 80.83 81.75 129 47 669.25 666.83 667.75 709 6 83.25 86.83 87.75 129 47 669.25 672.83 673.75 715 7 175.25 178.83 179.75 221 48 675.25 678.83 673.75 721 8 181.25 194.83 181.75 227 49 681.25 684.83 685.75 727 9 187.25 190.83 191.75 233 50 687.25 690.83 691.75 733 10 193.25 196.83 197.75 239 51 693.25 696.83 697.75 739 11 199.25 202.83 203.75 245 52 699.25 702.83 703.75 745 12 205.25 208.83 209.75 251 53 705.25 708.83 709.75 741 13 211.25 214.83 215.75 257 54 711.25 714.83 715.75 757 14 471.25 474.83 475.75 517 57 729.25 732.83 733.75 775 15 477.25 480.83 481.75 523 58 735.25 738.83 739.75 781 16 483.25 486.83 487.75 529 59 741.25 744.83 745.75 787 17 489.25 492.83 493.75 535 60 747.25 750.83 751.75 793 18 495.25 498.83 499.75 541 61 753.25 756.83 757.75 793 19 501.25 504.83 505.75 547 62 759.25 756.83 757.75 799 20 507.25 510.83 511.75 553 63 765.25 768.83 775.75 873 22 519.25 522.83 529.75 571 66 788.25 798.83 799.75 811 23 13.25 516.83 517.75 559 64 771.25 774.83 775.75 823 24 531.25 534.83 555.75 577 67 789.25 780.83 779.75 813 25 537.25 548.83 599.75 571 66 788.25 798.83 799.75 811 26 533.25 566.83 577.75 589 69 801.25 804.83 805.75 829 26 533.25 546.83 559.75 577 67 789.25 786.83 779.75 823 27 549.25 522.83 529.75 571 66 788.25 792.83 799.75 811 28 555.25 528.83 559.75 577 67 789.25 804.83 807.75 829 29 561.25 504.83 565.75 589.76 67 777.25 780.83 781.75 829 24 531.25 534.83 555.75 587 67 789.25 828.83 829.75 811 27 549.25 549.83 599.75 571 66 788.25 792.83 799.75 841 28 555.25 558.83 559.75 601 71 813.25 848.83 897.75 889 29 561.25 564.83 565.75 607 788.25 879.88 83 829.75 811 20 507.25 508.83 599.75 601 71 813.25 848.83 887.75 889 29 561.25 564.83 567.75 667 82 879.25 884.83 887.75 907.88 30 567.25 508.83 599.75 601 71 813.25 848.83 829.75 871.75 889 30 567.25 508.83 599.75 607 788.25 888.83 829.75 887.75 889 30 567.25 508.83 599.75 607 788.25 888.83 829.75 897.75 899.75 897.75 899.75 897.75 899.75 897.75 899.75 897.75 899.75 897.75 899.75 897.75 8					107					
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8         181.25         184.83         185.75         227         49         681.25         684.83         687.75         727           9         187.25         190.83         191.75         233         50         687.25         690.83         691.75         733           10         193.25         196.83         197.75         239         51         693.25         690.83         691.75         733           11         199.25         202.83         203.75         245         52         699.25         702.83         703.75         745           12         205.25         208.83         209.75         251         53         705.25         708.83         703.75         745           13         211.25         214.83         215.75         257         54         711.25         714.83         715.75         751           14         471.25         474.83         475.75         517         57         720.83         721.75         763           15         477.25         480.83         481.75         523         58         735.25         738.83         739.75         781           16         483.25         498.83         499.75         <				179.75	221					
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THE PROPERTY OF THE VISION FREQUENCIES  UHF TELEVISION FREQUENCIES  14 471,25 474.83 475.75 517 57 729.25 726.83 721.75 763 723.25 726.83 721.75 769 723.25 726.83 721.75 769 723.25 726.83 721.75 769 723.25 726.83 721.75 769 723.25 726.83 721.75 769 723.25 726.83 721.75 769 723.25 726.83 721.75 769 723.25 726.83 727.75 769 723.25 726.83 727.75 769 723.25 726.83 727.75 769 723.25 726.83 729.75 775 781 781 783.25 782.83 783.75 775 781 783.83 729.75 781 783.83 729.75 781 783.83 729.75 781 783.83 745.75 787 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.83 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 775 783 783 783.75 783 783 783.75 783 783 783.75 783 783 783.75 783 783 783.75 783 783 783 783 783 783 783 783 783 783					251				709.75	751
UHF TELEVISION FREQUENCIES         55         717.25         720.83         721.75         763           14         471.25         474.83         475.75         517         57         729.25         726.83         721.75         769           15         477.25         480.83         481.75         523         58         735.25         738.83         739.75         781           16         483.25         486.83         487.75         529         59         741.25         744.83         745.75         787           17         489.25         492.83         493.75         535         60         747.25         750.83         757.75         787           18         495.25         498.83         499.75         541         61         753.25         756.83         757.75         799           19         501.25         504.83         505.75         547         62         759.25         762.83         763.75         899           20         507.25         510.83         511.75         559         64         771.25         786.83         769.75         811           21         513.25         534.83         535.75         577         67					257				715.75	757
UHF TELEVISION FREQUENCIES         56         723.25         726.83         727.75         769           14         471.25         440.83         471.75         517         57         729.25         732.83         733.75         775           15         477.25         480.83         481.75         523         58         735.25         738.83         739.75         781           16         483.25         492.83         493.75         529         59         741.25         744.83         745.75         781           17         489.25         492.83         499.75         541         61         753.25         756.83         751.75         793           18         495.25         498.83         499.75         541         61         753.25         756.83         751.75         793           19         501.25         504.83         505.75         547         62         759.25         762.83         763.75         805           20         507.25         510.83         511.75         553         64         771.25         774.83         769.75         811           21         513.25         516.83         517.75         559         64	10								721.75	763
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14 471.25 480.83 481.75 523 58 735.25 738.83 739.75 781 16 483.25 486.83 487.75 529 59 741.25 744.83 745.75 781 17 489.25 492.83 493.75 535 60 747.25 750.83 751.75 793 18 495.25 498.83 499.75 541 61 753.25 756.83 757.75 799 19 501.25 504.83 505.75 547 67 759.25 756.83 763.75 780 20 507.25 510.83 511.75 553 63 765.25 762.83 763.75 805 20 507.25 510.83 511.75 553 63 765.25 762.83 763.75 811 21 513.25 516.83 511.75 559 64 771.25 774.83 775.75 817 22 519.25 528.83 529.75 571 66 777.25 780.83 787.75 829 23 525.25 528.83 529.75 571 66 783.25 786.83 787.75 829 24 531.25 534.83 535.75 587 66 783.25 786.83 793.75 835 25 537.25 540.83 541.75 583 68 795.25 792.83 793.75 841 25 537.25 540.83 541.75 583 68 795.25 798.83 805.75 841 26 543.25 552.83 553.75 595 70 807.25 804.83 805.75 847 27 549.25 552.83 553.75 601 71 813.25 816.83 811.75 859 29 561.25 564.83 565.75 607 72 819.25 822.83 823.75 859 29 561.25 564.83 565.75 607 72 819.25 822.83 823.75 865 29 561.25 564.83 565.75 607 72 819.25 822.83 823.75 865 30 567.25 570.83 577.75 619 74 831.25 828.83 829.75 871 31 573.25 576.83 589.5 631 76 843.25 828.83 829.75 871 31 573.25 568.83 589.75 631 76 843.25 828.83 829.75 871 31 573.25 568.83 589.75 631 76 843.25 828.83 829.75 871 31 573.25 568.83 589.75 631 76 843.25 828.83 829.75 871 31 573.25 568.83 589.75 631 76 843.25 828.83 829.75 871 33 585.25 588.83 589.75 631 76 843.25 846.83 847.75 889 34 591.25 594.83 589.75 631 77 849.25 828.83 841.75 883 34 591.25 594.83 589.75 637 77 849.25 828.83 847.75 889 34 591.25 644.83 655.75 665 82 867.25 868.83 871.75 913 38 615.25 618.83 619.75 665 82 879.25 870.83 871.75 913 38 615.25 618.83 619.75 665 82 879.25 870.83 871.75 913 38 615.25 612.83 613.75 665 82 879.25 870.83 871.75 913									733.75	775
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25 537.25 546.83 547.75 589 69 801.25 804.83 805.75 847.25 26 543.25 552.83 559.75 601 71 813.25 816.83 817.75 859 829 561.25 564.83 565.75 607 72 819.25 828.83 823.75 865 829 561.25 564.83 565.75 607 72 819.25 828.83 823.75 865 829.75 871 813.25 816.83 817.75 859 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 828.83 829.75 871 815.25 840.83 851.75 883 841.75 883 845.25 845.85										
26 543.25 548.28 557.75 595 70 807.25 810.83 811.75 859 28 555.25 558.83 559.75 601 71 813.25 816.83 817.75 859 29 561.25 564.83 565.75 607 72 819.25 822.83 823.75 865 30 567.25 570.83 571.75 613 73 825.25 828.83 829.75 871 311 573.25 576.83 577.75 619 74 831.25 834.83 835.75 877 312 579.25 582.83 583.75 625 75 837.25 840.83 841.75 883 33 585.25 588.83 589.75 631 76 843.25 846.83 847.75 889 34 591.25 594.83 595.75 637 77 849.25 840.83 847.75 889 35 597.25 600.83 601.75 643 78 855.25 858.83 859.75 901 36 603.25 606.83 607.75 649 79 861.25 864.83 855.75 907 37 609.25 612.83 613.75 655 80 867.25 870.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 877.75 913 39 621.25 644.83 625.75 667 82 879.25 882.83 883.75 925										847
28 555.25 558.83 595.75 601 72 819.25 822.83 823.75 865 29 561.25 564.83 565.75 601 72 819.25 822.83 823.75 865 30 567.25 570.83 571.75 613 73 825.25 828.83 829.75 871 31 573.25 576.83 577.75 619 74 831.25 834.83 832.75 873 32 579.25 582.83 583.75 625 75 837.25 840.83 841.75 883 33 585.25 588.83 589.75 631 76 843.25 846.83 841.75 883 34 591.25 594.83 599.75 637 77 849.25 856.83 859.75 895 35 597.25 600.83 601.75 643 78 855.25 858.83 859.75 901 36 603.25 606.83 607.75 649 79 861.25 864.83 857.75 903 37 609.25 612.83 613.75 655 80 867.25 870.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 877.75 913 39 621.25 644.83 625.75 667 82 879.25 882.83 887.75 923										853
28 551.25 564.83 555.75 607 72 819.25 822.83 823.75 865 30 567.25 570.83 571.75 619 74 831.25 828.83 829.75 871 31 573.25 576.83 577.75 619 74 831.25 846.83 835.75 877 32 579.25 582.83 583.75 625 75 837.25 840.83 841.75 883 33 585.25 588.83 589.75 631 76 843.25 846.83 841.75 883 34 591.25 594.83 595.75 637 77 849.25 852.83 853.75 895 35 597.25 600.83 601.75 643 78 855.25 858.83 859.75 901 36 603.25 606.83 607.75 649 79 861.25 864.83 859.75 901 37 609.25 612.83 613.75 655 80 867.25 870.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 877.75 919 39 621.25 644.83 625.75 667 82 879.25 882.83 883.75 925										859
29 561.25 576.83 577.75 613 73 825.25 828.83 829.75 871 31 573.25 576.83 577.75 613 74 831.25 834.83 835.75 877 32 579.25 582.83 583.75 625 75 837.25 840.83 841.75 883 33 585.25 588.83 589.75 631 76 843.25 846.83 847.75 883 34 591.25 594.83 599.75 637 77 849.25 852.83 865.37 590.75 859.55 637 77 849.25 852.83 853.75 901 36 603.25 606.83 607.75 649 79 861.25 864.83 859.75 901 37 609.25 612.83 613.75 655 80 867.25 870.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 877.75 913 39 621.25 644.83 625.75 667 82 879.25 886.83 887.75 913										865
30										871
31 573.25 578.28 377.25 582.83 583.75 625 75 837.25 840.83 841.75 883 32 579.25 582.83 589.75 631 76 843.25 846.83 847.75 889 34 591.25 594.83 595.75 637 77 849.25 852.83 853.75 895 35 597.25 600.83 601.75 643 78 855.25 858.83 859.75 901 36 603.25 606.83 607.75 649 79 861.25 864.83 865.75 907 37 609.25 612.83 613.75 655 80 857.25 876.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 871.75 913 39 621.25 624.83 625.75 667 82 879.25 882.83 883.75 925									835.75	877
33 582.5 588.8 589.75 631 76 843.25 846.83 847.75 889 34 591.25 594.83 595.75 637 77 849.25 852.83 853.75 895 35 597.25 600.83 601.75 643 78 855.25 858.83 869.75 901 36 603.25 606.83 607.75 649 79 861.25 864.83 865.75 907 37 609.25 612.83 613.75 655 80 867.25 876.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 877.75 919 39 621.25 624.83 625.75 667 82 879.25 882.83 883.75 925										883
33 585.25 588.83 589.75 637 77 849.25 852.83 853.75 895 345 591.25 594.83 595.75 637 77 849.25 852.83 853.75 895 35 597.25 600.83 601.75 643 78 855.25 858.83 859.75 901 37 609.25 612.83 613.75 655 80 867.25 876.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 871.75 913 39 621.25 624.83 625.75 667 82 879.25 882.83 883.75 925										
35 597.25 600.83 601.75 643 78 855.25 858.83 859.75 901 36 603.25 606.83 607.75 649 79 861.25 864.83 865.75 907 37 609.25 612.83 613.75 655 80 867.25 870.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 877.75 919 39 621.25 624.83 625.75 667 82 879.25 882.83 883.75 925										
35 597.25 600.63 601.75 649 79 861.25 864.83 865.75 907 37 609.25 612.83 613.75 655 80 867.25 876.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 873.75 915 39 621.25 624.83 625.75 667 82 879.25 882.83 883.75 925										901
36 603.25 606.83 607.75 655 80 867.25 870.83 871.75 913 38 615.25 618.83 619.75 661 81 873.25 876.83 877.75 919 39 621.25 624.83 625.75 667 82 879.25 882.83 883.75 925										907
37 609.25 612.83 619.75 661 81 873.25 876.83 877.75 919 39 621.25 624.83 625.75 667 82 879.25 882.83 883.75 925										
38 615.25 618.83 619.75 667 82 879.25 882.83 883.75 925										919
39 621.25 624.83 625.75 667 62 675.25 666.63										
40 627.25 630.63 631.73 673 63 653.23 665.65										
	40	627.25	0,10.83	031.75	0/3	63	003.23			

<sup>\*</sup>All measurements at video carrier.
\*\*Polystyrene, velocity of propagation .92.
\*\*\*Polyethylene, velocity of propagation .81.



### FCC RADIATION STANDARDS

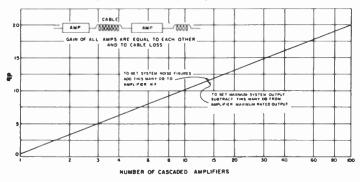
Maximum cable-system radiation level allowed by FCC standards. Values are in dBmV, as read on a peak-reading level meter using a cut, folded-diselegant parameters.

pore	antenna.						
`CH	LEVEL	CH	LEVEL	CH	LEVEL	СН	LEVEL
T7	20	6	-40	8	-46	0	-51
T8	-26	A	-43	9	46	P	-52
T9	29	В	-43	10	-46	Q	-52
T10	-32	c	-43	11	47	R	52
TII	-33	D	-44	12	47	S	-52
T12	-35	E	-44	13	-47	T	-52
T13	-36	F	-44	J	50	U	-52
2	-36	G	45	K	-50	V	-53
3	-37	н	-45	L	51	W	-53
4	-38	1	-45	M	-51		
5	-39	7	-46	N	-51		

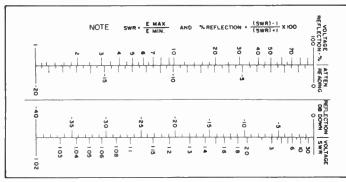
Values listed in table are to the nearest lower dB, based on formula

Cable attenuation or any other gain or loss device must be considered when measurements are made. From ch. 2 to ch. 13 and from ch. A to ch. I, measurements are made at 10 ft. All others are made at 100 ft. To permit all measurements to be made at 10 ft., subtract 20 dB from indicated reading for ch. 17 through T13 and ch. J through W.

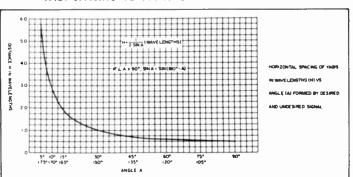
### CASCADED SYSTEM NOISE CHART



### **VSWR CHART**



### YAGI SPACING TO PHASE OUT UNWANTED SIGNALS



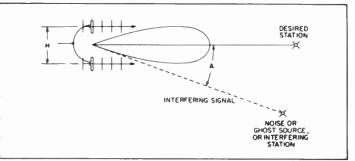
### PREFERRED UHF-TO-VHF CONVERSIONS

UHF	VHF	UHF	VHF
14	3, 8, 10, 12, 13	43	2, 3, 6, 9, 11, 12
15	3, 6, 7, 8, 10, 11, 12	44	2, 3, 4, 6, 8, 9, 10, 11, 12
16	2, 3, 6, 9, 11, 13	45	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
17	2, 6, 7, 9, 11, 12, 13	46	2, 3, 4, 5, 7, 8, 10, 11, 12, 13
18	5, 7, 8, 9, 10, 11, 12	47	2, 3, 4, 5, 7, 10, 12, 13
19	5, 7, 10, 12, 13	48	2, 5, 7, 8, 9, 11, 12, 13
20	4, 5, 7, 8, 10, 12, 13	49	2, 3, 4, 5, 7, 8, 9, 11, 12, 13
21	4, 5, 8, 9, 10, 11, 13	50	2, 3, 5, 7, 8, 11, 13
22	4, 5, 8, 11, 13	51	2, 7, 8, 10, 11, 13
22	4, 5, 8, 11, 13	52	2, 8, 9, 10, 12, 13
23	4, 5, 8, 9, 10, 11, 12, 13	53	2, 3, 4, 6, 8, 9, 10, 12
24	3, 4, 5, 6, 9, 12	54	2, 3, 4, 6, 8, 9, 12
25	3, 6, 8, 9, 12	55	2, 3, 4, 6, 8, 9, 11, 13
26	2, 3, 6, 9, 10, 11, 12, 13	56	2, 3, 4, 6, 7, 9, 10, 11, 13
27	2, 6, 7, 10, 13	57	2, 3, 4, 6, 7, 9, 10, 11, 13
28	6, 7, 10, 11, 13	58	2, 3, 4, 6, 7, 9, 10, 12, 13
29	6, 7, 10, 11, 12, 13	59	2, 3, 5, 6, 7, 9, 10, 11, 12
30	6, 7, 8, 11	60	2, 3, 4, 5, 7, 8, 10, 11, 12
31	6, 7, 8, 11, 12, 13	61	2, 3, 4, 5, 7, 8, 10, 11
32	4, 5, 7, 8, 11, 12, 13	62	2, 3, 5, 7, 8, 10, 11, 13
33	2, 4, 5, 8, 9, 12	63	2, 3, 5, 7, 8, 10, 11, 12, 13
34	2, 4, 5, 8, 9, 12, 13	64	2, 3, 4, 7, 8, 9, 11, 12, 13
35	2, 3, 4, 5, 7, 8, 9, 12, 13	65	2, 3, 4, 7, 8, 9, 11, 12
36	2, 3, 5, 7, 8, 9, 10	66	2, 3, 4, 5, 7, 8, 9, 11, 12
37	3, 5, 7, 9, 10, 13	67	2, 3, 4, 8, 9, 11, 12, 13
38	2, 8, 9, 10, 13	68	2, 3, 4, 6, 8, 9, 10, 12, 13
39	2, 3, 6, 8, 9, 10, 11	69	2, 3, 4, 5, 6, 8, 9, 10, 12, 13
40	6, 8, 10, 11	70	2, 3, 4, 5, 6, 8, 9, 10, 12, 13
41	6, 7, 10, 11	71	2, 3, 4, 5, 6, 7, 9, 10, 12, 13
42	2, 6, 7, 9, 10, 12	[l	

89.3 MHz	color beat on channel 7
89.5 MHz	
92.3 MHz	color beat on channel 8
92.5 MHz	
95.3 MHz	color beat on channel 9
95.5 MHz	
98.3 MHz	color beat on channel 10
98.5 MHz	
101.3 MHz	color beat on channel 11
101.5 MHz	
104.3 MHz	color beat on channel 12
104.5 MHz	
107.3 MHz	color beat on channel 13
107.5 MHz	

<sup>\*</sup>Possible color beat from 2XFM.

# HORIZONTAL SPACING OF YAGIS IN WAVELENGTHS (H) VS. ANGLE (A) FORMED BY DESIRED AND UNDESIRED SIGNALS



### CABLE ATTENUATION DATA

Nominal attenuation dB/100 feet at video carrier at 70°F.

표		POLYSTY	RENE		FOAM POLYETHYLENE			
CHANNEL	1.000"	.750"	.500"	.412"	.750"	.500"	.412"	
SUB-CH	ANNELS							
17	.092	.120	.181	.224	.139	.206	.264	
T8	.126	.165	.249	.307	.193	.284	.363	
T9	.154	.201	.303	.373	.236	.347	.441	
T10	.178	.232	.349	.430	.274	.401	.509	
TII	.200	.260	.390	.481	.308	.449	.570	
T12	.219	.285	.428	.527	.339	.493	.625	
T13	.219	.309	.463	.570	.369	.535	.677	
LO-BAN	D VHF CHA	NNELS and	FM					
2	.271	.352	.527	.649	.423	.610	.771	
3	.287	.372	.556	.685	.448	.646	.815	
4	.302	.391	.585	.770	.472	.679	.857	
5	.326	.421	.629	.775	.511	.733	.924	
6	.340	.438	.655	.806	.533	.764	.962	
FM								
93 MHz	.351	.457	.684	.842	.549	.791	1.000	
98 MHz	.361	.469	.702	.864	.563	.812	.1.027	
103 MHz	.370	.481	.720	.886	.578	.833	1.053	
08 MHz	.379	.492	.737	.907	.591	.853	1.078	
MID-BA	ND CHANN	ELS						
A	.419	.537	.801	.986	.663	.941	1.18	
В	.430	.552	.823	1.01	.682	.967	1.21	
С	.441	.566	.843	1.03	.700	.992	1.24	
D	.452	.580	.864	1.06	.719	1.01	1.27	
E	.463	.593	.884	1.08	.737	1.04	1.30	
F	.474	.607	.903	1.11	.755	1.06	1.33	
G	.485	.620	.923	1.13	.772	1.08	1.36	
н	.495	.633	.942	1.15	.790	1.11	1.39	
	.505	.646	.960	1.18	.807	1.13	1.41	
	D VHF CHA							
7	.515	.658	.979	1.20	.824	1.15	1.44	
8	.525	.671	.997	1.22	.841	1.18		
9	.535	.693	1.01	1.24	.857	1.20	1.50	
10	.545	.695	1.03	1.27	.873	1.22	1.55	
11	.555	.707	1.05	1.29				
12	.564	.719	1.06	1.31	.906	1.26	1.57	
13	.573 BAND CHAN	.730	1.08	1.33	.922	1.28	1.60	
J JUPER-	.583	.742	1.10	1.35	.937	1.31	1.63	
- K				1.37	.953	1.33	1.65	
	502							
	.592	.753	-1,11		968	1.35	1.68	
L	.601	.765	1.13	1.39	.968	1.35	1.68	
L M	.601 .610	.765 .776	1.13 1.15	1.39	.968 .984			
M N	.601 .610 .619	.765 .776 .787	1.13 1.15 1.16	1.39 1.41 1.43	.984 .999	1.37	1.70	
L M	.601 .610 .619	.765 .776 .787 .798	1.13 1.15	1.39	.984	1.37 1.39	1.70	
M N O P	.601 .610 .619 .628	.765 .776 .787 .798 .809	1.13 1.15 1.16 1.18 1.19	1.39 1.41 1.43 1.45	.984 .999 1.01	1.37 1.39 1.41	1.70 1.72 1.75	
M N O P Q	.601 .610 .619 .628 .637	.765 .776 .787 .798 .809	1.13 1.15 1.16 1.18 1.19 1.21	1.39 1.41 1.43 1.45 1.47	.984 .999 1.01 1.02	1.37 1.39 1.41 1.43	1.70 1.72 1.75 1.77	
L M N O P Q R	.601 .610 .619 .628 .637 .646	.765 .776 .787 .798 .809 .819	1.13 1.15 1.16 1.18 1.19 1.21	1.39 1.41 1.43 1.45 1.47 1.49	.984 .999 1.01 1.02 1.04 1.05	1.37 1.39 1.41 1.43	1.70 1.72 1.75 1.77 1.80	
L M N O P Q R	.601 .610 .619 .628 .637 .646 .654	.765 .776 .787 .798 .809 .819 .830 .841	1.13 1.15 1.16 1.18 1.19 1.21 1.22 1.24	1.39 1.41 1.43 1.45 1.47 1.49 1.51	.984 .999 1.01 1.02 1.04	1.37 1.39 1.41 1.43 1.45	1.70 1.72 1.75 1.77 1.80 1.82	
L M N O P Q R S T	.601 .610 .619 .628 .637 .646 .654 .663	.765 .776 .787 .798 .809 .819 .830 .841	1.13 1.15 1.16 1.18 1.19 1.21 1.22 1.24	1.39 1.41 1.43 1.45 1.47 1.49 1.51 1.53	.984 .999 1.01 1.02 1.04 1.05 1.07	1.37 1.39 1.41 1.43 1.45 1.47 1.49	1.70 1.72 1.75 1.77 1.80 1.82	
L M N O P Q R	.601 .610 .619 .628 .637 .646 .654	.765 .776 .787 .798 .809 .819 .830 .841	1.13 1.15 1.16 1.18 1.19 1.21 1.22 1.24	1.39 1.41 1.43 1.45 1.47 1.49 1.51	.984 .999 1.01 1.02 1.04 1.05	1.37 1.39 1.41 1.43 1.45 1.47	1.70 1.72 1.75 1.77 1.80 1.82 1.84	

### USEFUL FORMULAS

300 Wavelength in Meters (Air)  $=\frac{360}{\text{Freq. in MHz}}$ Wavelength in Feet (Air)  $=\frac{304}{\text{Freq. in MHz}}$ E (Volts) = I (Amps) x R (Ohms)

Power W (Watts) =  $\frac{E^2 \text{ (Volts)}}{R \text{ (Ohms)}}$ 

Temperature Conversion  $F^{\circ} = C^{\circ} \times \underline{9} + 32$ 

Ef (Field Intensity in Microvolts per Meter) = 0.021 E (Field Strength Meter Reading in Microvolts Using Reference Dipole) x f (frequency in MHz)

UHF Channels 14 to 83

Frequencies 470-890 MHz

To Find Center Frequency of Any UHF Channel

C.F. = 473 + 6 (Channel Number-14)

<b>=</b>			GAS INJE		video carrier at 70°F  AIR DIELECTRIC			
CHANNEL	2nd GE					-		
3	1.000"	.750"	.500"	.412"	1.000"	.750"	.500"	.412′
SUB-CH	ANNELS							
17	.115	.139	.202	.250	.100	.129	.196	.236
Т8	.156	.190	.275	.341	.136	.176	.266	.321
T9	.189	.230	.332	.412	.165	.213	.322	.388
T10	.216	.263	.381	.473	.189	.244	.370	.445
TII	.241	.293	.424	.527	.211	.272	.412	.496
T12	.263	.320	.464	.575	.230	.297	.450	.542
			-	.620		.321	.485	.584
T13	.284	.345	.500	.620	.248	.321	.405	.564
	ND VHF CH	1		1				
2	.322	.391	.567	.703	.281	.363	.549	.662
3	.339	.412	.597	.740	.296	.383	.578	.697
4	.355	.432	.625	.776	.310	.401	.606	.730
5	.381	.463	.670	.831	.332	.430	.650	.78
6	.395	.481	.696	.863	.345	.446	.674	.81:
93 MHz	.417	.508	.736	.912	.365	.471	.712	.85
98 MHz	.429	.522	.755	.936	.374	.484	.731	.88
03 MHz	.450	.535	.774	.960	.383	.496	.749	.90
08 MHz	.462	.548	.792	.983	.392	.508	.767	.92
	ND VHF CH	Τ	T	Т	T			
A	.477	.580	.839	1.041	.417	.538	.814	.98
В	.488	.594	.860	1.067	.427	.551	.844	1.00
С	.500	.608	.880	1.092	.437	.564	.853	1.02
D	.511	.622	.900	1.116	.446	.577	.872	1.05
E	.522	.635	.919	1.140	.456	.589	.891	1.0
F	.533	.648	.938	1.163	.465	.601	.909	1.09
G	.543	.660	.956	1.186	.474	.613	.927	-1.11
н	.553	.671	.974	1.208	.483	.625	.944	1.13
1	.563	685	.992	1.230	.492	.634	.962	1 = 1.15
	BAND VHF	T	1	r	1	1	1	1
	.573	.697	1.009	1.252	.501	.647	.978	- 1.17
8	.583	.709	1.026	1.273	.509	.658	.995	1.19
9	.592	.721	1.043	1.294	.518	.669	1.011	1.2
10	.602	.732	1.060	1.315	.526	.680	1.027	1.23
11	.611	.743	1.076	1.335	.534	.690	1.043	1.25
12	.620	.755	1.092	1.355	.542	.700	1.059	1.27
13	.629	.766	1.108	1.375	.550	.711	1.074	1.29
-	BAND VHF	1	1	1		1	,	
1	.638	.776	1,124	1.394	.558	.721	1.089	1.31
K	.647	.787	1.139	1.413	.565	.730	1.104	1.33
L	.656	.797	1.154	1.432	.573	.740	1.119	1.34
M	.664	.808	1.169	1.451	.580	.750	1.134	1.36
N	.673	.818	1.184	1,469	.588	.759	1.148	1.38
0	.681	.828	1,199	1.487	.595	.769	1.162	1,40
P	.689	.838	1.213	1.505	.602	.778	1.176	1.41
<u> </u>	.697	.848	1.228	1.523	.609	.787	1.190	1.43
R	.705	.858	1.242	1.540	.616	.796	1.203	1.45
<u>s</u>	.713	.867	1.256	1.558	.623	.805	1.217	1.46
U	.721	.877	1.269	1.575	.630	.814	1.231	1.48
v	.736	.896	1.297	1.608	.643	.831	1.257	1.5
w	.744	.905	1.310	1.625	.650	.840	1.270	1.53

### **USEFUL INFORMATION**

The ratio of the difference in attenuation in coaxial cable for any two frequencies carried by the cable is approximately the square root of the ratio of the two frequencies. Example: Lo-Channel 54 MHz, Hi-Channel 216 MHz, 216  $\div$  54  $\pm$  4;  $\sqrt{4}$   $\pm$  2 or the high channel has twice as much attenuation as the low channel.

# TECHNICAL DATA & INFORMATION

# **CONVERSION TABLES**

& INFORMATION			21101011 171		
To convert from	To	Multiply by	To convert from	To	Multiply by
Abamperes	Amperes	10.0000	Cubic centimeters	Liters	0.001
Abamperes	Statampere	2.998 x 10 <sup>10</sup>	Cubic centimeters	Pints (liquid)	2.113 x 10-3
Abcoulombs	Ampere-hours	2.778 x 10-3	Cubic centumeters	Quarts (liquid)	1.057 x 10-3
Abcoulombs	Coulombs	10,0000	Cubic feet	Bushels (dry)	0.8036
Abcoulombs	Faradays	$1.036 \times 10^{-4}$	Cubic feet	Cubic centimeters	2.832 x 10 <sup>4</sup>
Abcoulombs	Statcoulombs	2.998 x 10 <sup>10</sup>	Cubic feet	Cubic inches	1728
Abíarads	Farads	109	Cubic feet	Cubic meters	2.832 x 10 <sup>-2</sup>
Abfarads	Microfarads	1015	Cubic feet (US)	Cubic yards	3.704 x 10 <sup>-2</sup>
Abfarads	Statfarads	$8.988 \times 10^{20}$	Cubic feet	Gallons (liquid)	7.481
Abhenrys	Henrys	10-9	Cubic feet	Liters	28.316
Abhenrys	Microhenrys	0.001	Cubic feet	Pints (liquid)	59.84
Abhenrys	Millihenrys	10-6	Cubic feet	Quarts (liquid)	29, 922
Abhenrys	Stathenrys	1. 113 x 10 <sup>-21</sup>	Cubic hectometers	Cubic meters	106
Abohms	Megohms	10-15	Cubic inches	Bushels (dry)	4.6503 x 10 <sup>-4</sup>
Abohms Abohms	Microhms Ohms	0.001 10-9	Cubic inches	Cubic centimeters	16.39
Abohma	Statohms	1. 113 x 10 <sup>-21</sup>	Cubic inches	Cubic feet	5. 787 x 10 <sup>-4</sup>
Abvolts	Microvolts	0.01	Cubic inches	Cubic meters	1.639 x 10 <sup>-5</sup>
Abvolts	Millivolts	10-5	Cubic inches (US)	Cubic yards	2. 143 x 10 <sup>-5</sup> 4. 329 x 10 <sup>-3</sup>
Abvolts	Statvolts	3. 336 x 10 <sup>-1</sup>	Cubic inches	Gallons	1.639 x 10 <sup>-2</sup>
Abvolts	Volts	10-8	Cubic inches Cubic inches	Liters	$3.463 \times 10^{-2}$
Acres	Ares (square dekameters)	••	Cubic inches	Pints (liquid) Quarts (liquid)	1. 732 x 10 <sup>-2</sup>
Acres	Hectares	40.40073	Cubic meters	Bushels (dry)	28.38
2016	(square hectometers)	0.4046873	Cubic meters	Cubic centimeters	106
Acres	Square feet	4. 356 x 10 <sup>4</sup>	Cubic meters  Cubic meters	Cubic feet	35.31
Acres	Square inches	6, 272, 640	Cubic meters		6. 102 x 10 <sup>4</sup>
Acres	Square kilometers	4.047 x 10 <sup>-3</sup>	Cubic meters	Cubic inches	1. 308
Acres	Square meters	4047	Cubic meters	Cubic yards Gallons (liquid)	264.2
Acres	Square miles	$1.563 \times 10^{-3}$	Cubic meters	Liters	1000
Acres	Square rods	160	Cubic meters	Pints (liquid)	2113
Acres	Square yards	4840	Cubic meters	Quarts (liquid)	1057
Amperes	Abamperes	0.1	Cubic meters	Steres	1
Amperes	Milliamperes	1000	Cubic yards	Cubic centimeters	7.646 x 10 <sup>5</sup>
Amperes	Statamperes	2.998 x 109	Cubic yards	Cubic feet	27
Ampere-hours	Abcoulombs	360	Cubic yards	Cubic inches	46656
Ampere-hours	Coulombs	3600	Cubic yards	Cubic meters	0.7646
Ampere-hours	Faradays	$3.731 \times 10^{-2}$	Cubic yards	Gallons	202.0
Ampere-hours	Statcoulombs	$1.080 \times 10^{13}$	Cubic yards	Liters	764.6
Ares	Acres (US)	0.02471044	Cubic yards	Pints (liquid)	1616
Ares	Hectares	0.01	Cubic yards	Quarts (liquid)	807.9
Ares	Square feet	1076.4	Decimeters	Meters	0.1
Ares	Square meters	100	Decigrams	Grams	0.1
Ares	Square miles	$3.861 \times 10^{-5}$	Decisteres	Cubic meters	0.1
Ares	Square yards	119.60	Degrees	Circumferences	
Bushels (dry)	Cubic centimeters	3524 x 10 <sup>4</sup>		(revolutions)	2.778 x 10-3
Bushels (dry)	Cubic feet	1.2444	Degrees	Minutes	60
Bushels (dry)	Cubic inches	2150.4	Degrees	Quadrants	1. 111 x 10 <sup>-2</sup>
Bushels (dry)		3.524 x 10 <sup>-2</sup>	Degrees	Radians	$1.745 \times 10^{-2}$
Bushels (dry)	Liters	35.24	Degrees	Seconds	3600
Centimeters		3.281 x 10 <sup>-2</sup>	Degrees/second	Radians/second	1.745 x 10 <sup>-2</sup>
Centimeters	Inches	0.3937	Degrees/second	Revolutions/minute	0. 1667
Centimeters	Kilometers	10-5	Degrees/second	Revolutions/second	2.778 x 10 <sup>-3</sup>
Centimeters	Meters	0.01	Dekagrams	Grams	10
Centimeters	Mils	393.7	Dekameters Faradays	Meters	10
Centimeters		6.214 x 10 <sup>-6</sup>	,	Abcoulombs	9649 26.81
Centimeters	Millimeters	10 1.094 x 10 <sup>-2</sup>	Faradays Faradays	Ampere-hours	9.649 x 10 <sup>4</sup>
Centimeters			Faradays	Coulombs Statcoulombs	2.893 x 10 <sup>14</sup>
Centimeters/second Centimeters/second	Feet/minute	1.969 3.282 x 10 <sup>-2</sup>	Farads	Abfarads	10-9
Centimeters/second	Feet/second Kilometers/hour	0.036	Farads		106
Centimeters/second		0.0006	Farads	Microfarads Statfarads	8. 988 x 10 <sup>11</sup>
Centimeters/second	Kilometers/minute Knots	1.943 x 10 <sup>-2</sup>	Feet	Centimeters	30.48
Centimeters/second	Meters/minute	1.943 x 10 -	Feet	Inches	12
Centimeters/second	Meters/second	0.01	Feet	Kilometers	3.048 x 10 <sup>-4</sup>
Centimeters/second	Miles/hour	2.237 x 10 <sup>-2</sup>	Feet	Meters	0.3048
Centimeters/second	Miles/minute	3. 728 x 10 <sup>-4</sup>	Feet	Miles (nautical)	1.645 x 10 <sup>-4</sup>
Circular mils	Square centimeters	5.067 x 10 <sup>-6</sup>	Feet	Miles (statute)	1.894 x 10 <sup>-4</sup>
Circular mils	Square inches	7.854 x 10 <sup>-7</sup>	Feet	Mils	1.2 x 10 <sup>4</sup>
Circular mils		5.067 x 10 <sup>-4</sup>	Feet	Millimeters	304. 8
Circular mils	Square milis	0.7854	Feet	Millimeters Yards	0.3333
Coulombs	Abcoulombs	0.1	Feet/minute	Centimeter/second	0.5080
Coulombs	Ampere-hours	2.778 x 10 <sup>-4</sup>	Feet/minute	Feet/second	1.667 x 10 <sup>-2</sup>
Coulombs	Faradays	1.036 x 10 <sup>-5</sup>	Feet/minute	Kilometers/hour	1.829 x 10 <sup>-2</sup>
Coulombs		2.998 x 10 <sup>9</sup>	Feet/minute	Kilometers/second	3.048 x 10 <sup>-4</sup>
Cubic centimeters	Cubic feet	2. 998 x 10 <sup>7</sup> 3. 531 x 10 <sup>-5</sup>	Feet/minute Feet/minute	Kilometers/second Knots	9.868 x 10 <sup>-3</sup>
Cubic centimeters	Cubic inches	6. 102 x 10 <sup>-2</sup>	Feet/minute	Meters/minute	0.3048
Cubic centimeters	Cubic inches Cubic meters	10-6	Feet/minute Feet/minute	Meters/minute Meters/second	5.080 x 10 <sup>-3</sup>
Cubic centimeters	Cubic meters Cubic yards	1.308 x 10 <sup>-6</sup>	Feet/minute	Miles/hour	1. 136 x 10 <sup>-2</sup>
Cubic centimeters	Gallons (liquid)	2.642 x 10 <sup>-4</sup>	Feet/minute	Miles/minute	1. 894 x 10 <sup>-4</sup>
	Carrons (ridara)		~	***************************************	5/1 % 10

# **CONVERSION TABLES**

& INFORMATION					
To convert from	To	Multiply by	To convert from	To	Multiply by
	Centimeters/second	30.48	Kilometers/hour	Feet/second	0.9113
Feet/second	Feet/minute	60	Kilometers/hour	Kilometers/minute	$1.667 \times 10^{-2}$
Feet/second		1.097	Kilometers/hour	Knots	0.5396
Feet/second	Kilometers/hour Kilometers/minute	1.829 x 10 <sup>-2</sup>	Kilometers/hour	Meters/minute	16.67
Feet/second	Knots	0.5921	Kilometers/hour	Meters/second	0.2778
Feet/second Feet/second	Meters/minute	18.29	Kilometers/hour	Miles/hour	0.6214
Feet/second	Meters/second	0,3048	Kilometers/hour	Miles/minute	$1.036 \times 10^{-2}$
Feet/second	Miles/hour	0.6818	Kilometers/minute	Centimeters/second	1667
Feet/second	Miles/minute	1.136 x 10 <sup>-2</sup>	Kilometers/minute	Feet/minute	3281
Gallons (liquid)	Cubic centimeters	3785.	Kilometers/minute	Feet/second	54.68
Gallons (liquid)	Cubic feet	0.1337	Kilometers/minute	Kilometers/hour	60
Gallons (liquid)	Cubic inches	231	Kilometers/minute	Knots Meters/minute	32.38 1000
Gallons (liquid)	Cubic meters	$3.785 \times 10^{-3}$	Kilometers/minute	Meters/minute Meters/second	16.67
Gallons (liquid)	Cubic yards	$4.951 \times 10^{-3}$	Kilometers/minute Kilometers/minute	Miles/hour	37.28
Gallons (liquid)	Liters	3. 785	Kilometers/minute	Miles/moute	0.6214
Gallons (liquid)	Pints (liquid)	8	Kilowatt hours	Watt-hours	1000
Gallons (liquid)	Quarts (liquid)	4	Kilowatts	Watts	1000
Grains	Grams	6.480 x 10 <sup>-2</sup>	Knots	Centimeters/second	51.48
Grains	Kilograms	6.481 x 10 <sup>-5</sup>	Knots	Feet/hour	6080.20
Grains	Milligrams	64.81 2.286 x 10 <sup>-3</sup>	Knots	Feet/minute	101.3
Grains	Ounces (avoirdupois)	1.429 x 10 <sup>-4</sup>	Knots	Feet/second	1.689
Grains	Pounds (avoirdupois)	1.429 x 10 -	Knots	Kilometers/hour	1.853
Grams	Grains	6.480 x 10 <sup>-5</sup>	Knots	Kilometers/minute	$3.088 \times 10^{-2}$
Grams	Kilograms	64.80	Knots	Meters/minute	30.88
Grams	Milligrams Ounces (avoirdupois)	3.527 x 10 <sup>-2</sup>	Knots	Meters/second	0.5148
	Pounds (avoirdupois)	2.205 x 10-3	Knots	Miles/hour	1. 152
Grams Grams	Tons (long)	9.842 x 10 <sup>-7</sup>	Knote	Miles/minute	$1.919 \times 10^{-2}$
Grams	Tons (metric)	10-6	Liters	Bushels (dry)	$2.838 \times 10^{-2}$
Grams	Tons (short)	1, 102 x 10 <sup>-6</sup>	Liters	Cubic centimeters	1000
Hectares	Acres	2.471	Liters	Cubic'feet	$3.531 \times 10^{-2}$
Hectares	Acres	100	Liters	Cubic inches	61.02
Hectares	Square feet	1.076 x 10 <sup>5</sup>	Liters	Cubic meters	0.001
Hectares	Square meters	10000	Liters	Cubic yards	1.308 x 10 <sup>-3</sup>
Hectares	Square rods	$3.954 \times 10^{2}$	Liters	Gallons (liquid)	0.2642
Hectares	Square yards	11959.85	Mils	Millimeters	$2.540 \times 10^{-2}$
Hectograms	Grams	100	Mils	Yards	2.778 x 10 <sup>-5</sup>
Hectograms	Ounces (avoirdupois)	3.527	Minutes (angle)	Degrees	1.667 × 10 <sup>-2</sup>
Hectoliters	Liters	100	Minutes (angle)	Quadrants	1.852 x 10 <sup>-4</sup> 2.909 x 10 <sup>-4</sup>
Hectometers	Meters	100	Minutes (angle)	Radians Revolutions	2.909 x 10
Hectometers	Rods	19.88	Minutes (angle)		4.630 x 10-5
Hectometers	Yards	109.4		(circumferences)	4.630 x 10 °
Hectowatts	Watts	100 0.5	Minutes (angle)	Seconds	10,000
Hemispheres	Spheres Spherical right angles	4	Myriagrams	Grams	10,000
Hemispheres Hemispheres	Steradians	6.283	Myriagrams	Kilograms Kilometers	10
Henrys	Abhenrys	109	Myriameters Myriameters	Meters	10,000
Henrys	Microhenrys	106	Myriameters	Miles	
Henrys	Millihenrys	1000	Ohms	Abohms	6,21370 10 <sup>9</sup>
Henrys	Stathenrys	1. 113 x 10 <sup>-12</sup>	Ohm s	Megohms	10-6
Inches	Centimeters	2.540	Ohms	Microhms	106
Inches	Feet	$8.333 \times 10^{-2}$	Ohm s	Statohms	1.112 x 10 <sup>-</sup>
Inches	Kilometers	2.540 x 10 <sup>-5</sup>	Ounces (avoirdupois)	Grains	437.5
Inches	Meters	$2.540 \times 10^{-2}$	Ounces (avoirdupois)	Grams	28.35
Inches	Miles	1.578 x 10 <sup>-5</sup>	Ounces (avoirdupois)	Kilograms	2.835,x 10-4
Inches	Millimeters	25.40	Ounces (avoirdupois)	Milligrams	2.835 x 10 <sup>4</sup>
Inches	Mils	1000 2.778 x 10 <sup>-2</sup>	Ounces (avoirdupois)	Pounds (avoirdupois)	6.250 x 10
Inches	Yards		Ounces (avoirdupois)	Tons (long)	2.790 x 10
Kilograms	Grains	1.543 x 10 <sup>4</sup>	Ounces (avoirdupois)	Tons (metric)	2.835 x 10 <sup>-1</sup> 3.125 x 10 <sup>-1</sup>
Kilograms	Grams	1000	Ounces (avoirdupois)	Tons (short)	
Kilograms	Milligrams	106	Pints (liquid)	Cubic centimeters	473.2
Kilograms	Ounces (avoirdupois)	35.27	Pints (liquid)	Cubic feet	1.671 x 10 <sup>-7</sup> 28.87
Kilograms	Pounds (avoirdupois)	2.205	Pints (liquid)	Cubic inches	4.732 x 10
Kilograms	Tons (long) Tons (metric)	9.842 x 10 <sup>-4</sup> 0.001	Pints (liquid)	Cubic meters	6. 189 x 10
Kilograms Kilograms	Tons (metric) Tons (short)	1. 102 x 10 <sup>-3</sup>	Pints (liquid)	Cubic yards	0. 125
Kilograms Kiloliters	Gallons (liquid)	264. 18	Pints (liquid)	Gallons (liquid) Grains	7000
Kiloliters	Liters	1000	Pounds (avoirdupois)	Grams	453.6
Kilometers	Centimeters	105	Pounds (avoirdupois) Pounds (avoirdupois)	Kilograms	0.4536
Kilometers	Feet	3281	Pounds (avoirdupois) Pounds (avoirdupois)	Milligrams	4.536 x 10 <sup>5</sup>
Kilometers	Inches	3.937 x 10 <sup>4</sup>	Pounds (avoirdupois)	Ounces (avoirdupois)	16
Kilometers	Meters	1000	Pounds (avoirdupois) Pounds (avoirdupois)	Tons (long)	4.464 x 10
Kilometers	Miles (nautical)	0.5396	Pounds (avoirdupois)	Tons (short)	0.0005
Kilometers	Miles (statute)	0.6214	Quadrants	Degrees	90
Kilometers	Millimeters	106	Quadrants	Minutes	5400
Kilometers	Mils	$3.937 \times 10^{7}$	Quadrants	Radians	1.571
Kilometers	Yards	1094	Quadrants	Revolutions	
	Yards Centimeters/second	1094 27. 78	Quadrants	(circumferences)	0.25 3.24 x 10 <sup>5</sup>

# TECHNICAL DATA & INFORMATION

# **CONVERSION TABLES**

& INFORMATION		99:112			
To convert from	То	Multiply by	To convert from	То	Multiply by
Quarts (liquid)	Cubic centimeters	946.4	Saura an anatana	Saura leilane et aus	10-6
Quarts (liquid)	Cubic feet	3, 342 x 10 <sup>-2</sup>	Square meters Square meters	Square kilometers Square miles	3.861 x 10 <sup>-7</sup>
Quarts (liquid)	Cubic inches	57.75	Square meters	Square millimeters	106
Quarts (liquid)	Cubic meters	9. 464 x 10 <sup>-4</sup>	Square meters	Square millimeters	1. 196
Quarts (liquid)	Cubic yards	1.238 x 10 <sup>-3</sup>	Square miles	Acres	640
Quarts (liquid)	Gallons (liquid)	0.25	Square miles	Square centimeters	2.590 x 10 <sup>10</sup>
Radians	Circumferences	0.1591	Square miles	Square feet	2.788 x 10 <sup>7</sup>
Radians	Degrees	57.30	Square miles	Square inches	4.015 x 109
Radians	Degrees, minutes, seconds		•	Square kilometers	4.015 x 107
Radians	Minutes	3438	Square miles	-	2.590 x 10 <sup>6</sup>
Radians	Quadrants	0.6366	Square miles	Square meters	
Radians	Revolutions	0. 1591	Square miles	Square yards	3.098 x 106
Radians	Seconds		Square millimeters	Circular mils	1973
Radians/second	Degrees/second	2.063 x 10 <sup>5</sup>	Square millimeters	Square centimeters	0.01
Radians/second	•	57.30	Square millimeters	Square feet	1.076 x 10 <sup>-5</sup>
Radians/second	Revolutions/minute	9. 549	Square millimeters	Square inches	1.550 x 10 <sup>-3</sup>
Revolutions (circumferences)	Revolutions/second	0. 1592	Square millimeters	Square kilometers	10-6
Revolutions (circumferences)		360	Square millimeters	Square meters	
Revolutions (circumferences)		2. 16 x 10 <sup>4</sup>	Square millimeters	Square miles	$3.861 \times 10^{-13}$
Revolutions (circumferences)		4	Square millimeters	Square yards	1. 196 x 10 <sup>-6</sup>
Revolutions (circumferences)		6.283	Square rods	Acres	0.00625
Revolutions/minute		1.296 x 10 <sup>6</sup>	Square rods	Square feet	272.25
	Degrees/second	6	Square rods	Square inches	39204
Revolutions/minute Revolutions/minute	Radians/second	0.1047	Square rods	Square meters	25.293
	Revolutions/second	1.667 x 10 <sup>-2</sup>	Square rods	Square miles	9.766 x 10 <sup>-6</sup>
Revolutions/second Revolutions/second	Degrees/second	360	Square rods	Square yards	30.25
	Radians/second	6.283	Square yards	Acres	2.066 x 10-4
Revolutions/second	Revolutions/minute	60	Square yards	Square centimeters	8361
Seconds (angle)	Degrees	2.778 x 10 <sup>-4</sup>	Square yards	Square feet	9
Seconds (angle)	Minutes	1.667 x 10 <sup>-2</sup>	Square yards	Square inches	1296
Seconds (angle)	Quadrants	3.087 × 10 <sup>-6</sup>	Square yards	Square kilometers	$8.361 \times 10^{-7}$
Seconds (angle)	Radians	$4.848 \times 10^{-6}$	Square yards	Square meters	0.8361
Seconds (angle)	Revolutions	_	Square yards	Square miles	$3.228 \times 10^{-7}$
	(circumferences)	7.716 $\times$ 10 <sup>-7</sup>	Square yards	Square millimeters	8.361 x 10-5
Hemispheres	Spheres	2	Statamperes	Abamperes	3.335 x 10-11
Spherical right angles	Spheres	8	Statamperes	Amperes	3.335 x 10-10
Steradians	Spheres	12.57	Statcoulombs	Abcoulombs	$3.335 \times 10^{-11}$
Hemispheres	Spherical right angles	0.25	Statcoulombs	Ampere-hours	9.259 x 10-14
Spheres	Spherical right angles	0.125	Statcoulombs	Coulombs	3.335 x 10-10
Steradians	Spherical right angles	1.571	Statcoulombs	Faradays	3.457 x 10-15
Circuilar mils	Square centimeters	1.973 x 10 <sup>5</sup>	Statfarads (or centimeters)	•	1.112 x 10-21
Square decimeters	Square centimeters	0.01	Statfarads	Farads	1.112 x 10-12
Square feet	Square centimeters	$1.076 \times 10^{-3}$	Statfarads	Microfarads	1.112 x 10-6
Square inches	Square centimeters	0. 1550	Stathenrys	Abhenrys	8.988 x 10 <sup>20</sup>
Square kilometers	Square centimeters	10-10	Stathenrys	Henrys	8.988 x 10 <sup>11</sup>
Square meters	Square centimeters	0.0001	Stathenrys	Microhenrys	8.988 x 10 <sup>17</sup>
Square miles	Square centimeters	3.861 x 10 <sup>-11</sup>	Stathenrys	Millihenrys	8.988 x 10 <sup>14</sup>
Square millimeters	Square centimeters	100	Statohms	Abohms	8.988 x 10 <sup>20</sup>
Square yards	Square centimeters	1. 196 x 10-4	Statohms	Megohms	8. 988 x 10 <sup>5</sup>
Acres	-	2.296 x 10 <sup>-5</sup>	Statohms	Microhms	8. 988 x 10 17
Acres		9. 290 x 10 <sup>-4</sup>	Statohms	Ohms	8. 988 x 10 11
Circular mils		1.833 x 10 <sup>8</sup>	Statvolts		8. 988 x 10 1
			Statvolts	Abvolts	2.998 x 10 10
Square centimeters	Square feet	929.0		Microvolts	2.998 x 108
Square inches	-	144 9.290 x 10 <sup>-8</sup>	Statuels	Millivolts	2.998 x 10 <sup>5</sup>
Square kilometers			Statvolts	Volts	299.8
Square meters		9.290 x 10 <sup>-2</sup>	Steradians	Hemispheres	0.1592
Square miles		3.587 x 10 <sup>-8</sup>	Steradians	Spheres	7.958 x 10 <sup>-2</sup>
Square millimeters		9.290 x 10 <sup>4</sup>	Steradians	Spherical right angles	0.6366
Circular mils	Square inches	1.273 x 10 <sup>6</sup>	Steres	Cubic meters	1
equare centimeters		6.452	Steres	Liters	999. 973
Square feet		$6.944 \times 10^{-3}$	Tons (long)	Grams	1.016 x 10 <sup>6</sup>
-		6.452 x 10 <sup>-10</sup>	Tons (long)	Kilograms	1016
-		6.452 x 10 <sup>-4</sup>	Tons (long)	Milligrams	1.016 x 109
-		645.2	Tons (long)	Ounces (avoirdupois)	$3.584 \times 10^4$
Square yards	Square inches	7.716 x 10 <sup>-4</sup>	Tons (long)	Pounds (avoirdupois)	2240
		247.1	Tons (long)	Tons (metric)	1.016
Square centimeters	Square kilometers	10 10	Tons (long)	Tons (short)	1.120
Square feet	Square kilometers	1.076 x 107	Tons (metric)	Grams	106
Square inches		1.550 x 10 <sup>9</sup>	Tons (metric)	Kilograms	1000
		106	Tons (metric)	Milligrams	109
quare meters	Square kilometers				3.527 x 10 <sup>4</sup>
	_ •	0.3861	ions (metric)	Ounces (avoiraunnis)	
iquare miles	Square kilometers	0.3861 1012	Tons (metric) Tons (metric)	Ounces (avoirdupois) Pounds (avoirdupois)	
quare miles quare millimeters	Square kilometers Square kilometers	10 12	Tons (metric)	Pounds (avoirdupois)	2205
Square miles Square millimeters Square kilometers	Square kilometers Square kilometers Square yards	1. 196 x 10 <sup>6</sup>	Tons (metric) Tons (metric)	Pounds (avoirdupois) Tons (long)	2205 0.9842
Square miles Square millimeters Square kilometers Square meters	Square kilometers Square kilometers Square yards Acres	10 12 1. 196 × 10 <sup>6</sup> 2. 471 × 10 <sup>-4</sup>	Tons (metric) Tons (metric) Tons (metric)	Pounds (avoirdupois) Tons (long) Tons (short)	2205 0.9842 1.102
quare miles Square millimeters Square kilometers Square meters Square meters	Square kilometers Square kilometers Square yards Acres Acres	1. 196 × 10 <sup>6</sup> 2. 471 × 10 <sup>-4</sup> 0. 01	Tons (metric) Tons (metric) Tons (metric) Tons (short)	Pounds (avoirdupois) Tons (long) Tons (short) Grams	2205 0.9842 1.102 9.072 x 10 <sup>5</sup>
Square miles Square millimeters Square kilometers Square meters Square meters Square meters	Square kilometers Square kilometers Square yards Acres Acres Circular mils	10 12 1. 196 × 10 <sup>6</sup> 2. 471 × 10 <sup>-4</sup> 0. 01 1. 973 × 10 <sup>9</sup>	Tons (metric) Tons (metric) Tons (metric) Tons (short) Tons (short)	Pounds (avoirdupois) Tons (long) Tons (short) Grams Kilograms	2205 0.9842 1.102 9.072 x 10 <sup>5</sup> 907.2
Square miles Square millimeters Square kilometers Square meters Square meters Square meters Square meters Square meters	Square kilometers Square kilometers Square yards Acres Acres Circular mils Square centimeters	10 12 1. 196 × 10 <sup>6</sup> 2. 471 × 10 <sup>-4</sup> 0. 01 1. 973 × 10 <sup>9</sup> 10 <sup>4</sup>	Tons (metric) Tons (metric) Tons (metric) Tons (short) Tons (short) Tons (short)	Pounds (avoirdupois) Tons (long) Tons (short) Grams Kilograms Milligrams	2205 0.9842 1.102 9.072 x 10 <sup>5</sup> 907.2 9.072 x 10 <sup>8</sup>
Square miles Square millimeters Square kilometers Square meters Square meters Square meters	Square kilometers Square kilometers Square yards Acres Acres Circular mils	10 12 1. 196 × 10 <sup>6</sup> 2. 471 × 10 <sup>-4</sup> 0. 01 1. 973 × 10 <sup>9</sup>	Tons (metric) Tons (metric) Tons (metric) Tons (short) Tons (short)	Pounds (avoirdupois) Tons (long) Tons (short) Grams Kilograms	2205 0.9842 1.102 9.072 x 10 <sup>5</sup> 907.2

TE	CHNICA	L DATA
&	INFORM	ATION

# **CONVERSION TABLES**

To convert from	То	Multiply by	To convert from	To	Multiply by
Tons (short)	Tons (long)	0.8929	Yards	Feet	3
Tons (short)	Tons (metric)	0.9072	Yards	Inches	36
Volts	Abvolts	108	Yards	Kilometers	9. 144 x 10 <sup>-4</sup>
Volts	Microvolts	106	Yards	Meters	0.9144
Volts	Millivolts	1000	Yards	Miles	5.682 x 10 <sup>-4</sup>
Volts	Statvolts	$3.335 \times 10^{-3}$	Yards	Miles (nautical)	$4.934 \times 10^{-4}$
Watts	Horsepower	0.0013410	Yards	Millimeters	914.4
Watts	Kilowatts	0.001	Yards	Mils	$3.6 \times 10^4$
Yards	Centimeters	91.44	14143		

# TECHNICAL DATA & INFORMATION

# **TUBE LETTER SYMBOLS**

Ahf High frequency gain  Alf Low frequency gain  Av Voltage gain  Cc Coupling capacitor  Cd Distributed capacitance  Cgk Grid-to-cathode capacitance  Cgp Grid-to-plate capacitance  Ci Input capacitance  Ck Cathode bypass capacitor  Co Output capacitance  Cpk Plate-to-cathode capacitance  Cgs Shunt capacitance (Cd + Ci + Co)  Eb Plate volts (dc)  Eb Supply volts (dc)  Ebo Quiescent plate voltage  Ecl Control grid voltage	eglInstantaneous value of ac control grid volts eg2Instantaneous value of ac screen grid volts epoInstantaneous value of plate voltage above and below the quiescent value EgRMS value of grid volts EpRMS value of plate volts gmGrid-plate transconductance (mutual conductance) IbDC value of plate volts IboQuiescent value of plate current IclDC value of control grid current IfFilament or heater current	ib Instantaneous total value of plate current  icl Instantaneous total value of contro grid current  ic2 Instantaneous total value of screen grid current  ig1 Instantaneous ac value of control grid current  ig2 Instantaneous ac value of screen grid current  ip Instantaneous ac value of plate current  ip Instantaneous ac value of plate current  ip Instantaneous values of plate current above and below the quiescent value  Rb DC plate resistance
		ig2Instantaneous ac value of screen
Cnk Plate-to-cathode capacitance	(mutual conductance)	ipInstantaneous ac value of plate
$C_8$ Shunt capacitance $(C_d + C_i + C_o)$	$I_b \dots DC$ value of plate volts	current
	Ibo Quiescent value of plate current	ipo Instantaneous values of plate
		•
	•	
Ec2 Screen grid voltage	Igl RMS value of control grid current	Rg DC grid resistance
Ecc Control grid supply voltage	Ig2 RMS value of screen grid current	$R_k^{\circ}$ DC cathode resistance
Ef Filament terminal voltage	Igml Crest values of ac current control	RL Plate load resistance
ebInstantaneous total plate volts	grid	rpAC plate resistance
(ac and dc)	Igm2 Crest values of ac current screen	μ Amplification factor
eclInstantaneous total control grid	grid	
volts (ac and dc)	Ip RMS values of plate current	
ec2Instantaneous total screen grid	Ipm Crest value of plate current	
volts (ac and dc)	$I_s$ Total electron emission	

# TECHNICAL DATA & INFORMATION

# SEMICONDUCTOR LETTER SYMBOLS

GC 1141	Old Marie Total				
SIC	GNAL AND RECTIFIER DIODES	IR	Reverse current	I <sub>GT</sub>	Gate trigger current (continuous d.c.). The minimum d.c. gate current re-
PRV	Peak Reverse Voltage	$v_{R}$	Reverse test voltage		quired to cause switching from the 'off' state at a stated condition.
Io	Average Rectifier Forward Current		THYRISTORS AND SCRs	T	Holding current. That value of for-
Ir	Average Reverse Current			I HO	ward anode current below which the
I surge	Peak Surge Current	If	Forward current, r.m.s. value of forward anode current during the ''on' state.		controlled rectifier switches from the conducting state to the forward blocking condition with the gate open, at
$^{ m V}_{ m F}$	Average Forward Voltage Drop	I	Repetitive pulse current. Repetitive		stated conditions.
v <sub>R</sub>	D.c. Blocking Voltage	<sup>I</sup> FM(pulse)	peak forward anode current after application of gate signal for specified pulse conditions.	IHX	Holding current (gate connected). The value of forward anode current below which the controlled rectifier
	ZENER DIODES	7	Peak forward surge current. The		switches from the conducting state to
IF	Forward current	<sup>I</sup> FM(surge)	maximum forward current having a single forward cycle in a 60 Hz single-		the forward blocking condition with the gate terminal returned to the cathode terminal through specified
I Z	Zener current		phase resistive load system.		impedance and/or bias voltage.
$I_{ZK}$	Zener current near breakdown knee	I FOM	Peak forward blocking current, gate open. The maximum current through	P <sub>F(AV)</sub>	Average forward power, Average
IZM	Maximum D.c. zener current (limited by power dissipation)		the thyristor when the device is in the "off" state for a stated anode-to-	1(A+)	value of power dissipation between anode and cathode.
I ZT	Zener test current		cathode voltage (anode positive) and junction temperature with the gate	P	Peak gate power. The maximum in-
v <sub>f</sub>	Forward voltage		open.	PGFM	stantaneous value of gate power dissi- pation permitted.
$v_z$	Nominal zener voltage	IFXM	Peak forward blocking current. Same as I <sub>FOM</sub> except that the gate terminal is returned to the cathode through a	Ť	Peak reverse blocking current. The
$z_z$	Zener impedance		stated impedance and/or bias voltage.	I ROM	maximum current through the thyris- tor when the device is in the reverse
$z_{zK}$	Zener impedance near breakdown knee	<sup>I</sup> GFM	Peak forward gate current. The maxi- mum instantaneous value of current which may flow between gate and		blocking state (anode negative) for a stated anode-to-cathode voltage and junction temperature with the gate
ZZT	Zener impedance at zener test current		cathode.		open.

# TECHNICAL DATA & INFORMATION

# SEMICONDUCTOR LETTER SYMBOLS

& INF	URMATION			CINDOCTOR LET	IEN	STIVIDULS
I <sub>RXM</sub>	as I ROM except	ocking current, Same that the gate terminal the cathode through a	BV <sub>CBO</sub>	D.c. collector-to-base breakdown voltage, collector reverse-biased with respect to base, emitter open.	P <sub>out</sub>	Output power  Equivalent base resistance, high fre-
		e and/or bias voltage.	BV <sub>CEO</sub>	D.c. collector-to-emitter breakdown		quencies
P <sub>GF(AV)</sub>		d gate power. The	-	voltage, collector reverse-biased with respect to emitter, base open.	Т <sub>ј</sub>	Junction temperature Storage temperature
		n averaged over a full	$_{\mathrm{BV}_{\mathrm{EBO}}}$	D.c. emitter-to-base breakdown volt- age, emitter reverse-biased with re-	T <sub>stg</sub>	Fall time, from 90 percent to 10 per-
$v_{\mathbf{F}}$		voltage. The voltage		spect to base, collector open.	1	cent of pulse (switching applications).
	during the ''on'	en anode and cathode condition for speci- f anode and tempera-	BV ECO	D.c. emitter-to-collector breakdown voltage, emitter reverse-biased with respect to collector, base open.	tr	Rise time, from 10 percent to 90 percent pulse (switching applications).
V <sub>F(on)</sub>		d ''on'' voltage. The	C or c	Collector electrode	t <sub>s</sub>	Storage time (switching applications).
	cathode at a spec	ed between anode and cified time after turn-	$c_c$	Collector junction capacitance	v <sub>BE</sub>	Base-to-emitter d.c. voltage
	on function has t	een initiated at stated	C <sub>e</sub>	Emitter junction capacitance	V <sub>CE</sub>	Collector-to-base d.c. voltage
$v_{FOM}$		ocking voltage, gate repetitive forward	$^{\mathrm{C_{ib},C_{ic}}}_{\mathrm{C_{ie}}}$	Input capacitance for common base, collector, and emitter, respectively.	V <sub>CEC</sub>	Collector-to-emitter d.c. voltage  D.c. collector-to-emitter voltage with
	voltage which m thyristor betwee	ay be applied to the n anode and cathode with the gate open at	Cob, Coc	Output terminal capacitance, a.c. in- put open, for common base, collector and emitter, respectively.		collector junction reverse-biased, zero base current.
	stated conditions		D	Distortion	VCER	Similar to V <sub>CEO</sub> , except with a resistor (of value R) between base and
V <sub>FXM</sub>	as V <sub>FOM</sub> except	ocking voltage. Same that the gate terminal	E or e	Emitter electrode	V	emitter.
	is returned to the stated impedance	he cathode through a e and/or voltage.		Alpha cutoff frequency for common	VCES	Similar to V <sub>CEO</sub> , except with base shorted to emitter.
$v_{GFM}$	mum instantane	te voltage. The maxi- ous voltage between	fab, fac,	base, collector, and emitter, respectively.	VCEV	D.c. collector-to-emitter voltage, used when only voltage bias is used.
		nal and the cathode ng from the flow of rent	f <sub>co</sub>	Cutoff frequency	$v_{CEX}$	D.c. collector-to-emitter voltage, base-emitter back biased.
V <sub>GRM</sub>		te voltage. The maxi-	fmax	Maximum frequency of oscillation	v <sub>EB</sub>	Emitter-to-base d.c. voltage
GRIM	mum instantaneo be applied betwee and the cathode	us voltage which may een the gate terminal terminal when the the gate region and	GC (CB), GC (CC), GE (CE)	Grounded (or common) base, collector, and emitter, respectively.	v <sub>pt</sub>	Punch-through voltage
	the adjacent cat verse biased.	thode region is re-	G <sub>b</sub> , G <sub>c</sub> , G <sub>e</sub>	Power gain for common base, collector, and emitter, respectively.	1	UNIJUNCTION TRANSISTORS
V <sub>GT</sub>	The d.c. voltag	age (continuous d.c.). e between the gate	h	Hybrid parameter	I <sub>E</sub>	Emitter current
V <sub>ROM(rep)</sub>	the d.c. gate trig	required to produce ger current, ocking voltage, gate	h <sub>fe</sub> , h <sub>fb</sub> , h <sub>fc</sub>	Small signal forward current transfer ratio, a.c. output shorted, common emitter, common base, common collector, respectively.	I EO	Emitter reverse current, Measured between emitter and base-two at a specified voltage, and base-one open-
11011(10p)	of reverse voltage tinuous d.c.) wh	num allowable value re (repetitive or con- tich can be applied	h <sub>ib</sub>	Small-signal input impedance, a.c. output shorted, common base.	I p	circuited.  Peak point emitter current. The maximum emitter current that can flow
		and cathode (anode e gate open for stated	h <sub>ob</sub>	Small-signal output admittance, a.c. input open, common base.		without allowing the UJT to go into the negative resistance region.
V <sub>RXM</sub>	as V <sub>ROM</sub> except	ocking voltage. Same that the gate terminal ne cathode through a	I	Direct current (d.c.).	IV	Valley point emitter. The current flowing in the emitter when the device is biased to the valley point.
		and/or bias voltage.	I <sub>B</sub> , I <sub>C</sub>	D.c. current for base, collector, and emitter, respectively.	$r_{BB}$	Interbase resistance. Resistance be-
	May 1	<b>&gt;</b> P.6	I CBO	D.c. collector current, collector reverse-biased with respect to base,		tween base-two and base-one meas- ured at a specified interbase voltage.
	TRANSISTO	ORS		emitter-to-base open.	$V_{\rm B2B1}$	Voltage between base-two and base- one. Positive at base-two.
<sup>A</sup> G	Available gain		I CES	D.c. collector current, collector reverse-biased with respect to emitter,	v	
Ap	Power gain		T .	base shorted to emitter.	$v_p$	Peak point emitter voltage. The maximum voltage seen at the emitter
AĮ	Current gain		I EBO	D.c. emitter current, emitter reverse-biased with respect to base, collector-to-base open.		before the UJT goes into the negative resistance region.
B or b	Base electrode	Marton breekdown	NF	Noise Figure	$v_D$	Forward voltage drop of the emitter junction,
BV BCO	voltage, base r	ollector breakdown everse-biased with ctor, emitter open.	P <sub>D</sub>	Total average power dissipation of all	v <sub>EB1</sub>	Emitter to base-one voltage
BV <sub>BEO</sub>	D.c. base-to-emi	tter breakdown volt-	_	electrodes of a semiconductor device.	V <sub>EB1(SAT)</sub>	Emitter saturation voltage. Forward
2.23	age, base rever spect to emitter,	se-biased with re- collector open.	P <sub>G</sub>	Power gain		voltage drop from emitter to base- one at a specified emitter current (larger than I <sub>V</sub> ) and specified inter-
			P <sub>Go</sub>	Over-all power gain		base voltage.
			Pin	Input power		

### TECHNICAL DATA & INFORMATION

V<sub>OB1</sub>

# SEMICONDUCTOR LETTER SYMBOLS

V<sub>v</sub> Valley point emitter voltage. The voltage at which the valley point occurs with a specified VB2B1.

> Base-one peak pulse voltage. The peak voltage measured across a resistor in series with base-one when the UJT is operated as a relaxation oscillator in a specified circuit.

Interbase resistance temperature coarBB efficient. Variation of resistance between B2 and B1 over the specified temperature range and measured at the specific interbase voltage and temperature with emitter open circuited.

Interbase modulation current. B2 cur-IB2(mod) rent modulation due to firing. Measured at a specified interbase voltage, emitter and temperature.

 $I_{\mathbf{D}}$ Drain current Maximum leakage from drain to gate 1<sub>DGO</sub> with source open Drain current with gate connected to  $I_{DSS}$ 

FIELD EFFECT TRANSISTORS

source

 $I_G$ Maximum gate current (leakage) with IGSS drain connected to source

V(BR)DGO Drain to gate, source open D.c. drain voltage

drain

Gate current

 $v_D$ Drain to gate, source connected to V(BR)DGS

Drain to source, gate connection not V(BR)DS specified

V(BR)DSX Drain to source, gate biased to cutoff or beyond

Gate to source, drain connection not V(BR)GS specified

Gate to source, drain connected to V(BR)GSS source

Gate to drain, source connection not V(BR)GD specified

Gate to drain, source connected to V(BR)GDS

D.c. gate voltage  $V_{\mathbf{G}}$ 

VG1S(OFF) Gate 1-source cutoff voltage (with gate 2 connected to source)

VG2S(OFF) Gate 2-source cutoff voltage (with gate 1 connected to source)

VGS(OFF) Cutoff

### TECHNICAL DATA & INFORMATION

# **ELECTRONICS SYMBOLS**

AMPLIFIER

general

with two inputs



with two outputs



with adjustable gain



supply



with associated attenuator



with external feedback



Amplifier Letter Combinations (amplifier-use identification in symbol if required)

BDG Bridging BST Booster CMP Compression DC Direct Current EXP Expansion LIM Limiting Monitoring PCM Program

Preliminary

Power Torque

ANTENNA

general



dipole



loop



counterpoise



ARRESTER, LIGHTNING

carbon block -00-

electrolytic or aluminum

horn gap

ے دــ

protective gap

sphere gap

--valve or film element

multigap

ATTENUATOR, FIXED (see PAD)

(same symbol as variable attenuator, without variability)

ATTENUATOR, VARIABLE



unbalanced



AUDIBLE SIGNALING DEVICE

bell, electrical; ringer, telephone

=

buzzer



horn, electrical; loudspeaker; siren; underwater sound hydrophone, projector or transducer



Horn, Letter Combinations (if required)

Horn, electrical \*#W Howler Loudspeaker \*LS

\*SN Siren **TEM** Electromagnetic with moving coil

‡ EMN Electromagnetic with moving coil and neutralizing winding Magnetic armature į PM Permanent magnet

identification replaces (\*) asterisk and (†) dagger)

with moving coil

sounder, telegraph



BATTERY

generalized direct current source; one cell



multicell

-|-|-

CAPACITOR

general  $\rightarrow$  $\vdash$ 

polarized



adjustable or variable



continuously adjustable



phase-shifter



split-stator



feed-through

CELL, PHOTOSENSITIVE (Semiconductor)

asymmetrical photoconductive transducer



symmetrical photoconductive transducer



photovoltaic transducer; solar cell



CIRCUIT BREAKER

general



with magnetic overload





CIRCUIT ELEMENT

general

EG

Circuit Element Letter Combinations (replaces (\*) asterisk)

Equalizer

FAX Facsimile set FL Filter FL-BE Filter, band elimination FL-BP Filter, band pass Filter, high pass FL-HP FL-LP Filter, low pass

Power supply

### TECHNICAL DATA & INFORMATION

## **ELECTRONICS SYMBOLS**

RG Recording unit RU Reproducing unit Telephone dial TEL TPR Telephone station Teleprinter TTY Teletypewriter

Additional Letter Combinations (symbols preferred)

Amplifier AT Attenuator Capacitor CB Circuit breaker Handset I Indicating or switch board lamp L Inductor Jack LS Loudspeaker Microphone OSC Oscillator PAD Pad Plug HT Receiver, headset

Switch or key switch Transformer Wall receptacle

CLUTCH: BRAKE

Relay

Resistor

disengaged when operating means is de-energized

engaged when operating means is de-energized

COIL, RELAY and OPERATING (16)

semicircular dot indicates

CONNECTOR

assembly, moveble or stationary portion; jack, plug, or receptacle

→ on --<

jack or receptacle

**→ ••** []

plug

separable connectors

→ • ①

two-conductor switchboard jack

two-conductor switch-

jacks normalled through one way

المليب

jacks normalled through both ways

TAILAL

2-conductor nonpolarized,



2-conductor polarized, male contacts



waveguide flange



plain, rectangular



choke, rectangular



engaged 4-conductor; the plug has 1 male and 3 female contacts, individua contact designations shown



shown carried through



coaxial, center conductor shown carried through; outside conductor not carried through



mated choke flanges in rectangular waveguide



COUNTER, ELECTROMAGNETIC: MESSAGE REGISTER

general

with a make contact



COUPLER, DIRECTIONAL (common coexial/waveguide usage)



(common coexial/waveguide usage)

E-plane aperture-coupling, 30-decibel transmission loss



COUPLING

by loop from coaxial to circular waveguide, direct-current grounds connected



CRYSTAL, PIEZO-ELECTRIC



DELAY LINE

general



tapped delay



bifilar slow-wave structure (commonly used in traveling-wave tubes)



(length of delay indication replaces (\*) asterisk)

DETECTOR, PRIMARY; MEASURING TRANSDUCER (see HALL GENERATOR and THERMAL CONVERTER)



DISCONTINUITY (common coaxial/waveguide usage) equivalent series element, general



capacitive reactance



inductive reactance



inductance-capacitance circuit, intinite reactance at resonance



inductance-capacitance circuit, zero reactance at resonance



resistance



equivalent shunt element, general



capacitive susceptance



conductance



inductive susceptance



inductance-capacitance circuit, infinite susceptance at resonance



inductance-capacitance circuit, zero susceptance at resonance



ELECTRON TUBE

triode



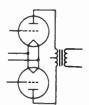
pentode, envelope connected to bese terminal



twin triode, equipotential cathode



typical wiring figure to show tube symbols placed in any convenient position



rectifier; voltage regulator (see LAMP, GLOW)



phototube, single and multiplier



cathode-ray tube, electrostatic and magnetic de-



mercury-pool tube, ignitor and control grid (see RECTIFIER)



resonant magnetron, coaxial output and permanent megnet



reflex klystron, integral cavity, aperture coupled

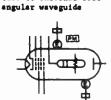


transmit-receive (TR) tube gas filled, tunable integral cavity, aparture coupled, with starter



traveling-wave tube (typical)

forward-wave travelingwave-tube amplifier shown with four grids, having slow-wave structure with attenuation, magnetic focusing by external permanent magnet, rf input and rf output coupling each E-plane aperture to external rect-



FERRITE DEVICES

field polarization rotator



field polarization amplitude modulator



FUSE

high-voltage primary

cutout, dry





# TECHNICAL DATA & INFORMATION

# **ELECTRONICS SYMBOLS**

high-voltage primary cutout, oil



GOVERNOR (Contactmaking)

contacts shown here as closed



HAMDSET

general



operator's set with pushto talk switch



HYBRID



junction (common coaxial/waveguide usage)



circular



(E, H or HE transverse field indicators replace (\*) esterisk)

rectangular waveguide and coaxial coupling



INDUCTOR

general

~~~ # #F

magnetic core

\*\*\*

tapped

 $\mathbb{T}$ 

adjustable, continuously adjustable



KEY, TELEGRAPE

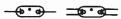


LAID

bellast lamp; bellast tube



lamp, fluorescent, 2 and 4 terminel



lamp, glow; neon lam a-c





lamp, incandescent



indicating lamp; switchboard lamp (see VISUAL SIGNALING DEVICE)

LOGIC (see 806B and Y32-14) (including some duplicate symbols; left and righthand symbols are not mixed)

AMD function



OR function



EXCLUSIVE-OR function



((\*) input side of logic symbols in general)

condition indicators

state (logic negation)

0

a Logic Negation output becomes 1-state if and only if the input is not 1-state

an AND func. where output is low if and only if all inputs are high



electric inverter



(elec. invtr. output becomes 1-state if and only if the input is 1-state) (elec. invtr. output is more pos. if and only if input is less pos.)

level (relative)

l-state is 1-state is less + more +

(symbol is a rt. triangle pointing in direction of flow) an AND func, with input 1-states at more pos. level and output 1-state at less pos. level



single shot (one output)



schmitt trigger, waveform and two outputs



flip-flop, complementary



flip-flop, latch



register



(binary register denoting four flip-flops and bits)

amplifier (see AMPLIFIER)



channel path(s) (see PATH, TRANSHISSION)

magnetic heads (see PICK-UP HEAD)

oscillator (see OSCIL-LATOR)



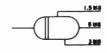
relay, contacts (see CONTACT, ELECTRICAL) relay, electromagnetic (see RELAY COIL RECOG-NITION)

signal flow (see DIREC-TION OF FLOW)

time delay (see DELAY LINE)



time delay with typical delay taps:

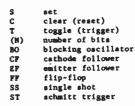


functions not otherwise symbolized



(identification replaces
(\*))

Logic Letter Combinations



RG(N) register (N stages) SR shift register

MACHINE, ROTATING

METER, INSTRUMENT

(\*) asterisk)

AH

CHA

CHC

DB

DM

DTR

GD

INT

IIA

MA

OP

**(•)** 

identification replaces

Meter Letter Combinations

Ampere-hour

Contact-making (or

breaking) ammeter Contact-making (or

Contact-making (or breaking) voltmeter

cathode-ray oscil-

DB (decibel) meter DBM (decibels re-

ferred to 1 milli-

Demand-totalizing

Prequency meter

Galvanometer Ground detector

Indicating

Integrating

Microsumeter Millianmeter

Noise meter

meter

Oil pressure

(common coaxial/waveguide

transducer from rectangu-

lar waveguide to coaxial

with mode suppression, direct-current grounds

connected

MODE TRANSDUCER

breaking) clock

Oscilloscope or

Anneter

lograph

relay

watt) meter

Demand meter

generator

motor

MOTION, MECHANICAL

rotation applied to a resistor

(identification replaces
(\*) asterisk)

NUCLEAR-RADIATION DE-TECTOR, gas filled; IONIZATION CHAMBER; PROPORTIONAL COUNTER TUBE; GEIGER-MULLER COUNTER TUBE (50) (see RADIATION-SENSITIVITY INDICATOR)



PATH. TRANSMISSION

cable; 2-conductor, shield grounded and 5-conductor shielded



PICKUP HEAD

general

vriting; recording

reading; playback

ing; playback

erasins

-- ( )
writing, reading, and

erasing

---

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RECTIFIER

semiconductor diode; metallic rectifier; electrolytic rectifier; asymmetrical variator

mercury-pool tube power rectifier



fullwave bridge-type



RESISTOR

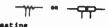
general



### **TECHNICAL DATA** & INFORMATION

## **ELECTRONICS SYMBOLS**

tapped



heating



symmetrical variator resistor, voltage sensitive (silicon carbide, etc.)



(identification marks replace (\*) asterisk)

With adjustable contact



adjustable or continuously adjustable (variable)



(identification replaces (\*) asterisk)

> RESONATOR. TUNED CAVITY

(common coaxial/waveguide usage)

resonator with mode suppression coupled by an Eplane aperture to a guided transmission path and by a loop to a coaxial path



tunable resonator with direct-current ground connected to an electron device and adjustably coupled by an E-plane aperture to a rectangular waveguide



ROTARY JOINT, RF (COU-PLER) (72)

general; with rectangular wavegulde



(transmission path recognition symbol replaces (\*) asterisk)

coaxial type in rectangular Waveguide

circular waveguide type in rectangular waveguide



SEMICONDUCTOR DEVICE (Two Terminal, diode)

semiconductor diade: rectifier



capacitive diode (also Varicap, Varactor, reactance diode, parametric





breakdown diode, unidirectional (also backward diode, avalanche diode.voltage regulator diode, Zener diode, voltage reference diode)



breakdown diode, bidirectional and backward diode (also bipolar voltage limiter)



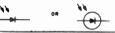
tunnel dicde (also Esaki diode)



temperature-dependent



photodiode (also solar ce11)



semiconductor diode, PNPN switch (also Shockley diode, four-layer diode and SCR).



(Multi-Terminal, transistor, etc.)

PNP transistor



NPN transistor



unijunction translator. N-type base



unifunction transistor. P-type base



field-effect transistor, N-type base



field-effect transistor, P-type base



semiconductor triode, PNPN-type switch



semiconductor triode, NPNP-type switch



NPN transistor, transverse-biased base



PNIP transistor, ohmic connection to the intrinsic region



NPIN transistor, ohmic connection to the intrinsic region



PNIN transistor, ohmic connection to the intrinsic region



NPIP transistor, ohmic connection to the intrinsic region



explosive



igniter



sensing link; fusible link operated

SWITCH

oush button, circuit closing (make)



push button, circuit opening (break)

nonlocking: momentary circuit closing (make)

nonlocking; momentary circuit opening (break)

transfer

locking, circuit closing

locking, circuit opening

transfer, 3-position

wafer

(example shown: 3-pole 3-circuit with 2 nonshorting and 1 shorting moving contacts)



safety interlock, circuit opening and closing

2-pole field-discharge knife, with terminals and discharge resistor



(identification replaces (\*) asterisk) SYNCHRO



Synchro Letter Combinetions

CDX Control-differential transmitter

Control transformer Control transmitter Torque-differential

receiver Torque-differential transmitter

Torque receiver

Torque transmitter Resolver

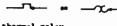
Outer winding rotatable in bearings

THERMAL ELEMENT

actuating device



thermal cutout: flasher



thermal relay

thermostat (operates on rising temperature), con-

thermostat, make contact



thermostat, integral heater and transfer contacts



THERMISTOR; THERMAL RESISTOR



with integral heater



THE IMOCOUPLE

temperature-measuring



current-measuring, integral heater connected



current-measuring, integral heater insulated



semiconductor



current-measuring, semiconductor



TRANSFORMER

general

magnetic-core



### **TECHNICAL DATA** & INFORMATION

# **ELECTRONICS SYMBOLS**

one winding with adjustable inductance



separately adjustable inductance



adjustable mutual inductor, constant-current



autotransformer, 1-phase adjustable



current, with polarity marking



potential, with polarity



with direct-current connections and mode suppression between two rectangular waveguides

(common coaxial/waveguide



shielded, with magnetic



with a shield between windings, connected to the frame



VIBRATOR; INTERRUPTER

typical shunt drive (terminals shown)



typical separate drive (terminals shown)



VISUAL SIGNALING DEVICE

communication switchboardtype lamp



indicating, pilot, sig-naling, or switchboard light (see LAP)



(identification replaces (\*) asterisk)

indicating light letter

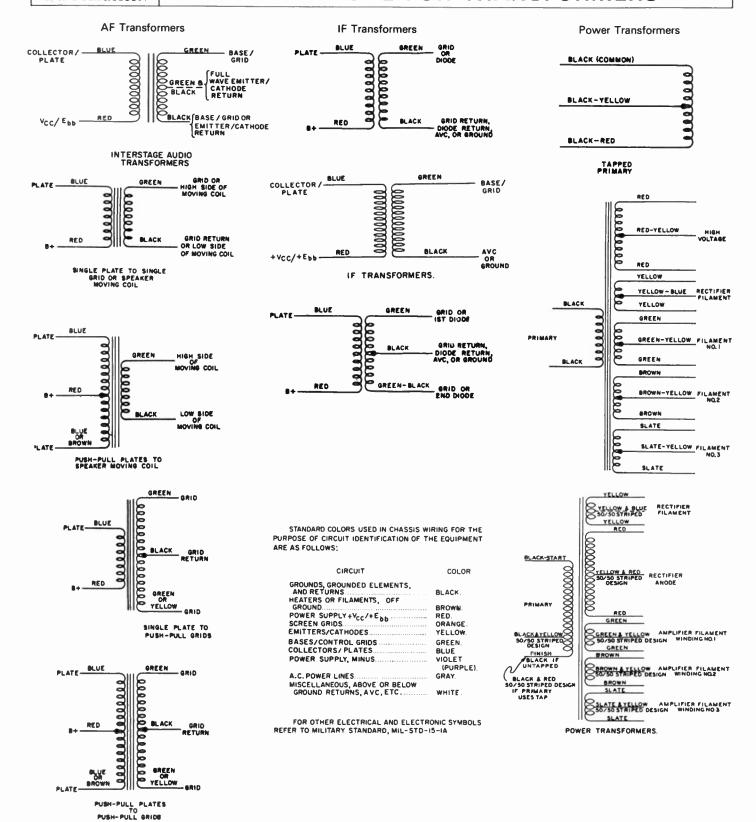
- combinations
  - Blue Clear
- C G NE Green
- Neon Orange
- OP Opalescent
- Purple White Yellow

jeweled signal light



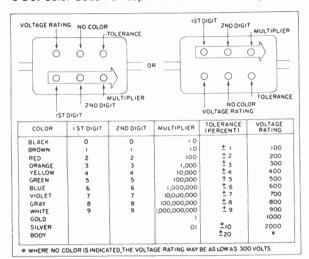
# **NOTES:**

## **COLOR CODE FOR TRANSFORMERS**

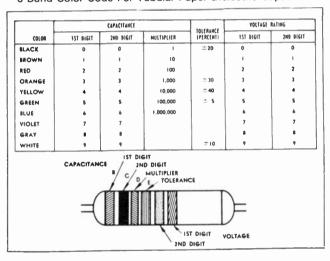


# **ELECTRONICS COLOR CODING**

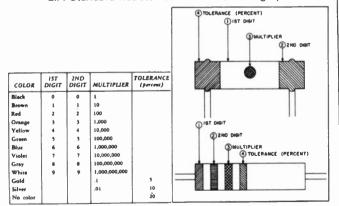
### 5-Dot Color Code For Capacitors (dielectric not specified)



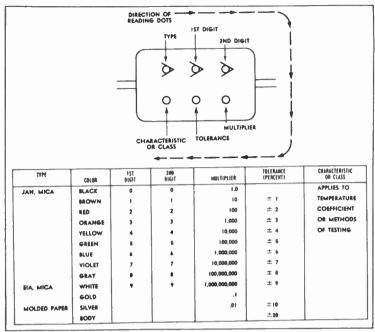
### 6-Band Color Code For Tubular Paper Dielectric Capacitors



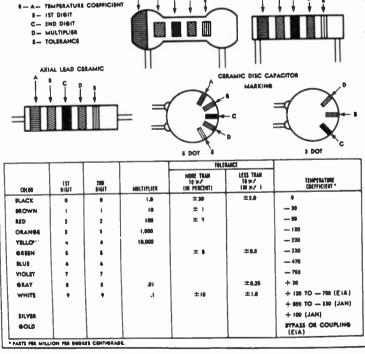
EIA Standard Resistor Color Code (marking system)



### 6-Dot Color Code For Mica and Molded Paper Capacitors



### Color Code For Ceramic Capacitors Having Different Configurations



# PERIODIC TABLE OF THE ELEMENTS

| H                |              |                |        |         |          |             |         |         |        | ELEME            | IC NUMBER- | 1.002        |              |             |            |              | INERT<br>GASES |
|------------------|--------------|----------------|--------|---------|----------|-------------|---------|---------|--------|------------------|------------|--------------|--------------|-------------|------------|--------------|----------------|
| LIGHT N          | METALS       |                |        |         |          |             |         |         |        |                  |            |              | <u> </u>     | NONME TAL   | .s —       |              | He             |
| IA               | ΠA           |                |        |         |          |             |         |         |        |                  |            | <b>MA</b>    | IVA          | <b>▼</b> A  | VIA        | VIIA         | 4.003          |
| 3                | 145          |                |        |         |          |             |         |         |        |                  |            | 5            | 6            | 7           | 8          | 9 _          | 10             |
| Li               | Be           |                |        |         |          | UE AVV      | METALS  |         |        |                  |            | B            | C            | N           | 0          | F            | Ne             |
| 6.94             | 9.012        |                |        |         |          | MEMAI       | ME IALS |         |        |                  |            | 10-81        | 12.01        | 14.007      | 15.999     | 18.998       | 2018           |
| 1                | 1            |                |        |         |          |             |         |         |        |                  |            | 13<br>A I    | R. C.        | 15 D        |            | l., -        | I A . I        |
| <b>Na</b> 22.990 | Mg<br>24.305 | жв             | IVB    | ¥Β      | VI8      | <b>VI</b> 8 |         | VIII    |        | IB               | пө         | AI<br>26.982 | Si<br>28.086 | P<br>30.974 | S<br>32.06 | CI<br>35.453 | A r            |
| 19               | 20           | SI             | 55     | 23      | 24       | 25          | 26      | 27      | 28     | 29               | 30         | 31           | 32           | 33          | 34         | 35.453       | 36             |
| K                | Ca           | Sc             | Ti     | l v     | Cr       | Mn          | Fe      | Co      | Ni     | Cu               | Zn         | Ga           | Ge           | As          | Se         | Br           | Kr             |
| 39.102           | 40.08        | 44.956         | 47.90  | 50.942  | 51996    | 54.938      | 55.847  | 58.933  | 58.71  | 63.546           | 65.37      | 69.72        | 72.59        | 74.922      | 78.96      | 79.904       | 83.80          |
| 37               | 38           | 39             | 40     | 41      | 42       | 43 •        | 44      | 45      | 46-    | 47               | 48         | 49           | 50           | 51          | 52         | 53           | 54             |
| Rb               | Sr           | ΙΥ             | Zr     | Nb      | Мо       | Tc          | Ru      | Rh      | Pd     | Ag               | l Cd       | l In         | Sn           | Sb          | Те         |              | Xe             |
| 85.47            | 87.62        | 88.905         | 91.22  | 92.906  | 95.94    | (99)        | 101.07  | 102.905 | 106.4  | 107.868          | H2.40      | 114.82       | 118.69       | 121.75      | 127.60     | 126.904      | 131.30         |
| 55               | 56           | 57             | 72     | 73      | 74       | 75          | 76      | 77      | 78     | 79               | 80         | 81           | 82           | 83          | 84_ 4      | 85 •         | 86 •           |
| Cs               | Ba           | La             | Hf     | Ta      | W        | Re          | Os      | Ir      | Pt     | Au               | Hg         | 11           | Pb           | Bi          | Po         | At           | Rn             |
| 132.905          | 137,34       | 138.91<br>89 • | 178.49 | 180.948 | 183.85   | 186.2       | 190.2   | 192.2   | 195.09 | 196.967          | 200.59     | 204.37       | 207.2        | 208.980     | (210)      | (210)        | (555)          |
| 1**              | 1            |                |        | 58      | #O       | leo         | Ter     | Tee     | Tan-   | Tax              | Ton        | Too          | To a         | Tee         | Tee        | Tee          | 1              |
| Fr               | Ra           | Ac             | 1      | 1 -     | 59<br>D- | 60<br>N L   | 61<br>D | 62      | 63     | 64               | 65         | 66           | 67           | 60          | 69<br>T    | 70<br>VL     | 1".            |
| (223)            | (226)        | (227)          | (257)  | Ce      | Pr       | Nd          | Pm      | Sm      | Eu     | Gd               | Ib         | Dy           | Ho           | Er          | lm         | Yb           | Lu             |
|                  |              |                |        | 140.12  | 140.907  | 144.24      | (147)   | 150.35  | THANUM | 157.25<br>CEDIEC | 158.924    | 162.50       | 164.930      | 167.26      | 168.934    | 173.04       | 174.97         |
|                  |              |                |        |         |          |             |         | LAN     | INANUM | SERIES.          |            |              |              |             |            |              |                |
|                  |              | 90 •           | 91 •   | 92 •    | 93 •     | 94 4        | 95      | 96 6    | 97 (   | 98 •             | 99 •       | ю0 •         | 101 4        | 102         | 103 4      | 105 @        | 106            |

| 90      | 91 •  | 92 •   | 93 •  | 94 • | 95 • | 96 •  | 97 •    | 98 (  | 99 •  | Ю0 •  | IOI • | 102   | 103 • | 105 •     | 106       |
|---------|-------|--------|-------|------|------|-------|---------|-------|-------|-------|-------|-------|-------|-----------|-----------|
| Th      | Pa    | U      | Np    | Pu   | Am   | Cm    | Bk      | Cf    | Fs    | Fm    | Md    | No    | l r   |           |           |
| 232.038 | (2 30 | 238.03 | (237) | l .  |      | (247) |         | (249) | (254) | (257) | (258) | (255) | (256) | (258-261) | (258-261) |
|         |       |        |       |      |      | ACTI  | NIUM SE | RIES  |       |       |       |       |       |           |           |

. INDICATES PRINCIPAL RADIOACTIVE ELEMENTS

| Symbol | Name                    | Atomic<br>Number | Atomic<br>Weight |          |              |     |                 |          |              |    |         |
|--------|-------------------------|------------------|------------------|----------|--------------|-----|-----------------|----------|--------------|----|---------|
| Ac     | Actinium                | 89               | 1(227)           | Gd       | Gadolinium   | 64  | 157.25          | Pd       | Palladium    | 46 | 106 1   |
| Ag     | Silver                  | 47               | 107.868          | Ge       | Germanium    | 32  | 72.59           | Pm       | Panadium     | 61 | 106.4   |
| Al     | Aluminum                | 13               | 26.982           | Н        | Hydrogen     | 1   | 1,008           | Po       | Prometmum    | 84 | (147)   |
| Am     | Americium               | 95               | (243)            | He       | Helium       | 2   | 4.003           | Pr       |              |    | (210)   |
| Ar     | Argon                   | 18               | 39.95            | Hf       | Hafnium      | 72  | 178.49          | Pr<br>Pt | Praseodymium | 59 | 140.907 |
| As     | Arsenic                 | 33               | 74.922           | Hg       | Mercury      | 80  | 200.59          |          | Platinum     | 78 | 195.09  |
| At     | Astatine                | 85               | (210)            | Ho       | Holmium      | 67  | 164.930         | Pu       | Plutonium    | 94 | (242)   |
| Au     | Gold                    | 79               | 196.967          | I        | lodine       | 53  | 126.904         | Ra       | Radium       | 88 | (226)   |
| В      | Boron                   | 5                | 10.81            | In       | Indium       | 49  | 114.82          | Rb       | Rubidium     | 37 | 85.47   |
| Ba     | Barium                  | 56               | 137.34           | In<br>Ir | Iridium      | 77  | 192.2           | Re       | Rhenium      | 75 | 186.2   |
| Be     | Beryllium               | 4                | 9.012            | K        | Potassium    | 19  | 39.102          | Rh       | Rhodium      | 45 | 102,905 |
| Bi     | Bismuth                 | 83               | 208.980          | Kr       | Krypton      | 36  | 83.80           | Rn       | Radon        | 86 | (222)   |
| Bk     | Berkelium               | 97               | (247)            | *Ku      | Kurchatovium | 104 |                 | Ru       | Ruthenium    | 44 | 101.07  |
| Br     | Bromine                 | 35               | 79.904           | La       | Lanthanum    | 57  | (257)<br>138,91 | S        | Sulfur       | 16 | 32.06   |
| C      | Carbon                  | 6                | 12.011           | Li       | Lithium      | 3   |                 | Sb       | Antimony     | 51 | 121.75  |
| Ca     | Calcium                 | 20               | 40.08            | -        |              | 103 | 6.94            | Sc       | Scandium     | 21 | 44.956  |
| Cd     | Cadmium                 | 20<br>48         | 112.40           | Lr       | Lawrencium   |     | (256)           | Se       | Selenium     | 34 | 78.96   |
| Ce     | Caumium                 | 46<br>58         |                  | Lu       | Lutetium     | 71  | 174.97          | Si       | Silicon      | 14 | 28.086  |
| Cf     |                         | 98               | 140.12           | Md       | Mendelevium  | 101 | (258)           | Sm       | Samarium     | 62 | 150.35  |
| Cl     | Californium<br>Chlorine |                  | (249)            | Mg       | Magnesium    | 12  | 24.305          | Sn       | Tin          | 50 | 118.69  |
|        |                         | 17               | 35.453           | Mn       | Manganese    | 25  | 54.938          | Sr       | Strontium    | 38 | 87.62   |
| Cm     | Curium                  | 96               | (247)            | Mo       | Molybdenum   | 42  | 95.94           | Ta       | Tantalum     | 73 | 180.948 |
| Co     | Cobalt                  | 27               | 58,933           | N        | Nitrogen     | 7   | 14.007          | Tb       | Terbium      | 65 | 158.924 |
| Cr     | Chromium                | 24               | 51.996           | Na       | Sodium       | 11  | 22.990          | Tc       | Technetium   | 43 | (99)    |
| Cs     | Cesium                  | 55               | 132.905          | Nb       | Niobium      | 41  | 92,906          | Te       | Tellurium    | 52 | 127,60  |
| Cu     | Copper                  | 29               | 63,546           | Nd       | Neodymium    | 60  | 144.24          | Th       | Thorium      | 90 | 232,038 |
| Dy     | Dysprosium              | 66               | 162.50           | Ne       | Neon         | 10  | 20.18           | Ti       | Titanium     | 22 | 47.90   |
| Es     | Einsteinium             | 99               | (254)            | Ni       | Nickel       | 28  | 58.71           | Tl       | Thallium     | 81 | 204.37  |
| Er     | Erbium                  | 68               | 167,26           | No       | Nobelium     | 102 | (255)           | Tm       | Thulium      | 69 | 158.934 |
| Eu     | Europium                | 63               | 151.96           | Np       | Neptunium    | 93  | (237)           | U        | Uranium      | 92 | 238.03  |
| F      | Fluorine                | 9                | 18.998           | O        | Oxygen       | 8   | 15.999          | V        | Vanadium     | 23 | 50.942  |
| Fe     | Iron                    | 26               | 55.847           | Os       | Osmium       | 76  | 190.2           | W        | Tungsten     | 74 | 183.85  |
| Fm     | Fermium                 | 100              | (257)            | P        | Phosphorus   | 15  | 30.974          | Xe       | Xenon        | 54 | 131.30  |
| Fr     | Francium                | 87               | (223)            | Pa       | Protactinium | 91  | (231)           | Y        | Yttrium      | 39 | 88.905  |
| Ga     | Gallium                 | 31               | 69.72            | Pb       | Lead         | 82  | 207.2           | Yb       | Ytterbium    | 70 | 173.04  |
|        |                         |                  |                  |          | 2000         | 32  |                 | Zn       | Zinc         | 30 | 65.37   |
|        |                         |                  |                  |          |              |     |                 | Zr       | Zirconium    | 40 | 91.22   |
|        |                         |                  |                  |          |              |     |                 |          |              |    | 31.22   |

<sup>\*</sup> Note: Element proposed but not confirmed.

# **TABLE OF LOGARITHMS**

|      |                                                  |                                                  |                                                                                                                                                          |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                       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7050         7059           1         7076         7084         7093         7101         7118         7126         7136         7143         7143         7126         71218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           3         71243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7325         7364         7372         7300         7308         7326           7         7434         7437         7443         7451         7459         7300         7308           7         7443         7454         7457         7443         7459         7469         7469           7         7549         7443         7451         7459         7459         7466         7469         7469         7466         7469         7469         7469         7469         7466         7469         7469         7469         7469         7469         7466         7764         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7059         7059         7059         7059         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7348         7352         7300         7308         736         7388         736         7388         736         7360         7308         736         736         736         7443         7451         7450         7450         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226         7210         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7249         7246         7247         7437         7443         7457         7449         7457         7449         7457         7459         7449         7457         7449         7457<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7168         7703         7101         7118         7126         7135         7143         7126           2         7168         7177         7185         7164         7727         7216         7218         7226           3         7243         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7346         7372         7300         7308         7368           7494         7437         7437         7459         7466         7467         7466         7466         7467         7469         7467         7469         7469         7467         7469         7469         7467         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7056         7168         7177         7185         7193         7202         7210         7218         7226           2         7160         7161         7185         7202         7210         7218         7226           3         7243         7251         7257         7262         7210         7218         7226           4         7324         7326         7364         7372         7300         7398           7404         7412         7419         7457         7264         7372         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7451         7451         7451         7451         7451         7451         7452         7443         7451         7451         7452         7464         7451         7454         7451         7461         7451         7461<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7084         7093         7101         7118         7126         7218         7226           1         7060         7168         7177         7185         7202         7210         7218         7226           1         7060         7183         7267         7262         7202         7218         7226           1         7064         7326         7267         7262         7306         7388         7368           1         7324         7326         7364         7372         7431         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7449         7451         7449         7451         7452         7443         7451         7451         7452         7444         7451         7449         7451         7444         7451         7452         7444         7451         7454         7454         7454         7454</td><td>6990         6998         7007         7016         70124         7013         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7216         7218         7226           4         7324         7324         7327         7431         7451         7450         7308           5         7240         7432         7443         7452         7450         7450         7451           6         7482         7432         7443         7452         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7452         7452         7452         7451         7451         7451         7451         7451         7452</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7218         7226           3         7243         7251         7259         7260         7308         7308         7326           4         7324         7332         7340         7348         7372         7310         7388           4         7324         7332         7343         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7110         7118         7126         7218         7226           2         71243         7251         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       7101         7118         7126         7267         7202         7210         7218         7226         7210         7118         7126         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7218         7226         7226         7210         7218         7226         7226         7210         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         72</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         <td< td=""><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7016         7024         7030         7101         7110         7118         7126         7130         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7145         7144         7146         7146         7140         7147         7148         7156         7144         7140         7147         7148         7144         7146         7144         7147         7148         7144         7146         7144         7147         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           7160         7160         7168         7177         7185         7193         7202         7210         7218         7226           7160         7168         7177         7185         7193         7202         7210         7218         7226           7243         7251         7259         7267         7210         7218         7226           7243         7351         7497         7496         7364         7497         7404           7482         7490         7497         7505         7513         7459         7406           7703         7703         7716         7723         7734         7767         7664         7612         7619           7703         7704         7716         7723         7784         7762         7767         7664         7617         7619           7703         7716         7718         7723         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1707         7160         7168         7177         7185         7193         7202         7210         7218         7226           1760         7168         7177         7185         7193         7202         7210         7218         7226           1724         7251         7259         7267         7278         7322         7300         7308           1724         7402         7402         7324         7322         7300         7308           1724         7402         7402         7402         7300         7308           1724         7402         7402         7404         7417         7427         7439         7449         7451         7459         7461         7461         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1006         7168         7169         7101         7110         7118         7126         7135         7143         7143         7143 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   7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         70</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059         7059           1 7056         7168         7170         7110         7110         7118         7120         7210         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         <t< td=""><td>6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167         7166         7193         7101         7110         7118         7126         7135         7143         7126           7243         7251         7259         7284         7220         7210         7218         7226         7220         7210         7138         7136         7143         711         7126         7220         7210         7218         7226         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220<!--</td--><td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td><td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td></td></t<></td></td<></td></td></td></td></td></td></td> | 0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           3         71243         7251         7252         7202         7218         7226           4         7324         7326         7262         7210         7218         7226           7         7434         7251         7264         7232         7300         7308           7         7404         7412         7443         7451         7451         7459         7456         7388           7         7404         7412         7443         7451         7459         7456         7459         7456         7459         7456         7459         7456         7459         7456         7459         7456         7459         7459         7466         7459         7466         7649         7649         7649         7657         7604         7657         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694 | 6990         6998         7007         7016         7013         7042         7033         7042         7050         7059           1         7066         7084         7093         7101         7118         7126         7135         7143           3         7164         7075         7185         7193         7202         7210         7218         7226           3         7243         7251         7257         7262         7210         7218         7226           4         7324         7332         7340         7348         7352         7300         7308           7         7443         7451         7443         7451         7459         7450         7308           7         7443         7452         7443         7451         7459         7459         7466           7         7549         7443         7451         7459         7445         7459         7466         7467         7469         7469         7466         7674         7466         7674         7619         7664         7674         7619         7664         7674         7619         7619         7619         7619         7619         7619         < | 0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           7         7163         7177         7185         7193         7202         7210         7218         7226           3         7243         7251         7257         7244         7292         7300         7308         7326           4         7324         7332         7340         7348         7354         7372         7380         7308         7368           7443         7432         7433         7443         7451         7450         7450         7466         7466         7467         7466         7466         7467         7466         7466         7466         7466         7467         7466         7467         7469         7466         7467         7469         7466         7467         7469         7466         7476         7469         7466         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469 <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7168         7703         7101         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7136         7143         7143         7126         71218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           3         71243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7325         7364         7372         7300         7308         7326           7         7434         7437         7443         7451         7459         7300         7308           7         7443         7454         7457         7443         7459         7469         7469           7         7549         7443         7451         7459         7459         7466         7469         7469         7466         7469         7469         7469         7469         7466         7469         7469         7469         7469         7469         7466         7764         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7059         7059         7059         7059         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7348         7352         7300         7308         736         7388         736         7388         736         7360         7308         736         736         736         7443         7451         7450         7450         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226         7210         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7249         7246         7247         7437         7443         7457         7449         7457         7449         7457         7459         7449         7457         7449         7457<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7168         7703         7101         7118         7126         7135         7143         7126           2         7168         7177         7185         7164         7727         7216         7218         7226           3         7243         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7346         7372         7300         7308         7368           7494         7437         7437         7459         7466         7467         7466         7466         7467         7469         7467         7469         7469         7467         7469         7469         7467         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7056         7168         7177         7185         7193         7202         7210         7218         7226           2         7160         7161         7185         7202         7210         7218         7226           3         7243         7251         7257         7262         7210         7218         7226           4         7324         7326         7364         7372         7300         7398           7404         7412         7419         7457         7264         7372         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7451         7451         7451         7451         7451         7451         7452         7443         7451         7451         7452         7464         7451         7454         7451         7461         7451         7461<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7084         7093         7101         7118         7126         7218         7226           1         7060         7168         7177         7185         7202         7210         7218         7226           1         7060         7183         7267         7262         7202         7218         7226           1         7064         7326         7267         7262         7306         7388         7368           1         7324         7326         7364         7372         7431         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7449         7451         7449         7451         7452         7443         7451         7451         7452         7444         7451         7449         7451         7444         7451         7452         7444         7451         7454         7454         7454         7454</td><td>6990         6998         7007         7016         70124         7013         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7216         7218         7226           4         7324         7324         7327         7431         7451         7450         7308           5         7240         7432         7443         7452         7450         7450         7451           6         7482         7432         7443         7452         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7452         7452         7452         7451         7451         7451         7451         7451         7452</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7218         7226           3         7243         7251         7259         7260         7308         7308         7326           4         7324         7332         7340         7348         7372         7310         7388           4         7324         7332         7343         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7110         7118         7126         7218         7226           2         71243         7251         7259         7260         7218         7226           3         7243         7251         7257         7244         7292         7300         7308           4         7324         7332         7340         7348         7356         7364         7372         7300         7308           5         7404         7412         7497         7505         7513         7451         7459         7450         7459         7466         7457         7469         7466         7457         7469         7466         7672         7694         7459         7466         7443         7450         7469         7469         7469         7657         7649         7657         7649         7664         7672         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7101         7118         7126         7267         7202         7210         7218         7226         7210         7118         7126         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7218         7226         7226         7210         7218         7226         7226         7210         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         72</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         <td< td=""><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7016         7024         7030         7101         7110         7118         7126         7130         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7145         7144         7146         7146         7140         7147         7148         7156         7144         7140         7147         7148         7144         7146         7144         7147         7148         7144         7146         7144         7147         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           7160         7160         7168         7177         7185         7193         7202         7210         7218         7226           7160         7168         7177         7185         7193         7202         7210         7218         7226           7243         7251         7259         7267         7210         7218         7226           7243         7351         7497         7496         7364         7497         7404           7482         7490         7497         7505         7513         7459         7406           7703         7703         7716         7723         7734         7767         7664         7612         7619           7703         7704         7716         7723         7784         7762         7767         7664         7617         7619           7703         7716         7718         7723         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1707         7160         7168         7177         7185         7193         7202         7210         7218         7226           1760         7168         7177         7185         7193         7202         7210         7218         7226           1724         7251         7259         7267         7278         7322         7300         7308           1724         7402         7402         7324         7322         7300         7308           1724         7402         7402         7402         7300         7308           1724         7402         7402         7404         7417         7427         7439         7449         7451         7459         7461         7461         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1006         7168         7169         7101         7110         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7141         7142         7143         7143         7143         7144         7141         7143         7144         7145         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         71</td><td>0         6990         6998         7007         7016         7024         7033         7042         7036         7037         7007         7007         7007         7007         7007         7007         7007         7007         7007         7007         7000         7007         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         70</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059         7059           1 7056         7168         7170         7110         7110         7118         7120         7210         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         <t< td=""><td>6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167  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7220<!--</td--><td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td><td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td></td></t<></td></td<></td></td></td></td></td></td> | 0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7168         7703         7101         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126 <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7136         7143         7143         7126         71218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           3         71243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7325         7364         7372         7300         7308         7326           7         7434         7437         7443         7451         7459         7300         7308           7         7443         7454         7457         7443         7459         7469         7469           7         7549         7443         7451         7459         7459         7466         7469         7469         7466         7469         7469         7469         7469         7466         7469         7469         7469         7469         7469         7466         7764         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7059         7059         7059         7059         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7348         7352         7300         7308         736         7388         736         7388         736         7360         7308         736         736         736         7443         7451         7450         7450         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226         7210         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7249         7246         7247         7437         7443         7457         7449         7457         7449         7457         7459         7449         7457         7449         7457<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7168         7703         7101         7118         7126         7135         7143         7126           2         7168         7177         7185         7164         7727         7216         7218         7226           3         7243         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7346         7372         7300         7308         7368           7494         7437         7437         7459         7466         7467         7466         7466         7467         7469         7467         7469         7469         7467         7469         7469         7467         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7056         7168         7177         7185         7193         7202         7210         7218         7226           2         7160         7161         7185         7202         7210         7218         7226           3         7243         7251         7257         7262         7210         7218         7226           4         7324         7326         7364         7372         7300         7398           7404         7412         7419         7457         7264         7372         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7451         7451         7451         7451         7451         7451         7452         7443         7451         7451         7452         7464         7451         7454         7451         7461         7451         7461<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7084         7093         7101         7118    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7452         7451         7451         7451         7451         7451         7452</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7218         7226           3         7243         7251         7259         7260         7308         7308         7326           4         7324         7332         7340         7348         7372         7310         7388           4         7324         7332         7343         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7110         7118         7126         7218         7226           2         71243         7251         7259         7260         7218         7226           3         7243         7251         7257         7244         7292         7300         7308           4         7324         7332         7340         7348         7356         7364         7372         7300         7308           5         7404         7412         7497         7505         7513         7451         7459         7450         7459         7466         7457         7469         7466         7457         7469         7466         7672         7694         7459         7466         7443         7450         7469         7469         7469         7657         7649         7657         7649         7664         7672         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7101         7118         7126         7267         7202         7210         7218         7226         7210         7118         7126         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7218         7226         7226         7210         7218         7226         7226         7210         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         72</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         <td< td=""><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7016         7024         7030         7101         7110         7118         7126         7130         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7145         7144         7146         7146         7140         7147         7148         7156         7144         7140         7147         7148         7144         7146         7144         7147         7148         7144         7146         7144         7147         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           7160         7160         7168         7177         7185         7193         7202         7210         7218         7226           7160         7168         7177         7185         7193         7202         7210         7218         7226           7243         7251         7259         7267         7210         7218         7226           7243         7351         7497         7496         7364         7497         7404           7482         7490         7497         7505         7513         7459         7406           7703         7703         7716         7723         7734         7767         7664         7612         7619           7703         7704         7716         7723         7784         7762         7767         7664         7617         7619           7703         7716         7718         7723         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1707         7160         7168         7177         7185         7193         7202         7210         7218         7226           1760         7168         7177         7185         7193         7202         7210         7218         7226           1724         7251         7259         7267         7278         7322         7300         7308           1724         7402         7402         7324         7322         7300         7308           1724         7402         7402         7402         7300         7308           1724         7402         7402         7404         7417         7427         7439         7449         7451         7459         7461         7461         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1006         7168         7169         7101         7110         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7141         7142         7143         7143         7143         7144         7141         7143         7144         7145         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         71</td><td>0         6990         6998         7007         7016         7024         7033         7042         7036         7037         7007         7007         7007         7007         7007         7007         7007         7007         7007         7007         7000         7007         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         70</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059         7059           1 7056         7168         7170         7110         7110         7118         7120         7210         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         <t< td=""><td>6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167         7166         7193         7101         7110         7118         7126         7135         7143         7126           7243         7251         7259         7284         7220         7210         7218         7226         7220         7210         7138         7136         7143         711         7126         7220         7210         7218         7226         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220<!--</td--><td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td><td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td></td></t<></td></td<></td></td></td></td></td> | 0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7136         7143         7143         7126         71218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218         7218 <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           3         71243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7325         7364         7372         7300         7308         7326           7         7434         7437         7443         7451         7459         7300         7308           7         7443         7454         7457         7443         7459         7469         7469           7         7549         7443         7451         7459         7459         7466         7469         7469         7466         7469         7469         7469         7469         7466         7469         7469         7469         7469         7469         7466         7764         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469</td> <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7059         7059         7059         7059         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td> <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7348         7352         7300         7308         736         7388         736         7388         736         7360         7308         736         736         736         7443         7451         7450         7450         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466</td> <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226         7210         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7249         7246         7247         7437         7443         7457         7449         7457         7449         7457         7459         7449         7457         7449         7457<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7168         7703         7101         7118         7126         7135         7143         7126           2         7168         7177         7185         7164         7727         7216         7218         7226           3         7243         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7346         7372         7300         7308         7368           7494         7437         7437         7459         7466         7467         7466         7466         7467         7469         7467         7469         7469         7467         7469         7469         7467         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7056         7168         7177         7185         7193         7202         7210         7218         7226           2         7160         7161         7185         7202         7210         7218         7226           3         7243         7251         7257         7262         7210         7218         7226           4         7324         7326         7364         7372         7300         7398           7404         7412         7419         7457         7264         7372         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7451         7451         7451         7451         7451         7451         7452         7443         7451         7451         7452         7464         7451         7454         7451         7461         7451         7461<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7084         7093         7101         7118         7126         7218         7226           1         7060         7168         7177         7185         7202         7210         7218         7226           1         7060         7183         7267         7262         7202         7218         7226           1         7064         7326         7267         7262         7306         7388         7368           1         7324         7326         7364         7372         7431         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7449         7451         7449         7451         7452         7443         7451         7451         7452         7444         7451         7449         7451         7444         7451         7452         7444         7451         7454         7454         7454         7454</td><td>6990         6998         7007         7016         70124         7013         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7216         7218         7226           4         7324         7324         7327         7431         7451         7450         7308           5         7240         7432         7443         7452         7450         7450         7451           6         7482         7432         7443         7452         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7452         7452         7452         7451         7451         7451         7451         7451         7452</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7218         7226           3         7243         7251         7259         7260         7308         7308         7326           4         7324         7332         7340         7348         7372         7310         7388           4         7324         7332         7343         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7110         7118         7126         7218         7226           2         71243         7251         7259         7260         7218         7226           3         7243         7251         7257         7244         7292         7300         7308           4         7324         7332         7340         7348         7356         7364         7372         7300         7308           5         7404         7412         7497         7505         7513         7451         7459         7450         7459         7466         7457         7469         7466         7457         7469         7466         7672         7694         7459         7466         7443         7450         7469         7469         7469         7657         7649         7657         7649         7664         7672         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7101         7118         7126         7267         7202         7210         7218         7226         7210         7118         7126         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7218         7226         7226         7210         7218         7226         7226         7210         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         72</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         <td< td=""><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7016         7024         7030         7101         7110         7118         7126         7130         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7145         7144         7146         7146         7140         7147         7148         7156         7144         7140         7147         7148         7144         7146         7144         7147         7148         7144         7146         7144         7147         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           7160       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7</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1707         7160         7168         7177         7185         7193         7202         7210         7218         7226           1760         7168         7177         7185         7193         7202         7210         7218         7226           1724         7251         7259         7267         7278         7322         7300         7308           1724         7402         7402         7324         7322         7300         7308           1724         7402         7402         7402         7300         7308           1724         7402         7402         7404         7417         7427         7439         7449         7451         7459         7461         7461         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1006         7168         7169         7101         7110         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7141         7142         7143         7143         7143         7144         7141         7143         7144         7145         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         71</td><td>0         6990         6998         7007         7016         7024         7033         7042         7036         7037         7007         7007         7007         7007         7007         7007         7007         7007         7007         7007         7000         7007         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         70</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059         7059           1 7056         7168         7170         7110         7110         7118         7120         7210         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         <t< td=""><td>6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167         7166         7193         7101         7110         7118         7126         7135         7143         7126           7243         7251         7259         7284         7220         7210         7218         7226         7220         7210         7138         7136         7143         711         7126         7220         7210         7218         7226         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220<!--</td--><td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td><td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td></td></t<></td></td<></td></td></td></td> | 0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           3         71243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7325         7364         7372         7300         7308         7326           7         7434         7437         7443         7451         7459         7300         7308           7         7443         7454         7457         7443         7459         7469         7469           7         7549         7443         7451         7459         7459         7466         7469         7469         7466         7469         7469      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       7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70 | 0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7348         7352         7300         7308         736         7388         736         7388         736         7360         7308         736         736         736         7443         7451         7450         7450         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466         7466 | 0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226         7210         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7249         7246         7247         7437         7443         7457         7449         7457         7449         7457         7459         7449         7457         7449         7457 <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7168         7703  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6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7056         7168         7177         7185         7193         7202         7210         7218         7226           2         7160         7161         7185         7202         7210         7218         7226           3         7243         7251         7257         7262         7210         7218         7226           4         7324         7326         7364         7372         7300         7398           7404         7412         7419         7457         7264         7372         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7451         7451         7451         7451         7451         7451         7452         7443         7451         7451         7452         7464         7451         7454         7451         7461         7451         7461<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7084         7093         7101         7118         7126         7218         7226           1         7060         7168         7177         7185         7202         7210         7218         7226           1         7060         7183         7267         7262         7202         7218         7226           1         7064         7326         7267         7262         7306         7388         7368           1         7324         7326         7364         7372         7431         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7449         7451         7449         7451         7452         7443         7451         7451         7452         7444         7451         7449         7451         7444         7451         7452         7444         7451         7454         7454         7454         7454</td><td>6990         6998         7007         7016         70124         7013         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7216         7218         7226           4         7324         7324         7327         7431         7451         7450         7308           5         7240         7432         7443         7452         7450         7450         7451           6         7482         7432         7443         7452         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7452         7452         7452         7451         7451         7451         7451         7451         7452</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7218         7226           3         7243         7251         7259         7260         7308         7308         7326           4         7324         7332         7340         7348         7372         7310         7388           4         7324         7332         7343         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7110         7118         7126         7218         7226           2         71243         7251         7259         7260         7218         7226           3         7243         7251         7257         7244         7292         7300         7308           4         7324         7332         7340         7348         7356         7364         7372         7300         7308           5         7404         7412         7497         7505         7513         7451         7459         7450         7459         7466         7457         7469         7466         7457         7469         7466         7672         7694         7459         7466         7443         7450         7469         7469         7469         7657         7649         7657         7649         7664         7672         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7101         7118         7126         7267         7202         7210         7218         7226         7210         7118         7126         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7218         7226         7226         7210         7218         7226         7226         7210         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         72</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         <td< td=""><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7016         7024         7030         7101         7110         7118         7126         7130         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7145         7144         7146         7146         7140         7147         7148         7156         7144         7140         7147         7148         7144         7146         7144         7147         7148         7144         7146         7144         7147         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           7160         7160         7168         7177         7185         7193         7202         7210         7218         7226           7160         7168         7177         7185         7193         7202         7210         7218         7226           7243         7251         7259         7267         7210         7218         7226           7243   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  7218         7226           1724         7251         7259         7267         7278         7322         7300         7308           1724         7402         7402         7324         7322         7300         7308           1724         7402         7402         7402         7300         7308           1724         7402         7402         7404         7417         7427         7439         7449         7451         7459         7461         7461         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1006         7168         7169         7101         7110         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7141         7142         7143         7143         7143         7144         7141         7143         7144         7145         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         71</td><td>0         6990         6998         7007         7016         7024         7033         7042         7036         7037         7007         7007         7007         7007         7007         7007         7007         7007         7007         7007         7000         7007         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         70</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059         7059           1 7056         7168         7170         7110         7110         7118         7120         7210         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         <t< td=""><td>6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167         7166         7193         7101         7110         7118         7126         7135         7143         7126           7243         7251         7259         7284         7220         7210         7218         7226         7220         7210         7138         7136         7143         711         7126         7220         7210         7218         7226         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220<!--</td--><td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td><td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td></td></t<></td></td<></td></td></td> | 0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7168         7703         7101         7118         7126         7135         7143         7126           2         7168         7177         7185         7164         7727         7216         7218         7226           3         7243         7259         7267         7275         7284         7292         7300         7308           4         7324         7332         7340         7346         7372         7300         7308         7368           7494         7437         7437         7459         7466         7467         7466         7466         7467         7469         7467         7469         7469         7467         7469         7469         7467         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469         7469 <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70</td> <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7056         7168         7177         7185         7193         7202         7210         7218         7226           2         7160         7161         7185         7202         7210         7218         7226           3         7243         7251         7257         7262         7210         7218         7226           4         7324         7326         7364         7372         7300         7398           7404         7412         7419         7457         7264         7372         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7451         7451         7451         7451         7451         7451         7452         7443         7451         7451         7452         7464         7451         7454         7451         7461         7451         7461<td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7084         7093         7101         7118         7126         7218         7226           1         7060         7168         7177         7185         7202         7210         7218         7226           1         7060         7183         7267         7262         7202         7218         7226           1         7064         7326         7267         7262         7306         7388         7368           1         7324         7326         7364         7372         7431         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7449         7451         7449         7451         7452         7443         7451         7451         7452         7444         7451         7449         7451         7444         7451         7452         7444         7451         7454         7454         7454         7454</td><td>6990         6998         7007         7016         70124         7013         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7216         7218         7226           4         7324         7324         7327         7431         7451         7450         7308           5         7240         7432         7443         7452         7450         7450         7451           6         7482         7432         7443         7452         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7452         7452         7452         7451         7451         7451         7451         7451         7452</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7218         7226           3         7243         7251         7259         7260         7308         7308         7326           4         7324         7332         7340         7348         7372         7310         7388           4         7324         7332         7343         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7110         7118         7126         7218         7226           2         71243         7251         7259         7260         7218         7226           3         7243         7251         7257         7244         7292         7300         7308           4         7324         7332         7340         7348         7356         7364         7372         7300         7308           5         7404         7412         7497         7505         7513         7451         7459         7450         7459         7466         7457         7469         7466         7457         7469         7466         7672         7694         7459         7466         7443         7450         7469         7469         7469         7657         7649         7657         7649         7664         7672         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694</td><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7101         7118         7126         7267         7202         7210         7218         7226         7210         7118         7126         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7218         7226         7226         7210         7218         7226         7226         7210         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         72</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         <td< td=""><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7016         7024         7030         7101         7110         7118         7126         7130         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7145         7144         7146         7146         7140         7147         7148         7156         7144         7140         7147         7148         7144         7146         7144         7147         7148         7144         7146         7144         7147         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           7160         7160         7168         7177         7185         7193         7202         7210         7218         7226           7160         7168         7177         7185         7193         7202         7210         7218         7226           7243         7251         7259         7267         7210         7218         7226           7243         7351         7497         7496         7364         7497         7404           7482         7490         7497         7505         7513         7459         7406           7703         7703         7716         7723         7734         7767         7664         7612         7619           7703         7704         7716         7723         7784         7762         7767         7664         7617         7619           7703         7716         7718         7723         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1707         7160         7168         7177         7185         7193         7202         7210         7218         7226           1760         7168         7177         7185         7193         7202         7210         7218         7226           1724         7251         7259         7267         7278         7322         7300         7308           1724         7402         7402         7324         7322         7300         7308           1724         7402         7402         7402         7300         7308           1724         7402         7402         7404         7417         7427         7439         7449         7451         7459         7461         7461         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1006         7168         7169         7101         7110         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7141         7142         7143         7143         7143         7144         7141         7143         7144         7145         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         71</td><td>0         6990         6998         7007         7016         7024         7033         7042         7036         7037         7007         7007         7007         7007         7007         7007         7007         7007         7007         7007         7000         7007         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         70</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059         7059           1 7056         7168         7170         7110         7110         7118         7120         7210         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         <t< td=""><td>6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167         7166         7193         7101         7110         7118         7126         7135         7143         7126           7243         7251         7259         7284         7220         7210         7218         7226         7220         7210         7138         7136         7143         711         7126         7220         7210         7218         7226         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220<!--</td--><td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td><td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td></td></t<></td></td<></td></td> | 0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         70 | 0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7056         7168         7177         7185         7193         7202         7210         7218         7226           2         7160         7161         7185         7202         7210         7218         7226           3         7243         7251         7257         7262         7210         7218         7226           4         7324         7326         7364         7372         7300         7398           7404         7412         7419         7457         7264         7372         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7451         7451         7451         7451         7451         7451         7452         7443         7451         7451         7452         7464         7451         7454         7451         7461         7451         7461 <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7084         7093         7101         7118         7126         7218         7226           1         7060         7168         7177         7185         7202         7210         7218         7226           1         7060         7183         7267         7262         7202         7218         7226           1         7064         7326         7267         7262         7306         7388         7368           1         7324         7326         7364         7372         7431         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7449         7451         7449         7451         7452         7443         7451         7451         7452         7444         7451         7449         7451         7444         7451         7452         7444         7451         7454         7454         7454         7454</td> <td>6990         6998         7007         7016         70124         7013         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7216         7218         7226           4         7324         7324         7327         7431         7451         7450         7308           5         7240         7432         7443         7452         7450         7450         7451           6         7482         7432         7443         7452         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7452         7452         7452         7451         7451         7451         7451         7451         7452</td> <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7218         7226           3         7243         7251         7259         7260         7308         7308         7326           4         7324         7332         7340         7348         7372         7310         7388           4         7324         7332         7343         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451</td> <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7110         7118         7126         7218         7226           2         71243         7251         7259         7260         7218         7226           3         7243         7251         7257         7244         7292         7300         7308           4         7324         7332         7340         7348         7356         7364         7372         7300         7308           5         7404         7412         7497         7505         7513         7451         7459         7450         7459         7466         7457         7469         7466         7457         7469         7466         7672         7694         7459         7466         7443         7450         7469         7469         7469         7657         7649         7657         7649         7664         7672         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694</td> <td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7101         7118         7126         7267         7202         7210         7218         7226         7210         7118         7126         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7218         7226         7226         7210         7218         7226         7226         7210         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         72</td> <td>6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         <td< td=""><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7016         7024         7030         7101         7110         7118         7126         7130         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7145         7144         7146         7146         7140         7147         7148         7156         7144         7140         7147         7148         7144         7146         7144         7147         7148         7144         7146         7144         7147         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           7160         7160         7168         7177         7185         7193         7202         7210         7218         7226           7160         7168         7177         7185         7193         7202         7210         7218         7226           7243         7251         7259         7267         7210         7218         7226           7243         7351         7497         7496         7364         7497         7404           7482         7490         7497         7505         7513         7459         7406           7703         7703         7716         7723         7734         7767         7664         7612         7619           7703         7704         7716         7723         7784         7762         7767         7664         7617         7619           7703         7716         7718         7723         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1707         7160         7168         7177         7185         7193         7202         7210         7218         7226           1760         7168         7177         7185         7193         7202         7210         7218         7226           1724         7251         7259         7267         7278         7322         7300         7308           1724         7402         7402         7324         7322         7300         7308           1724         7402         7402         7402         7300         7308           1724         7402         7402         7404         7417         7427         7439         7449         7451         7459         7461         7461         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1006         7168         7169         7101         7110         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7141         7142         7143         7143         7143         7144         7141         7143         7144         7145         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         71</td><td>0         6990         6998         7007         7016         7024         7033         7042         7036         7037         7007         7007         7007         7007         7007         7007         7007         7007         7007         7007         7000         7007         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         70</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059         7059           1 7056         7168         7170         7110         7110         7118         7120         7210         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         <t< td=""><td>6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167         7166         7193         7101         7110         7118         7126         7135         7143         7126           7243         7251         7259         7284         7220         7210         7218         7226         7220         7210         7138         7136         7143         711         7126         7220         7210         7218         7226         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220<!--</td--><td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td><td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td></td></t<></td></td<></td> | 0         6990         6998         7007         7016         7024         7033         7042         7050         7050           1         7076         7084         7093         7101         7118         7126         7218         7226           1         7060         7168         7177         7185         7202         7210         7218         7226           1         7060         7183         7267         7262         7202         7218         7226           1         7064         7326         7267         7262         7306         7388         7368           1         7324         7326         7364         7372         7431         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7443         7451         7459         7449         7451         7449         7451         7452         7443         7451         7451         7452         7444         7451         7449         7451         7444         7451         7452         7444         7451         7454         7454         7454         7454 | 6990         6998         7007         7016         70124         7013         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7210         7218         7226           3         7243         7251         7259         7267         7216         7218         7226           4         7324         7324         7327         7431         7451         7450         7308           5         7240         7432         7443         7452         7450         7450         7451           6         7482         7432         7443         7452         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7452         7452         7452         7451         7451         7451         7451         7451         7452 | 0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7118         7126         7218         7226           2         7160         7185         7187         7185         7193         7202         7218         7226           3         7243         7251         7259         7260         7308         7308         7326           4         7324         7332         7340         7348         7372         7310         7388           4         7324         7332         7343         7443         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451         7451 | 0         6990         6998         7007         7016         7024         7033         7042         7050         7059           1         7076         7084         7093         7101         7110         7118         7126         7218         7226           2         71243         7251         7259         7260         7218         7226           3         7243         7251         7257         7244         7292         7300         7308           4         7324         7332         7340         7348         7356         7364         7372         7300         7308           5         7404         7412         7497         7505         7513         7451         7459         7450         7459         7466         7457         7469         7466         7457         7469         7466         7672         7694         7459         7466         7443         7450         7469         7469         7469         7657         7649         7657         7649         7664         7672         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694         7694 | 0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7101         7118         7126         7267         7202         7210         7218         7226         7210         7118         7126         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7210         7218         7226         7218         7226         7226         7210         7218         7226         7226         7210         7218         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         7226         72 | 6990         6998         7007         7016         7024         7033         7042         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050         7050 <td< td=""><td>0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7016         7024         7030         7101         7110         7118         7126         7130         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7145         7144         7146         7146         7140         7147         7148         7156         7144         7140         7147         7148         7144         7146         7144         7147         7148         7144         7146         7144         7147         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           7160         7160         7168         7177         7185         7193         7202         7210         7218         7226           7160         7168         7177         7185         7193         7202         7210         7218         7226           7243         7251         7259         7267         7210         7218         7226           7243         7351         7497         7496         7364         7497         7404           7482         7490         7497         7505         7513         7459         7406           7703         7703         7716         7723         7734         7767         7664         7612         7619           7703         7704         7716         7723         7784         7762         7767         7664         7617         7619           7703         7716         7718         7723         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1707         7160         7168         7177         7185         7193         7202         7210         7218         7226           1760         7168         7177         7185         7193         7202         7210         7218         7226           1724         7251         7259         7267         7278         7322         7300         7308           1724         7402         7402         7324         7322         7300         7308           1724         7402         7402         7402         7300         7308           1724         7402         7402         7404         7417         7427         7439         7449         7451         7459         7461         7461         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464</td><td>6990         6998         7007         7016         7024         7033         7042         7050         7059           1006         7168         7169         7101         7110         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7141         7142         7143         7143         7143         7144         7141         7143         7144         7145         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         71</td><td>0         6990         6998         7007         7016         7024         7033         7042         7036         7037         7007         7007         7007         7007         7007         7007         7007         7007         7007         7007         7000         7007         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         70</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059         7059           1 7056         7168         7170         7110         7110         7118         7120         7210         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         <t< td=""><td>6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167         7166         7193         7101         7110         7118         7126         7135         7143         7126           7243         7251         7259         7284         7220         7210         7218         7226         7220         7210         7138         7136         7143         711         7126         7220         7210         7218         7226         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220<!--</td--><td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td><td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149     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        7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td></td></t<></td></td<> | 0         6990         6998         7007         7016         7024         7033         7042         7050         7050         7059         7007         7016         7024         7030         7101         7110         7118         7126         7130         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7145         7144         7146         7146         7140         7147         7148         7156         7144         7140         7147         7148         7144         7146         7144         7147         7148         7144         7146         7144         7147         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71 | 6990         6998         7007         7016         7024         7033         7042         7050         7059           7160         7160         7168         7177         7185         7193         7202         7210         7218         7226           7160         7168         7177         7185         7193         7202         7210         7218         7226           7243         7251         7259         7267         7210         7218         7226           7243         7351         7497         7496         7364         7497         7404           7482         7490         7497         7505         7513         7459         7406           7703         7703         7716         7723         7734         7767         7664         7612         7619           7703         7704         7716         7723         7784         7762         7767         7664         7617         7619           7703         7716         7718         7723         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7767         7 | 6990         6998         7007         7016         7024         7033         7042         7050         7059           1707         7160         7168         7177         7185         7193         7202         7210         7218         7226           1760         7168         7177         7185         7193         7202         7210         7218         7226           1724         7251         7259         7267         7278         7322         7300         7308           1724         7402         7402         7324         7322         7300         7308           1724         7402         7402         7402         7300         7308           1724         7402         7402         7404         7417         7427         7439         7449         7451         7459         7461         7461         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7462         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464         7464 | 6990         6998         7007         7016         7024         7033         7042         7050         7059           1006         7168         7169         7101         7110         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7141         7142         7143         7143         7143         7144         7141         7143         7144         7145         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         7146         71 | 0         6990         6998         7007         7016         7024         7033         7042         7036         7037         7007         7007         7007         7007         7007         7007         7007         7007         7007         7007         7000         7007         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         7000         70 | 6 6990         6998         7007         7016         7024         7033         7042         7050         7059         7059           1 7056         7168         7170         7110         7110         7118         7120         7210         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7218         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221         7221 <t< td=""><td>6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167         7166         7193         7101         7110         7118         7126         7135         7143         7126           7243         7251         7259         7284         7220         7210         7218         7226         7220         7210         7138         7136         7143         711         7126         7220         7210         7218         7226         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220<!--</td--><td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td><td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td></td></t<> | 6990         6998         7007         7016         7024         7033         7042         7050         7059         7069           7160         7166         7166         7167         7166         7193         7101         7110         7118         7126         7135         7143         7126           7243         7251         7259         7284         7220         7210         7218         7226         7220         7210         7138         7136         7143         711         7126         7220         7210         7218         7226         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7210         7218         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220         7220 </td <td>6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         &lt;</td> <td>0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0</td> <td>6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<></td> | 6 6990         6998         7007         7016         7024         7033         7042         7036         7089         7007         7016         7026         7026         7026         7026         7026         7026         7118         7116         7118         7126         7121         7121         7121         7121         7121         7128         7121         7128         7128         7129         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7141         7141         7141         7141         < | 0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0 | 6 6990         6998         7007         7016         7024         7033         7042         7050         7056           1 7076         7084         7093         7101         7118         7118         7126         7128         7129         7284         7297         728         7188         7135         7244         7297         7284         7297         7284         7297         7284         7297         7284         7297         7288         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7308         7443         7457         7443         7457         7443         7457         7443         7457         7443         7457         7448         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457         7444         7457 <td< td=""><td>6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<></td></td<> | 6 6990         6998         7007         7016         7024         7033         7042         7050         7059           1 7076         7084         7093         7101         7118         7126         7128         7121         7121         7128         7129         7124         7224         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7129         7128         7129         7224         7224         7221         7218         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128         7128 <t< td=""><td>1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144</td><td>6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<></td></t<> | 1         0.990         6.998         7007         7016         7110         7110         7111         7112         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7141         7143         7143         7144         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144 | 6990         6998         7007         7016         7124         7033         7020         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127         7127 <th< td=""><td>0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71</td><td>6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<></td></th<> | 0.090         6998         7007         7016         7024         7033         7042         7030         7059           1.076         7084         7093         7101         7110         7118         7126         7135         7143         7121         7126         7120         710         710         7118         7126         7135         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7143         7143         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         7144         71 | 6990         6998         7007         7016         7024         7033         7020         7113         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7143         7144         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126 <th< td=""><td>6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         &lt;</td><td>0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         &lt;</td><td>6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         <th< td=""></th<></td></th<> | 6990         6998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7118         7126         7139         7149         7149         7169         7101         7118         7126         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         71449         71449         7149         < | 0.090         0.998         7007         7016         7024         7033         7101         7110         7118         7126         7136         7139         7149         7169         7101         7110         7118         7126         7139         7149         7126         7139         7149         7149         7126         7136         7136         7139         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         7149         < | 6990         6998         7007         7016         7024         7031         7110         7110         7118         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126         7126 <th< td=""></th<> |

| 1.1.         0.000         0.011         0.072         11.39         14.61         17.61         20.01         2.51.2         2.64.1         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2         2.66.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Z           | 0     |      | 2             | 3     | 7*     | ιń       | 9       | 7    | 00     | 6             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|------|---------------|-------|--------|----------|---------|------|--------|---------------|
| 1,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0           |       | 0000 | 30 10         | 77    | 6021   | 0        | 7782    | 5    | ~      | 9542          |
| 1,000,000,000,000,000,000,000,000,000,0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -           |       |      | 0             | 1120  | 1.46.1 | 1741     | 20.41   | 201  | Li Li  | 7 7 0 0       |
| 4771         4914         4915         5416         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417         5417 <td< td=""><td>- ^</td><td>20102</td><td>2 6</td><td>3474</td><td>36.17</td><td>3802</td><td>3070</td><td>4150</td><td>4314</td><td>7 7</td><td>1674</td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | - ^         | 20102 | 2 6  | 3474          | 36.17 | 3802   | 3070     | 4150    | 4314 | 7 7    | 1674          |
| (0.02.1)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)         (0.12.2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>3</b> ~1 | 4771  | 1 6  | 5051          | 5185  | 5315   | 5441     | 5563    | 5682 | 79     | 5911          |
| 6990         7076         7160         7243         7324         7340         7364         7467         7593         8062         8129         8195         8261         8251         8692         8129         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180         8180 <th< td=""><td>7</td><td>6021</td><td>2</td><td>6232</td><td>6335</td><td>6435</td><td>6532</td><td>6628</td><td>6721</td><td>8</td><td>7069</td></th<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 7           | 6021  | 2    | 6232          | 6335  | 6435   | 6532     | 6628    | 6721 | 8      | 7069          |
| 1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,000,000   1,00 | 2           | 0669  | 0.7  | $\overline{}$ | 7243  | 7324   | 7404     | 7482    | 55   | 63     | 7709          |
| 4.47.8.         7.85.3         7.92.4         7.84.3         8.69.2         8.12.9         8.19.9         8.66.2         8.12.9         8.19.9         8.66.2         8.12.9         8.19.9         8.66.2         8.82.3         8.82.1         8.82.2         8.82.1         8.82.2         8.82.1         8.82.2         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1         8.82.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |       |      |               |       |        |          |         | ,    |        | -             |
| 0.0000   0.043   0.041   0.041   0.041   0.041   0.041   0.041   0.042   0.048   0.048   0.041   0.041   0.043   0.043   0.043   0.043   0.043   0.043   0.043   0.043   0.043   0.043   0.043   0.043   0.043   0.043   0.044   0.044   0.043   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.044   0.0 | 91          | 20 L  | 30 1 | 26            | 66    | 8062   | - 1      | 8195    | 97   | 35     | 8388          |
| 1139   1173   1173   1174   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175   1175    | r- 0        | 8451  | → a  | 8573          | n c   | 2698   | ~ n      | 8808    | 8865 | 76     | 70            |
| 1992   1992   1993   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1994   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995   1995    | 0 0         | 9031  | 00   | 9130          | r a   | u r    | a r      | 9343    | 9349 | 7 0    | * 0           |
| 1.000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 10          | 2466  | 7 7  | 9030          | 0 0   |        | - ^      | 0253    | 2007 | - ~    | 7 7           |
| 1461   0453   0452   0453   0564   0667   0668   0679   0792   0792   0792   0792   0792   0792   0792   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793   0793    | 2           |       | ۳    |               | 3     |        | 4        | 200     | 1000 | 1      | -             |
| 1792   1084   1084   1084   1094   1004   1003   1072   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084   1084    | =           | 0414  | 45   | 49            | 5.3   | 99     | 9        | 4       | 68   | 100    | 0755          |
| 1119   1173   1206   1239   1271   1303   1315   1367   1399   1371   1315   1367   1399   1371   1361   1367   1399   1371   1361   1367   1399   1371   1361   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362   1362    | 17          | 0792  | 82   | 86            | 89    | 93     | 96       | 0       | 03   | 0      | 1106          |
| 1461   1492   1523   1553   1584   1614   1673   1703   1818   1847   1875   1993   1993   1993   1703   1818   1847   1875   1993   1994   1987   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875   1875    | 13          | 1139  | 7    | 20            | 23    | 2.2    | 30       | 33      | 36   | m      | 474           |
| 1701   1790   1818   1847   1875   1903   1931   1959   1987   1842   1847   1847   1847   1847   1847   1847   1848   1175   2201   2227   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253   2253    | 14          | 1461  | 9    | 52            | 55    | 58     | 1614     | 64      | 29   | 1703   | ~             |
| 2041         2068         2095         2122         2148         2175         2201         2227         2253           2553         2553         2380         2405         2495         2498         2504         2554         2573         2573         2574         2593         2945         2480         2504         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2594         2694         2694         2694         2694         2694         26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 15          | 1921  | 6    | 1818          | 44    | 87     | 1903     | m)      | 96   | 1987   | 0             |
| 2.041         2.09         2.042         2.042         2.042         2.042         2.042         2.042         2.041         2.042         2.042         2.042         2.042         2.042         2.042         2.042         2.042         2.042         2.042         2.042         2.042         2.043         2.043         2.043         2.043         2.048         2.040         2.043         2.043         2.048         2.040         2.043         2.043         2.048         2.040         2.045         2.118         2.044         2.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044         3.044                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2           |       | č    | - 0           |       | 0 7    | -        | 0       | 6000 |        | 1             |
| 2.5543         2.525         2.648         2.672         2.439         2.431         2.542         2.432         2.443         2.443         2.543         2.648         2.672         2.648         2.672         2.433         2.443         2.648         2.673         2.645         2.647         2.648         2.673         2.645         2.647         2.648         2.672         2.648         2.673         2.645         2.647         2.648         2.647         2.669         2.643         2.646         2.648         2.673         2.645         2.647         2.669         2.643         2.647         2.669         2.643         2.644         2.644         3.661         3.647         3.661         3.647         3.647         3.647         3.647         3.647         3.647         3.644         3.664         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644         3.644 <t< td=""><td>9 [</td><td>†</td><td>3,</td><td>2 '</td><td>- 0</td><td>2405</td><td>2430</td><td>2 4</td><td>1777</td><td></td><td>2 2</td></t<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 9 [         | †     | 3,   | 2 '           | - 0   | 2405   | 2430     | 2 4     | 1777 |        | 2 2           |
| 1,222   3,243   3,264   3,304   3,324   3,345   3,365   3,385   3,3181   3,322   3,443   3,464   3,464   3,483   3,502   3,527   3,441   3,464   3,483   3,502   3,527   3,441   3,464   3,483   3,502   3,527   3,441   3,464   3,483   3,502   3,527   3,441   3,464   3,483   3,502   3,527   3,441   3,464   3,483   3,562   3,871   3,729   3,447   3,465   3,485   3,447   3,467   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,447   3,4 | 7 7         | 30    | 5.5  | 71 4          | 9 4   | 26405  | 26420    | 0 4     | 2718 |        | 76            |
| 3.222   3.243   3.264   3.056   3.118   3.129   3.100   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.181   3.18 | 10          | 0 0   | 0 0  | 0 0           | o a   | 0707   | 2000     | 000     | 2045 |        | 2 3           |
| 1,222         3,243         3,264         3,324         3,324         3,365         3,385         3,324         3,364         3,484         3,484         3,484         3,484         3,484         3,482         3,471         3,456         3,484         3,482         3,473         3,445         3,486         3,482         3,482         3,486         3,485         3,486         3,482         3,486         3,486         3,486         3,489         3,497         3,446         3,488         3,866         3,487         3,486         3,489         3,499         3,416         3,486         3,489         3,499         3,416         3,489         3,499         3,416         3,489         3,499         3,416         3,489         3,499         3,416         3,489         3,499         3,446         3,489         3,499         3,449         4,416         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419         4,419 <td< td=""><td>20</td><td>0 -</td><td>03</td><td>0 0</td><td>0 0</td><td>3096</td><td>3118</td><td>13</td><td>3160</td><td></td><td>3201</td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 20          | 0 -   | 03   | 0 0           | 0 0   | 3096   | 3118     | 13      | 3160 |        | 3201          |
| 1         31222         31243         3264         3284         3304         3324         3345         3364         3484         3362         3522         3541         3365         3489         3481         3362         3522         3541         3565         3579         3747         3747         3745         3485         3865         3674         3892         3909         3977         3945         3874         3892         3909         3977         3945         3945         3874         3892         3909         3977         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3946         3947         3945         3945         4487         4487         4669         4683         4669         4713         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494         4494                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ì           |       | 1    |               | 1     |        |          |         |      |        |               |
| 2         3424         3484         3481         3502         3522         3541         3560         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         3579         35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2.1         | 3222  | A.I  | 3263          | 20    | 3304   | 3324     | 3345    | 3365 | 38     | 3404          |
| 3 8617         3855         3674         3692         3711         3729         3747         3766         3           4 150         4160         4014         4031         4048         4065         4082         4071         4165         4167         4167         4167         4167         4167         4167         4169         4165         4169         4165         4169         4165         4169         4165         4169         4165         4169         4167         4161         4169         4165         4169         4165         4169         4165         4169         4169         4165         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         4169         41                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 77          | 3424  | 4    | 3464          | 400   | 3502   | 3522     | 3541    | 3560 | 57     | 3598          |
| 4 150         4 160         4 183         3856         3874         3892         3909         3927         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3945         3946         4949         4266         4099         4116         4940         4446         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440         4440                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 23          | 3617  | -2   | 3655          | 67    | 3695   | 3711     | 3729    | 3747 | 76     | 3784          |
| 4150 4166 4183 4200 4216 4232 4249 4265 4480 4116 4116 4116 4116 41310 4201 4202 4209 4125 4440 4116 4116 41310 4201 4202 4218 4239 4409 4425 4440 4116 4116 41310 4201 4201 4201 4201 4201 4201 4201 42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 24          | 3802  | മെ   | 3838          | 00 0  | 3874   | 3892     | 3909    | 3927 | 94     | 3962          |
| 4150         4166         4183         4200         4216         4232         4249         4265         4481           4114         4310         4362         4378         4393         4409         4425         4440           4472         4487         4564         4518         4393         4694         4425         4440           4624         4634         4659         4683         4698         4513         4728         4440           4624         4639         4654         4683         4698         4694         4725         4440           4624         4639         4654         4683         4698         4713         4728         4440           4771         4786         4800         4814         4829         4843         4871         4886         4742         4742         4742         4742         4742         4742         4742         4742         4742         4742         4742         4742         4742         4742         4742         47444         4829         4843         4867         4871         4886         4742         4742         4742         4742         4742         4742         4742         4742         4742                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 67          | -     | 7    | # O#          | 2     | 4040   | 000      | 700#    | 4604 | -      | 2             |
| 4314         4346         4362         4378         4393         4409         4425         4440         4659         4469         4659         4469         4659         4469         4659         4469         4659         4669         4669         4659         4669         4669         4659         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669         4669 <td< td=""><td>97</td><td>15</td><td>4166</td><td>4183</td><td>~</td><td>4216</td><td>N</td><td>24</td><td>92</td><td><math>\sim</math></td><td>4298</td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 97          | 15    | 4166 | 4183          | ~     | 4216   | N        | 24      | 92   | $\sim$ | 4298          |
| 4472         4487         4562         4518         4533         4548         4564         4579         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4594         4683         4697         4713         4724         4864         4683         4697         5011         5024         4873         4873         4874         4874         4874         4874         4874         4874         4874         4874         4874         4874         4874         4874         4874         4874         4877         4874         4877         4874         4874         4877         5186         5119         5024         5237         5250         5263         5276         5289         5289         5287         5289         5876         5889         5496         5410         5514         5527         5539         5416         5871         5488         5539         5416         5871         5488         5539         5411         5621         5628         5549         5549         5671         5688         5572 <td< td=""><td>2.7</td><td>3.1</td><td>4330</td><td>4346</td><td>~</td><td>4378</td><td>m</td><td>40</td><td>42</td><td>4</td><td>4456</td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2.7         | 3.1   | 4330 | 4346          | ~     | 4378   | m        | 40      | 42   | 4      | 4456          |
| 4024         4054         4059         4013         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124         4124 <td< td=""><td>87</td><td>P 1</td><td>4487</td><td>4502</td><td>s o</td><td>4533</td><td>so.</td><td>9 9</td><td>57</td><td>50</td><td>4609</td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 87          | P 1   | 4487 | 4502          | s o   | 4533   | so.      | 9 9     | 57   | 50     | 4609          |
| 4914         4928         4942         4955         4969         4983         4997         5011         5024         5051         5051         5052         5051         5051         5052         5051         5052         5051         5051         5052         5079         5012         5052         5215         5119         5126         5289         5216         5289         5216         5289         5216         5289         5216         5289         5416         5289         5416         5408         5409         5418         5409         5502         5514         5527         5289         5417         5529         5611         5622         5514         5527         5339         5416         5409         5502         5514         5527         5339         5416         5502         5514         5527         5339         5416         5409         5611         5628         5616         5617         5628         5617         5628         5617         5628         5617         5628         5617         5628         5617         5628         5617         5628         5617         5628         5617         5628         5617         5628         5679         5617         5628 <td< td=""><td>57</td><td>4 r</td><td>4034</td><td>ρα</td><td>ρα</td><td>4003</td><td>0 0</td><td>1 7</td><td>2 6</td><td>r 00</td><td>4900</td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 57          | 4 r   | 4034 | ρα            | ρα    | 4003   | 0 0      | 1 7     | 2 6  | r 00   | 4900          |
| 4914         4928         4945         4955         4969         4983         4997         5011         5024         5155         5119         5132         5145         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159 <td< td=""><td>20</td><td>-</td><td>00/#</td><td>000</td><td>0</td><td>4074</td><td>0</td><td>0</td><td>5</td><td>3</td><td>2</td></td<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 20          | -     | 00/# | 000           | 0     | 4074   | 0        | 0       | 5    | 3      | 2             |
| 2         5051         5065         5079         5105         5119         5132         5145         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         5159         51                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3.1         | 6     | 92   | - 6           | 95    | 4969   | 4983     | 4997    | 0    | 0.2    | 0             |
| 3         5185         5198         5211         5224         5237         5260         5263         5276         5289         528         5216         5289         5416         5289         5416         5878         5319         5416         5889         5416         5878         5416         5879         5416         5873         5416         5873         5416         5873         5416         5873         5416         5873         5416         5873         5416         5873         5416         5873         5416         5873         5418         5873         5688         5873         5418         5873         5441         5875         566         5877         5888         573         5789         5881         5873         5688         5889         5889         5888         5899         600         6017         6085         6086         5877         5888         5899         600         6017         6085         6086         5877         5888         5899         600         6017         6085         6086         6096         6097         6096         6097         6096         6097         6096         6097         6096         6097         6096         6097         6096 <td>32</td> <td>5051</td> <td>90</td> <td>0</td> <td>60</td> <td>5105</td> <td>5119</td> <td>5132</td> <td>7</td> <td>15</td> <td><math>\overline{}</math></td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 32          | 5051  | 90   | 0             | 60    | 5105   | 5119     | 5132    | 7    | 15     | $\overline{}$ |
| 4         5315         5328         5340         5353         5366         5378         5591         5403         5416         5           5         5441         5453         5465         5476         5502         5514         5539         5416         5           7         5682         5563         5540         5611         5623         5635         5539         5           7         5682         5694         5611         5623         5645         5539         5           8         5798         5802         5811         5729         5440         5555         5666         5777         5688         5999         6           9         5911         5622         5647         5686         5977         5888         5999         6         6           9         5911         6024         6053         6064         6075         6085         6096         6107         6         6         6         6         6         6         6         6         6         6         6         6         6         6         6         6         6         6         6         6         6         6         6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 33          | 5185  | 19   | $\sim$        | 22    | 5237   | 5250     | 5263    | 27   | 20     | 5302          |
| 5         5441         5453         5465         5478         5490         5502         5514         5527         5539         5           5         5682         5555         5587         5599         5611         5623         5635         5647         5658         5           5         5682         5684         5705         5717         5729         5740         5752         5743         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5776         5776         5776         5776         5776         5777         5771         5771         5771         5771         5771         5771         5772         5774         6484         6493         6797         6497         6090         6710         6712         6712         6712         6712         6712         6712         6712         6712         6712 <t< td=""><td>34</td><td>5315</td><td>32</td><td>~ ·</td><td>35</td><td>5366</td><td>5378</td><td>5391</td><td>40</td><td>7 7</td><td>77" 1</td></t<>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 34          | 5315  | 32   | ~ ·           | 35    | 5366   | 5378     | 5391    | 40   | 7 7    | 77" 1         |
| 568.2         556.3         5575         5587         5589         5611         562.3         5635         5647         5688         5775         5789         5611         562.3         5635         5647         5688         5875         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5788         5775         5775         5788         5775         5788         5775         5788         5775         5788         5775         5788         5775         5788         5797         5788         5797         5788         5797         5784         6107         60         6107         60         6107         60         6107         60         6107         60         6107         60         6107         60         6107         60         6070         6080         6090         6090         6090         6090         6090         6090         6090         6090         6090                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 35          | 5441  | 45   | 44            | 47    | 5490   | 5502     | 5514    | 52   | 23     | ŝ             |
| 5 5682         5694         5705         5717         5729         5740         5752         5763         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5775         5786         5775         5786         5775         588         5775         5786         5786         5775         5786         5775         5786         5775         5786         5775         5786         5777         6787         6797         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         60         6007         6007         60         6007         6007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 36          | 5563  | 57   | 5587          | 5     | 9      | 62       | vQ.     | 7.9  | - 9    | 5670          |
| 9         5798         5809         5821         5832         5843         5855         5866         5877         5888         5899         6           9         5911         5922         5933         5944         5955         5966         5977         5988         5999         6           1         6021         6031         6042         6055         6064         6075         6085         6097         6999         6           2         6212         6243         6253         6266         577         6385         6094         6107         6107         6108         6107         6107         6108         6094         6107         6107         6107         6085         6096         6107         6107         6107         6085         6096         6107         6107         6085         6096         6107         6107         6086         6096         6107         6096         6097         6096         6097         6096         6097         6096         6097         6099         6099         6099         6099         6099         6099         6099         6099         6099         6099         6099         6099         6099         6099         6099 <td>37</td> <td>5682</td> <td>69</td> <td>5705</td> <td>7</td> <td>5729</td> <td>~</td> <td>~</td> <td>76</td> <td>77</td> <td>5786</td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 37          | 5682  | 69   | 5705          | 7     | 5729   | ~        | ~       | 76   | 77     | 5786          |
| 9         5911         5922         5933         5944         5955         5966         5977         5988         5999         6           1         6021         6031         6042         6053         6064         6075         6085         6096         6107         6           1         6128         6138         6149         6160         6170         6180         6191         6201         6212         6           2         6232         6243         6253         6263         6274         6284         6294         6304         6314         6314         6414         6414         6454         6495         6403         6513         6413         6511         6511         6511         6511         6511         6501         6513         6513         6513         6513         6513         6513         6513         6513         6509         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699         6699 <td>38</td> <td>5798</td> <td>80</td> <td>5821</td> <td>83</td> <td>5843</td> <td>œ</td> <td>an</td> <td>87</td> <td>80</td> <td>5899</td>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 38          | 5798  | 80   | 5821          | 83    | 5843   | œ        | an      | 87   | 80     | 5899          |
| 6021 6031 6042 6053 6064 6075 6085 6096 6107 6 6128 6138 6149 6160 6170 6180 6191 6201 6212 6 6232 6243 6253 6263 6274 6284 6294 6304 6314 6 6435 6345 6355 6365 6375 6385 6395 6405 6415 6 6435 6444 6454 6454 6474 6484 6493 6503 6415 6 6532 6542 6551 6561 6571 6580 6590 6599 6609 6 6532 6542 6551 6561 6571 6580 6590 6599 6609 6 6532 6542 6543 6552 6551 6561 6771 6484 6693 6599 6609 6 6532 6542 6551 6561 6571 6580 6757 6684 6693 6792 6 6532 6543 6049 6589 6699 6599 6609 6 6532 6544 6590 6590 6590 6590 6599 6609 6 6532 6545 6545 6551 6561 6571 6776 6785 6794 6972 6 6532 6911 6920 6928 6937 6946 6955 6964 6972 6 6990 6998 7007 7016 7024 7033 7042 7050 7059 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 39          | 5911  | 92   | 5933          | 94    | 5955   | 6        | 2445    | 98   | 66     | 90 10         |
| 6.128         6.138         6.149         6.160         6.170         6.180         6.191         6.201         6.212           6.232         6.243         6.253         6.263         6.274         6.284         6.294         6.304         6.314           6.335         6.345         6.355         6.365         6.375         6.385         6.395         6.405         6.415           6.532         6.444         6.454         6.464         6.494         6.493         6.603         6.513           6.532         6.531         6.561         6.571         6.580         6.599         6.609         6.590         6.609           6.628         6.637         6.464         6.494         6.493         6.609         6.590         6.590         6.590         6.513           6.532         6.537         6.464         6.566         6.675         6.684         6.590         6.609         6.609           6.628         6.637         6.646         6.656         6.675         6.676         6.684         6.693         6.702           8         6.81         6.830         6.839         6.848         6.857         6.866         6.875         6.884                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 40          | 6021  | 03   | 9             | 0.5   | 6064   | 0.7      | αĐ      | 60   | 0      | 6117          |
| 6.232         6.243         6.253         6.264         6.274         6.284         6.294         6.304         6.314           4 5.35         6.345         6.355         6.365         6.375         6.385         6.395         6.405         6.415           4 6.43         6.444         6.454         6.464         6.474         6.493         6.495         6.615         6.513           6 65.32         6.542         6.551         6.561         6.571         6.580         6.590         6.693         6.603           6 65.32         6.646         6.656         6.655         6.675         6.674         6.693         6.609           6 60.2         6.51         6.776         6.776         6.784         6.693         6.794           6 60.2         6.67         6.675         6.675         6.676         6.684         6.693         6.702           8 61.2         683.1         683.9         684.8         685.7         6.866         6.875         6.884           9 690.2         691.1         692.0         692.8         693.7         694.6         693.5         694.4         693.5         694.4         693.7           9 699.0         6998         70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7           | _     | 13   | _             | 6160  | 6170   | 8        | part of | 20   | ~      | 22            |
| 4         6435         6434         6435         6435         6495         6495         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6415         6511         6511         6511         6511         6511         6511         6511         6511         6511         6511         6511         6511         6512         6617         6684         6693         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 42          | ~     | 24   | $\sim$        | 6263  | 6274   | 28       | ∧3      | 30   | ~      | 32            |
| 4         6435         6444         6454         6464         6474         6484         6493         6503         6513         6513         6513         6514         6484         6493         6503         6513         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         6609         66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 43          | 3     | 34   | ~             | 6365  | 6375   | 38       | 3       | 40   | 4      | 6425          |
| 5         6532         6542         6551         6561         6571         6580         6590         6599         6609           6         6628         6637         646         6656         6665         6675         6684         6693         6702           7         6721         6730         6739         6749         6758         6767         6776         6786         6794         6693         6794           8         6812         6830         6839         6848         6857         6866         6875         6884           9         6902         6911         6920         6928         6937         6946         6955         6964         6972           9         6990         6998         7007         7016         7024         7033         7042         7050         7059           0         1         2         3         4         5         6         7         8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 44          | -94   | 44   | 4             | 6464  | 6474   | 8        | 48      | 20   | 5      | 52            |
| 6         6628         6637         6646         6656         6665         6675         6684         6693         6702           8         6721         6730         6739         6749         6758         6767         6776         6776         6785         6794           9         6812         6821         6830         6839         6648         6857         6866         6875         6884           9         6902         6911         6920         6928         6937         6946         6955         6964         6972           9         6990         6998         7007         7016         7024         7033         7042         7050         7059           0         1         2         3         4         5         6         7         8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             | S     | 54   | ŝ             | 6561  | 6571   | SO<br>OD | 2       | 29   | 9      | 9             |
| 7         6721         6730         6739         6749         6758         6767         6776         6785         6794           8         6812         6821         6830         6839         6848         6857         6866         6875         6884           9         6902         6911         6920         6928         6937         6946         6955         6964         6972           9         6990         6998         7007         7016         7024         7033         7042         7050         7059           0         1         2         3         4         5         6         7         8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 9#          | 8299  | 9    | 9             | 9     | 99     | 67       | 9       | 69   | 20     | _             |
| 8         6812         6821         6830         6839         6848         6857         6866         6875         6884           9         6902         6911         6920         6928         6937         6946         6955         6964         6972           0         6990         6998         7007         7016         7024         7033         7042         7050         7059           0         1         2         3         4         5         6         7         8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 47          | 6721  | P==  | ~             | 74    | 75     | 16       | P       | 78   | 4      | 0             |
| 9 6902 6911 6920 6928 6937 6946 6955 6964 6972<br>0 6990 6998 7007 7016 7024 7033 7042 7050 7059<br>0 1 2 3 4 5 6 7 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 48          | 6812  | 80   | 00            | 83    | 84     | 85       | 86      | 87   | 88     | 5             |
| 0 1 2 3 4 5 6 7 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 49          | 2069  | 91   | 6 C           | 92    | 93     | 94       | 95      | 96   | 9.7    | 7067          |
| 0 1 2 3 4 5 6 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3           |       |      | ) I           |       | :      |          |         |      |        | - 1           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | z           | 0     |      | 7             | 3     | 4      | 5        | 9       | 7    | 00     | 6             |

| deg | func-<br>tion | 0, 00    | 0,10    | 0. 2 <sup>0</sup> | 0.3°    | 0.40    | 0.5°    | 0.6°    | 0. 7°   | 0.8°    | 0.90    |
|-----|---------------|----------|---------|-------------------|---------|---------|---------|---------|---------|---------|---------|
|     | sin           | 0. 0000  | 0.0017  | 0. 0035           | 0. 0052 | 0. 0070 | 0. 0087 | 0. 0105 | 0. 0122 | 0.0140  | 0. 0157 |
| 0   | cos           | 1.0000   | 1.0000  |                   | 1.0000  | 1. 0000 | 1. 0000 | 0. 9999 |         |         |         |
|     | tan           | 0. 0000  | 0.0017  | 0. 0035           | 0.0052  | 0. 0070 | 0. 0087 | 0. 0105 |         |         | 0. 0157 |
|     |               | 0.0175   | 0.0101  |                   |         |         |         |         |         |         |         |
| ,   | sin           | 0.0175   | 0.0192  | 0. 0209           |         | 0.0244  | 0.0262  | 0.0279  |         |         | 0.0332  |
| 1   | COS           | 0. 9998  | 0. 9998 | 0. 9998           |         | 0. 9997 | 0. 9997 | 0. 9996 |         |         |         |
|     | tan           | 0. 0175  | 0. 0192 | 0. 0209           | 0. 0227 | 0.0244  | 0. 0262 | 0. 0279 | 0. 0297 | 0.0314  | 0. 0332 |
|     | sin           | 0. 0349  | 0. 0366 | 0. 0384           | 0.0401  | 0.0419  | 0. 0436 | 0.0454  | 0.0471  | 0. 0488 | 0. 0506 |
| 2   | cos           | 0. 9994  | 0.9993  | 0.9993            | 0.9992  | 0.9991  | 0. 9990 |         |         |         | 0. 9987 |
|     | tan           | 0. 0349  |         |                   |         | 0.0419  | 0.0437  | 0.0454  |         |         | 0. 0507 |
|     | sin           | 0. 0523  | 0. 0541 | 0. 0558           | 0. 0576 | 0. 0593 | 0.0610  | 0. 0628 | 0. 0645 | 0.0//3  | 0.0100  |
| 3   | cos           | 0. 9986  | 0. 9985 |                   |         | 0. 9982 | 0. 9981 | 0. 9980 |         |         | 0.0680  |
| -   | tan           | 0. 0524  | 0. 0542 | 0. 0559           |         | 0. 9982 |         |         |         |         | 0. 9977 |
|     | tan           | 0.0524   | 0. 0342 | 0. 0559           | 0. 0577 | 0. 0594 | 0.0612  | 0.0629  | 0.0647  | 0. 0664 | 0. 0682 |
|     | şin           | 0.0698   |         | 0.0732            |         |         | 0.0785  |         | 0.0819  | 0.0837  | 0. 0854 |
| 4   | cos           | 0. 9976  | 0.9974  |                   |         | 0.9971  | 0. 9969 | 0. 9968 | 0. 9966 | 0.9965  | 0.9963  |
|     | tan           | 0.0699   | 0.0717  | 0.0734            | 0.0752  | 0. 0769 | 0.0787  | 0.0805  | 0.0822  | 0.0840  | 0. 0857 |
|     | sin           | 0. 0872  | 0. 0889 | 0. 0906           | 0. 0924 | 0.0941  | 0. 0958 | 0. 0976 | 0. 0993 | 0. 1011 | 0. 1028 |
| 5   | cos           | 0. 9962  | 0.9960  | 0. 9959           |         | 0. 9956 | 0, 9954 | 0. 9952 | 0. 9951 | 0. 9949 | 0. 9947 |
|     | tan           | 0. 0875  | 0.0892  | 0.0910            | 0.0928  | 0.0945  | 0. 0963 | 0. 0981 | 0. 0998 | 0. 1016 | 0. 1033 |
|     | -:-           | 0. 1045  | 0. 1063 | 0.1000            | 0 1007  | 6 1115  |         |         |         |         |         |
| 6   | sin           | 0. 1045  |         |                   | 0.1097  | 0. 1115 | 0. 1132 | 0.1149  | 0. 1167 |         | 0.1201  |
| ٠   | cos           |          |         |                   | 0.9940  | 0. 9938 | 0. 9936 | 0. 9934 | 0. 9932 |         | 0. 9928 |
|     | tan           | 0. 1051  | 0. 1069 | 0. 1086           | 0. 1104 | 0. 1122 | 0. 1139 | 0. 1157 | 0. 1175 | 0.1192  | 0. 1210 |
|     | sin           | 0.1219   |         | 0.1253            | 0.1271  | 0.1288  | 0.1305  | 0.1323  | 0.1340  | 0.1357  | 0.1374  |
| 7   | cos           | 0. 9925  | 0.9923  | 0.9921            | 0.9919  | 0.9917  | 0.9914  | 0.9912  | 0.9910  | 0.9907  | 0.9905  |
|     | tan           | 0.1228   | 0.1246  | 0.1263            | 0.1281  | 0.1299  | 0.1317  | 0.1334  | 0.1352  | 0.1370  | 0.1388  |
|     | sin           | 0. 1392  | 0. 1409 | 0. 1426           | 0. 1444 | 0. 1461 | 0. 1478 | 0. 1495 | 0. 1513 | 0. 1530 | 0, 1547 |
| 8   | cos           | 0. 9903  |         | 0. 9898           |         | 0. 9893 | 0. 9890 | 0. 9888 | 0. 9885 | 0. 9882 | 0. 9880 |
| .   | tan           | 0.1405   |         | 0. 1441           |         | 0. 1477 | 0. 1495 | 0. 1512 | 0. 1530 |         | 0. 1566 |
|     |               | 0.15/4   | 0 1503  | 0 1500            | 0.1/1/  |         |         |         |         |         |         |
| ,   | sin           | 0. 1564  |         | 0. 1599           |         | 0. 1633 | 0. 1650 | 0. 1668 | 0. 1685 | 0. 1702 | 0. 1719 |
| 1   | cos           | .0. 9877 | 0. 9874 | 0. 9871           | 0. 9869 | 0, 9866 | 0. 9863 | 0. 9860 | 0. 9857 | 0. 9854 | 0. 9851 |
| - 1 | tan           | 0.1584   | 0.1602  | 0.1620            | 0. 1638 | 0. 1655 | 0. 1673 | 0. 1691 | 0. 1709 | 0.1727  | 0. 1745 |
|     | sin           | 0. 1736  | 0.1754  | 0.1771            | 0.1788  | 0. 1805 | 0. 1822 | 0.1840  | 0.1857  | 0.1874  | 0. 1891 |
| 0   | cos           | 0.9848   | 0. 9845 | 0.9842            | 0.9839  | 0. 9836 | 0.9833  | 0. 9829 | 0.9826  | 0. 9823 | 0. 9820 |
|     | tan           | 0.1763   | 0.1781  | 0.1799            | 0.1817  | 0.1835  | 0. 1853 | 0.1871  | 0.1890  | 0.1908  | 0. 1926 |
|     | sin           | 0. 1908  | 0. 1925 | 0. 1942           | 0. 1959 | 0. 1977 | 0. 1994 | 0. 2011 | 0. 2028 | 0. 2045 | 0. 2062 |
| 1   | cos           | 0. 9816  | 0. 9813 | 0. 9810           | 0. 9806 | 0. 9803 | 0. 9799 | 0. 9796 |         | 0. 9789 | 0. 9785 |
|     | tan           | 0. 1944  | 0. 1962 | 0. 1980           | 0. 1998 | 0. 2016 | 0. 2035 | 0. 2053 | 0. 2071 | 0. 2089 | 0. 2107 |
|     |               | 0.2020   | 0.2001  | 0 3110            |         |         | 0.31/:  |         |         |         |         |
| 2   | sin           | 0. 2079  |         | 0. 2113           | 0. 2130 | 0. 2147 | 0. 2164 | 0. 2181 | 0. 2198 |         | 0. 2232 |
| ٠   | cos           | 0. 9781  | 0. 9778 | 0. 9774           | 0. 9770 |         | 0. 9763 | 0. 9759 | 0. 9755 | 0. 9751 | 0. 9748 |
|     | tan           | 0. 2126  | 0.2144  | 0. 2162           | 0. 2180 | 0. 2199 | 0. 2217 | 0. 2235 | 0. 2254 | 0. 2272 | 0. 2290 |
|     | sin           | 0. 2250  | 0, 2267 | 0. 2284           | 0. 2300 | 0. 2318 | 0. 2334 | 0. 2351 | 0. 2368 | 0. 2385 | 0. 2402 |
| 3   | cos           | 0.9744   | 0.9740  | 0, 9736           | 0.9732  | 0.9728  | 0.9724  | 0.9720  | 0.9715  | 0.9711  | 0.9707  |
|     | tan           | 0. 2309  | 0. 2327 | 0. 2345           | 0.2364  | 0. 2382 | 0.2401  | 0.2419  | 0. 2438 | 0. 2456 | 0. 2475 |
|     | func-         | 0. 0°    | 0. 10   | 0.30              | 0.30    | 0. 40   | 0. 5°   | 0.70    | 0.70    | 0.00    | 0.00    |
| leg | tion          | 0.0      | 0. 10   | 0.20              | 0.30    | 0.40    | 0.5     | 0.60    | 0.70    | 0.80    | 0.90    |

| See   100   0.0°   0.1°   0.2°   0.3°   0.4°   0.5°   0.6°   0.7°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.8°   0.   |        | func- |         |         | _                 |         |         |          |         |         |         |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|---------|---------|-------------------|---------|---------|----------|---------|---------|---------|--------|
| Sin   0. 2419   0. 2436   0. 2453   0. 2470   0. 2487   0. 2504   0. 2521   0. 2538   0. 2534   0. 2538   0. 2536   0. 2630   0. 9703   0. 9699   0. 9694   0. 9690   0. 9686   0. 9681   0. 9677   0. 9673   0. 9668   0. 9681   0. 9677   0. 9673   0. 9668   0. 9681   0. 9677   0. 9673   0. 9668   0. 9681   0. 9677   0. 9673   0. 9668   0. 9681   0. 9677   0. 9673   0. 9668   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680   0. 9680    | J      |       | 0.00    | 0.10    | 0.00              | 0.20    | 0.40    | 0 = 0    |         | 0       | 0       |        |
| tan 0.2494 0.2940 0.2957 0.2974 0.2969 0.3968 0.9587 0.2870 0.3070 0.3066 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.3981 0.398 | a e- g | tion  | 0.0     | 0. 1    | 0. 2              | 0. 30   | 0.4     | 0.50     | 0.6     | 0.70    | 0.8     | 0 9    |
| 14   cos   0.9703   0.9999   0.9994   0.9990   0.9868   0.9881   0.9677   0.9673   0.9668   0.968   0.9881   0.9677   0.9673   0.9668   0.968   0.9881   0.9677   0.9673   0.9668   0.968   0.9881   0.9677   0.9673   0.9658   0.2623   0.2642   0.2638   0.2642   0.2638   0.2642   0.2638   0.2655   0.2623   0.2642   0.2638   0.2655   0.2658   0.2655   0.2665   0.2623   0.2642   0.2638   0.2655   0.9655   0.9655   0.9655   0.9655   0.9646   0.9641   0.9636   0.9632   0.9627   0.9622   0.9625   0.9627   0.9622   0.9625   0.9627   0.9622   0.9626   0.2776   0.2679   0.2679   0.2675   0.2674   0.2773   0.2792   0.2811   0.2830   0.2658   0.2657   0.2674   0.2890   0.2658   0.9632   0.9657   0.9678   0.9553   0.9658   0.9553   0.9568   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.9563   0.   |        | sın   | 0. 2419 | 0. 2436 | 0. 2453           | 0. 2470 | 0. 2487 | 0. 2504  | 0. 2521 | 0. 2538 | 0. 2554 | 0.25   |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 14     | cos   | 0. 9703 | 0.9699  |                   |         |         |          |         |         |         |        |
| Sin   0.2588   0.2605   0.2622   0.2639   0.2550   0.2772   0.2669   0.2706   0.2723   0.2561   0.9659   0.9659   0.9659   0.9659   0.9640   0.9641   0.9636   0.9632   0.9627   0.9622   0.9621   0.9611   0.2698   0.2717   0.2736   0.2773   0.2773   0.2772   0.2811   0.2830   0.2661   0.2667   0.2773   0.2796   0.2773   0.2773   0.2772   0.2811   0.2830   0.2661   0.2667   0.2773   0.2796   0.2773   0.2796   0.2773   0.2797   0.2811   0.2830   0.2661   0.9661   0.9608   0.9603   0.9588   0.9583   0.9588   0.9583   0.9573   0.9573   0.9586   0.9677   0.2866   0.2905   0.2944   0.2949   0.2962   0.2981   0.3000   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.3019   0.30   |        |       | 1       |         |                   |         |         |          |         |         |         |        |
| tan 0.307 0.3074 0.3075 0.9550 0.9640 0.9641 0.9041 0.9036 0.9632 0.9627 0.9622 0.96 sin 0.2756 0.2773 0.2790 0.2807 0.2823 0.2824 0.2773 0.2792 0.2811 0.2830 0.26 sin 0.2867 0.2868 0.9003 0.9598 0.9593 0.9588 0.9583 0.9578 0.9573 0.95 tan 0.2867 0.2886 0.9005 0.2924 0.2931 0.2802 0.2881 0.2800 0.300 0.3019 0.30 sin 0.2924 0.2940 0.2957 0.2944 0.2940 0.3007 0.3024 0.3000 0.3019 0.30 sin 0.3056 0.9558 0.9553 0.9548 0.9553 0.9573 0.9532 0.9527 0.9521 0.9521 0.300 0.3019 0.300 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 0.3019 |        |       | 0. 21/3 | 0. 2712 | 0. 2 7 3 0        | 0. 2347 | 0. 2700 | 0. 2 300 | 0. 4005 | 0. 2023 | 0. 2042 | 0. 26  |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        | Sin   | 0. 2588 | 0. 2605 | 0. 2622           | 0. 2639 | 0. 2656 | 0.2672   | 0.2689  | 0.2706  | 0.2723  | 0. 27  |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 15     | COS   | 0.9659  | 0.9655  | 0.9650            | 0. 964b | 0.9541  | 0.9636   | 0.9632  | 0.9627  | 0.9622  | 0.96   |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        | tan   | 0, 2679 | 0. 2698 | 0.2717            | 0. 2736 | 0. 2754 | 0. 2773  | 0. 2792 | 0.2811  |         | 0. 28  |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        | sin   | 0, 2756 | 0. 2773 | 0. 2790           | 0. 2807 | 0.2823  | 0. 2840  | 0 2857  | 0 2874  | 0 2890  | 0.20   |
| tan 0. 2867 0. 2886 0. 2905 0. 2924 0. 2943 0. 2962 0. 2981 0. 3000 0. 3019 0. 305 0. 316 0. 305 0. 316 0. 305 0. 316 0. 305 0. 316 0. 305 0. 316 0. 305 0. 316 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0. 305 0.  | 16     | )     |         |         |                   |         |         |          |         |         |         |        |
| Sin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |       |         |         |                   |         |         |          |         |         |         | 0. 30  |
| 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |       |         |         |                   |         |         |          |         |         |         |        |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |       |         |         |                   |         |         |          |         |         |         |        |
| Sin   0.3090   0.3107   0.3123   0.3140   0.3156   0.3173   0.3190   0.3206   0.3223   0.323   0.320   0.9511   0.9505   0.9500   0.9494   0.9489   0.9483   0.9478   0.9472   0.9466   0.94   0.3249   0.3269   0.3288   0.3307   0.3327   0.3346   0.3305   0.3385   0.3404   0.348   0.3494   0.3494   0.9489   0.9483   0.9478   0.9472   0.9466   0.94   0.3249   0.3269   0.3289   0.3307   0.3327   0.3346   0.3305   0.3385   0.3404   0.349   0.9455   0.9449   0.9444   0.9438   0.9432   0.9426   0.9421   0.9415   0.9409   0.94   0.3443   0.3463   0.3482   0.3502   0.3522   0.3541   0.3501   0.3511   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.3501   0.350   | 17     |       |         |         |                   |         |         |          |         |         | 0. 9521 | 0.95   |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        | tan   | 0.3057  | 0. 3076 | 0. 3096           | 0. 3115 | 0, 3134 | 0. 3153  | 0.3172  | 0. 3191 | 0. 3211 | 0. 32  |
| Cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        | sin   | 0. 3090 | 0.3107  | 0.3123            | 0.3140  | 0. 3156 | 0.3173   | 0.3190  | 0. 3206 | 0. 3223 | 0. 32  |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 18     | COS   | 0.9511  | 0.9505  | 0.9500            | 0.9494  | 0.9489  | 0.9483   | 0.9478  | 0.9472  | 0.9466  | 0.94   |
| 9 cos tan 0. 9455 0. 9449 0. 9444 0. 9438 0. 9432 0. 9426 0. 9421 0. 9415 0. 9409 0. 948 tan 0. 3443 0. 3463 0. 3462 0. 3502 0. 3522 0. 3541 0. 3501 0. 3581 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0 |        | tan   | 0. 3249 | 0.3269  | 0, 3288           | 0. 3307 | 0.3327  | 0. 3346  | 0.3365  | 0.3385  |         | 0.34   |
| 9 cos tan 0. 9455 0. 9449 0. 9444 0. 9438 0. 9432 0. 9426 0. 9421 0. 9415 0. 9409 0. 948 tan 0. 3443 0. 3463 0. 3462 0. 3502 0. 3522 0. 3541 0. 3501 0. 3581 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0. 3600 0 |        | sin   | 0. 3256 | 0. 3272 | 0.3289            | 0 3305  | 0 3322  | 0 3338   | 0 3355  | 0 3371  | 0 3397  | 0.34   |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 9      |       |         |         |                   |         |         |          |         |         |         |        |
| Sin 0.3420 0.3437 0.3453 0.3469 0.3456 0.3502 0.3518 0.3535 0.3551 0.3551 cos 0.9397 0.9391 0.9385 0.9379 0.9373 0.9367 0.9361 0.9354 0.9348 0.9385 0.9379 0.3739 0.3759 0.3779 0.3799 0.3899 0.3719 0.3739 0.3759 0.3779 0.3799 0.3899 0.3809 0.3719 0.3739 0.3759 0.3779 0.3799 0.3899 0.3899 0.3899 0.3919 0.9304 0.9298 0.9291 0.9285 0.928 tan 0.3839 0.3859 0.3879 0.3879 0.3899 0.3919 0.3939 0.3959 0.3979 0.4000 0.400 0.4001 0.4001 0.4001 0.4101 0.4122 0.4142 0.4163 0.4163 0.4183 0.4204 0.428 0.9205 0.9205 0.9198 0.9191 0.9184 0.9178 0.9171 0.9164 0.9157 0.9150 0.91 tan 0.4245 0.4268 0.4268 0.4307 0.4327 0.4348 0.4369 0.4390 0.4411 0.44 0.425 0.4258 0.9128 0.9121 0.9144 0.9107 0.9100 0.9092 0.9085 0.9078 0.9088 tan 0.4452 0.4473 0.4494 0.4515 0.4536 0.4557 0.4578 0.4578 0.4633 0.4684 0.4706 0.4727 0.4748 0.4478 0.4473 0.4831 0.4834 0.4804 0.4804 0.4805 0.4877 0.4884 0.9014 0.9017 0.9108 0.9018 0.9018 0.9018 0.9018 0.9018 0.9014 0.9033 0.9056 0.9048 0.9041 0.9033 0.9056 0.9048 0.9041 0.9033 0.9056 0.9048 0.9041 0.9033 0.9056 0.9018 0.9019 0.4631 0.4653 0.4684 0.4706 0.4727 0.4748 0.4478 0.4473 0.4831 0.4834 0.4804 0.4804 0.4805 0.4877 0.4889 0.4899 0.4912 0.4942 0.4948 0.4701 0.4986 0.5008 0.5029 0.5051 0.507 0.8804 0.8804 0.4877 0.4889 0.4891 0.4826 0.4877 0.4889 0.4877 0.4889 0.4891 0.4826 0.4878 0.4878 0.4878 0.4878 0.4878 0.4884 0.4899 0.4805 0.8973 0.8973 0.8965 0.8977 0.8949 0.8942 0.8934 0.8926 0.8973 0.4877 0.4889 0.4912 0.4942 0.4948 0.4948 0.5008 0.5029 0.5051 0.50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1      |       |         |         |                   |         |         |          |         |         |         |        |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        | tan   | 0. 3443 | 0. 3403 | 0. 3402           | 0. 3302 | 0. 3722 | 0. 3541  | 0, 3501 | 0.,3561 | 0. 3600 | 0. 36  |
| tan 0. 3640 0. 3659 0. 3679 0. 3699 0. 3719 0. 3739 0. 3759 0. 3779 0. 3799 0. 88  sin 0. 3584 0. 3600 0. 361b 0. 3633 0. 3649 0. 3655 0. 3681 0. 3697 0. 3714 0. 37  cos 0. 9336 0. 9330 0. 9323 0. 9317 0. 9311 0. 9304 0. 9298 0. 9291 0. 9285 0. 92  tan 0. 3839 0. 3859 0. 3879 0. 3899 0. 3919 0. 3939 0. 3959 0. 3979 0. 4000 0. 40  sin 0. 3746 0. 3762 0. 3778 0. 3795 0. 3811 0. 3827 0. 3843 0. 3659 0. 3875 0. 38  cos 0. 9272 0. 9265 0. 9259 0. 9252 0. 9245 0. 9239 0. 9232 0. 9225 0. 9219 0. 92  tan 0. 3907 0. 3923 0. 3939 0. 3955 0. 3971 0. 3987 0. 4003 0. 4018 0. 4204 0. 42  sin 0. 3907 0. 3923 0. 3939 0. 3955 0. 3971 0. 3987 0. 4003 0. 4019 0. 4035 0. 40  cos 0. 9205 0. 9198 0. 9191 0. 9184 0. 9178 0. 9171 0. 9164 0. 9157 0. 9150 0. 91  tan 0. 4245 0. 4265 0. 4286 0. 4307 0. 4327 0. 4348 0. 4369 0. 4390 0. 4411 0. 44  sin 0. 4067 0. 4083 0. 4099 0. 4115 0. 4131 0. 4147 0. 4163 0. 4179 0. 4195 0. 42  cos 0. 9135 0. 9128 0. 9121 0. 9114 0. 9107 0. 9100 0. 9092 0. 9085 0. 9078 0. 90  tan 0. 4452 0. 4473 0. 4494 0. 4515 0. 4536 0. 4557 0. 4578 0. 4599 0. 4621 0. 46  sin 0. 4226 0. 4242 0. 4258 0. 4274 0. 4289 0. 4305 0. 4321 0. 4337 0. 4352 0. 43  sin 0. 4384 0. 4399 0. 4415 0. 4431 0. 9033 0. 9026 0. 9018 0. 9011 0. 9003 0. 89  tan 0. 4663 0. 4684 0. 4706 0. 4727 0. 4748 0. 4478 0. 4493 0. 4509 0. 4621  sin 0. 4384 0. 4399 0. 4415 0. 4431 0. 4446 0. 4462 0. 4478 0. 4493 0. 4894 0. 4804  sin 0. 4889 0. 8980 0. 8973 0. 8965 0. 8957 0. 8949 0. 8942 0. 8934 0. 8926 0. 89  tan 0. 4877 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50  sin 0. 4540 0. 4555 0. 4571 0. 4586 0. 4602 0. 4017 0. 4033 0. 4648 0. 4664 0. 88  tan 0. 4500 0. 4555 0. 4571 0. 4586 0. 4602 0. 4017 0. 4033 0. 4648 0. 4664 0. 88  tan 0. 5095 0. 5117 0. 5139 0. 5161 0. 5184 0. 5206 0. 5228 0. 5250 0. 5272 0. 52                                                                                                                                                                                                                                   |        | sin   | 0.3420  | 0.3437  | 0.3453            | 0.3469  | 0, 3486 | 0.3502   | 0.3518  | 0.3535  | 0.3551  | 0.35   |
| sin 0.3584 0.3600 0.361b 0.3633 0.3649 0.3665 0.3681 0.3697 0.3714 0.37 0.3839 0.3836 0.9330 0.9323 0.9317 0.9311 0.9304 0.9298 0.9291 0.9285 0.92 0.92 0.3839 0.3859 0.3879 0.3899 0.3919 0.3939 0.3959 0.3979 0.4000 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0 | 20     | (0\$  | 0. 9397 | 0.9391  | 0. 9385           | 0.9379  | 0.9373  | 0.9367   | 0.9361  | 0.9354  | 0.9348  | 0.93   |
| 11 cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        | tan   | 0. 3640 | 0.3659  | 0.3679            | 0. 3699 | 0.3719  | 0.3739   | 0.3759  | 0. 3779 | 0.3799  | 0.38   |
| 11 cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        | sin   | 0. 3584 | 0. 3600 | 0.3616            | 0. 3633 | 0 3649  | 0 3665   | 0.3681  | 0 3697  | 0 3714  | 0 37   |
| tan 0. 3839 0. 3859 0. 3879 0. 3899 0. 3919 0. 3939 0. 3959 0. 3979 0. 4000 0. 40  sin 0. 3746 0. 3762 0. 3778 0. 3795 0. 3811 0. 3827 0. 3843 0. 3859 0. 3875 0. 38  cos 0. 9272 0. 9265 0. 9259 0. 9252 0. 9245 0. 9239 0. 9232 0. 9225 0. 9219 0. 92  tan 0. 4040 0. 4061 0. 4081 0. 4101 0. 4122 0. 4142 0. 4163 0. 4183 0. 4204 0. 42  sin 0. 3907 0. 3923 0. 3939 0. 3955 0. 3971 0. 3987 0. 4003 0. 4019 0. 4035 0. 40  cos 0. 9205 0. 9198 0. 9191 0. 9184 0. 9178 0. 9171 0. 9164 0. 9157 0. 9150 0. 91  tan 0. 4245 0. 4265 0. 4286 0. 4307 0. 4327 0. 4348 0. 4369 0. 4390 0. 4411 0. 44  sin 0. 4067 0. 4083 0. 4099 0. 4115 0. 4131 0. 4147 0. 4163 0. 4179 0. 4195 0. 42  cos 0. 9135 0. 9128 0. 9121 0. 9114 0. 9107 0. 9100 0. 9092 0. 9085 0. 9078 0. 90  tan 0. 4452 0. 4473 0. 4494 0. 4515 0. 4536 0. 4557 0. 4578 0. 4599 0. 4621 0. 46  sin 0. 4226 0. 4242 0. 4258 0. 4274 0. 4289 0. 4305 0. 4321 0. 4337 0. 4352 0. 43  cos 0. 9003 0. 9056 0. 9048 0. 9041 0. 9033 0. 9026 0. 9018 0. 9011 0. 9003 0. 89  tan 0. 4684 0. 4706 0. 4727 0. 4748 0. 4770 0. 4791 0. 4813 0. 4834 0. 48  sin 0. 4384 0. 4399 0. 4415 0. 4431 0. 4446 0. 4462 0. 4478 0. 4493 0. 4504 0. 48  cos 0. 8988 0. 8980 0. 8973 0. 8965 0. 8957 0. 8949 0. 8942 0. 8934 0. 8926 0. 89  tan 0. 4877 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50  sin 0. 4540 0. 4555 0. 4571 0. 4586 0. 4602 0. 4017 0. 4033 0. 4648 0. 4664 0. 46  cos 0. 8910 0. 8902 0. 8894 0. 8886 0. 8878 0. 8870 0. 8862 0. 8854 0. 8846 0. 88  tan 0. 5095 0. 5117 0. 5139 0. 5161 0. 5184 0. 5206 0. 5228 0. 5250 0. 5272 0. 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 21     |       |         |         |                   |         |         |          |         |         |         |        |
| Sin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |       |         |         |                   |         |         |          |         |         |         |        |
| 22 cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |       |         |         |                   |         |         |          |         |         | 0. 1000 | 0, 10  |
| tan 0. 4040 0. 4061 0. 4081 0. 4101 0. 4122 0. 4142 0. 4163 0. 4183 0. 4204 0. 42  sin 0. 3907 0. 3923 0. 3939 0. 3955 0. 3971 0. 3987 0. 4003 0. 4019 0. 4035 0. 40  cos 0. 9205 0. 9198 0. 9191 0. 9184 0. 9178 0. 9171 0. 9164 0. 9157 0. 9150 0. 91  tan 0. 4245 0. 4265 0. 4286 0. 4307 0. 4327 0. 4348 0. 4369 0. 4390 0. 4411 0. 44  sin 0. 4067 0. 4083 0. 4099 0. 4115 0. 4131 0. 4147 0. 4163 0. 4179 0. 4195 0. 42  cos 0. 9135 0. 9128 0. 9121 0. 9114 0. 9107 0. 9100 0. 9092 0. 9085 0. 9078 0. 90  tan 0. 4452 0. 4473 0. 4494 0. 4515 0. 4536 0. 4557 0. 4578 0. 4599 0. 4621 0. 46  sin 0. 4226 0. 4242 0. 4258 0. 4274 0. 4289 0. 4305 0. 4321 0. 4337 0. 4352 0. 43  cos 0. 9003 0. 9056 0. 9048 0. 9041 0. 9033 0. 9026 0. 9018 0. 9011 0. 9003 0. 89  tan 0. 4684 0. 4706 0. 4727 0. 4748 0. 4770 0. 4791 0. 4813 0. 4834 0. 48  sin 0. 4384 0. 4399 0. 4415 0. 4431 0. 4446 0. 4402 0. 4478 0. 4493 0. 4509 0. 45  cos 0. 8988 0. 8980 0. 8973 0. 8965 0. 8957 0. 8949 0. 8942 0. 8934 0. 8926 0. 89  tan 0. 4877 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50  sin 0. 4540 0. 4555 0. 4571 0. 4586 0. 4602 0. 4017 0. 4033 0. 4648 0. 4664 0. 40  cos 0. 8910 0. 8902 0. 8894 0. 8886 0. 8878 0. 8870 0. 8862 0. 8854 0. 8846 0. 88  tan 0. 5095 0. 5117 0. 5139 0. 5161 0. 5184 0. 5206 0. 5228 0. 5250 0. 5272 0. 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        | sın   | 0. 3746 | 0.3762  | 0.3778            | 0.3795  | 0.3811  | 0.3827   | 0.3843  | 0.3859  | 0.3875  | 0.38   |
| sin 0. 3907 0. 3923 0. 3939 0. 3955 0. 3971 0. 3987 0. 4003 0. 4019 0. 4035 0. 40 0 0. 9205 0. 9198 0. 9191 0. 9184 0. 9178 0. 9171 0. 9164 0. 9157 0. 9150 0. 91 0. 4245 0. 4265 0. 4286 0. 4307 0. 4327 0. 4348 0. 4369 0. 4390 0. 4411 0. 44 0. 44 0. 4452 0. 9155 0. 9128 0. 9121 0. 9114 0. 9107 0. 9100 0. 9092 0. 9085 0. 9078 0. 90 0. 415 0. 4155 0. 4536 0. 4557 0. 4578 0. 4599 0. 4621 0. 46 0. 46 0. 4076 0. 4727 0. 4748 0. 4770 0. 4791 0. 4813 0. 4834 0. 480 0. 4809 0. 4399 0. 4415 0. 4431 0. 4446 0. 4402 0. 4478 0. 4493 0. 4509 0. 450 0. 450 0. 4601 0. 46 0. 4777 0. 4781 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50 0. 8910 0. 8902 0. 8894 0. 8894 0. 8878 0. 8870 0. 8802 0. 8854 0. 8846 0. 88 0. 5095 0. 5117 0. 5139 0. 5161 0. 5184 0. 5206 0. 5228 0. 5250 0. 5272 0. 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 22     | COS   | 0.9272  | 0.9265  | 0.9259            | 0.9252  | 0.9245  | 0.9239   | 0.9232  | 0.9225  | 0.9219  | 0.92   |
| 3 cos tan 0.9205 0.9198 0.9191 0.9184 0.9178 0.9171 0.9164 0.9157 0.9150 0.91   4 sin 0.4067 0.4083 0.4099 0.4115 0.4131 0.4147 0.4163 0.4179 0.4195 0.92   5 cos tan 0.4226 0.4242 0.4258 0.4274 0.4289 0.4305 0.4578 0.4579 0.4621 0.46   5 cos tan 0.4620 0.4242 0.4258 0.4274 0.4289 0.4305 0.431 0.4337 0.4352 0.43   5 cos tan 0.4684 0.4706 0.4727 0.4748 0.4707 0.4791 0.4813 0.4834 0.4808   5 cos tan 0.4684 0.4706 0.4727 0.4748 0.4707 0.4791 0.4813 0.4834 0.4836   5 cos tan 0.4687 0.4899 0.4415 0.4431 0.4446 0.4462 0.4478 0.4493 0.4509 0.450   5 cos tan 0.4687 0.4899 0.4921 0.4942 0.4964 0.4986 0.5008 0.5029 0.5051 0.50   5 cos tan 0.4877 0.4899 0.4921 0.4942 0.4964 0.4986 0.5008 0.5029 0.5051 0.50   5 cos tan 0.4877 0.4899 0.4921 0.4942 0.4964 0.4986 0.5008 0.5029 0.5051 0.50   5 cos tan 0.4540 0.4555 0.4571 0.4586 0.4602 0.4017 0.4033 0.4648 0.4664 0.40   5 cos tan 0.4550 0.8902 0.8894 0.8886 0.8878 0.8870 0.8862 0.8854 0.8866 0.88   5 cos tan 0.4500 0.4555 0.4571 0.4586 0.4602 0.4017 0.4033 0.4648 0.4664 0.466 0.88   5 cos tan 0.5095 0.5117 0.5139 0.5161 0.5184 0.5206 0.5228 0.5250 0.5272 0.52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        | tan   | 0.4040  | 0.40bl  | 0.4081            | 0.4101  | 0.4122  | 0.4142   | 0.4163  | 0.4183  | 0.4204  | 0.42   |
| 3 cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        | sin   | 0. 3907 | 0. 3923 | 0. 3939           | 0. 3955 | 0. 3971 | 0. 3987  | 0. 4003 | 0. 4019 | 0. 4035 | 0. 40  |
| tan 0. 4245 0. 4265 0. 4286 0. 4307 0. 4327 0. 4348 0. 4369 0. 4390 0. 4411 0. 44  sin 0. 4067 0. 4083 0. 4099 0. 4115 0. 4131 0. 4147 0. 4163 0. 4179 0. 4195 0. 42  tan 0. 4067 0. 4083 0. 4099 0. 4115 0. 4131 0. 4147 0. 4163 0. 4179 0. 4195 0. 42  tan 0. 4452 0. 4473 0. 4494 0. 4515 0. 4536 0. 4557 0. 4578 0. 4599 0. 4621 0. 46  sin 0. 4226 0. 4242 0. 4258 0. 4274 0. 4289 0. 4305 0. 4321 0. 4337 0. 4352 0. 43  cos 0. 9063 0. 9056 0. 9048 0. 9041 0. 9033 0. 9026 0. 9018 0. 9011 0. 9003 0. 89  tan 0. 4663 0. 4684 0. 4706 0. 4727 0. 4748 0. 4770 0. 4791 0. 4813 0. 4834 0. 48  sin 0. 4384 0. 4399 0. 4415 0. 4431 0. 4446 0. 4462 0. 4478 0. 4493 0. 4509 0. 456  cos 0. 8988 0. 8980 0. 8973 0. 8965 0. 8957 0. 8949 0. 8942 0. 8934 0. 8926 0. 89  tan 0. 4877 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50  sin 0. 4540 0. 4555 0. 4571 0. 4586 0. 4602 0. 4617 0. 4633 0. 4648 0. 4664 0. 466  cos 0. 8910 0. 8902 0. 8894 0. 8886 0. 8878 0. 8870 0. 8862 0. 8854 0. 8846 0. 88  tan 0. 5095 0. 5117 0. 5139 0. 5161 0. 5184 0. 5206 0. 5228 0. 5250 0. 5272 0. 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3      | COS   | 0. 9205 |         |                   |         |         |          |         |         |         |        |
| 4 cos tan 0.9135 0.9128 0.9121 0.9114 0.9107 0.9100 0.9092 0.9085 0.9078 0.908 tan 0.4452 0.4473 0.4494 0.4515 0.4536 0.4557 0.4578 0.4578 0.4599 0.4621 0.46  sin 0.4226 0.4242 0.4258 0.4274 0.4289 0.4305 0.4321 0.4337 0.4352 0.43 0.9063 0.9063 0.9066 0.9048 0.9041 0.9033 0.9026 0.9018 0.9011 0.9003 0.89 0.4663 0.4684 0.4706 0.4727 0.4748 0.4770 0.4791 0.4813 0.4834 0.48 0.4706 0.4727 0.4748 0.4770 0.4791 0.4813 0.4834 0.48 0.48 0.48 0.48 0.48 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0. | Ì      |       |         |         |                   |         |         |          |         |         |         | 0. 44  |
| 4 cos tan 0.9135 0.9128 0.9121 0.9114 0.9107 0.9100 0.9092 0.9085 0.9078 0.908 tan 0.4452 0.4473 0.4494 0.4515 0.4536 0.4557 0.4578 0.4578 0.4599 0.4621 0.46  sin 0.4226 0.4242 0.4258 0.4274 0.4289 0.4305 0.4321 0.4337 0.4352 0.43 0.9063 0.9063 0.9066 0.9048 0.9041 0.9033 0.9026 0.9018 0.9011 0.9003 0.89 0.4663 0.4684 0.4706 0.4727 0.4748 0.4770 0.4791 0.4813 0.4834 0.48 0.4706 0.4727 0.4748 0.4770 0.4791 0.4813 0.4834 0.48 0.48 0.48 0.48 0.48 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0.4904 0. |        | ein   | 0 4067  | 0 4093  | 0 4000            | 0.4116  | 0 4121  | 0 4147   | 0.4162  | 0.4170  | 0.4105  | 0.43   |
| tan 0. 4452 0. 4473 0. 4494 0. 4515 0. 4536 0. 4577 0. 4578 0. 4579 0. 4621 0. 46  sin 0. 4226 0. 4242 0. 4258 0. 4274 0. 4289 0. 4305 0. 4321 0. 4337 0. 4352 0. 43  cos 0. 9053 0. 9056 0. 9048 0. 9041 0. 9033 0. 9026 0. 9018 0. 9011 0. 9003 0. 89  tan 0. 4663 0. 4684 0. 4706 0. 4727 0. 4748 0. 4770 0. 4791 0. 4813 0. 4834 0. 48  sin 0. 4384 0. 4399 0. 4415 0. 4431 0. 4446 0. 4402 0. 4478 0. 4493 0. 4509 0. 45  cos 0. 8988 0. 8980 0. 8973 0. 8965 0. 8957 0. 8949 0. 8942 0. 8934 0. 8926 0. 89  tan 0. 4877 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50  sin 0. 4540 0. 4555 0. 4571 0. 4586 0. 4602 0. 4017 0. 4033 0. 4648 0. 4664 0. 40  cos 0. 8910 0. 8902 0. 8894 0. 8886 0. 8878 0. 8870 0. 8862 0. 8854 0. 8846 0. 88  tan 0. 5095 0. 5117 0. 5139 0. 5161 0. 5184 0. 5206 0. 5228 0. 5250 0. 5272 0. 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |       |         |         |                   |         |         |          |         |         |         |        |
| sin 0. 4226 0. 4242 0. 4258 0. 4274 0. 4289 0. 4305 0. 4321 0. 4337 0. 4352 0. 43 5 cos 0. 9063 0. 9056 0. 9048 0. 9041 0. 9033 0. 9026 0. 9018 0. 9011 0. 9003 0. 89 6 tan 0. 4663 0. 4684 0. 4706 0. 4727 0. 4748 0. 4770 0. 4791 0. 4813 0. 4834 0. 48 6 sin 0. 4384 0. 4399 0. 4415 0. 4431 0. 4446 0. 4462 0. 4478 0. 4479 0. 4509 0. 45 6 cos 0. 8988 0. 8980 0. 8973 0. 8965 0. 8957 0. 8949 0. 8942 0. 8934 0. 8926 0. 89 6 tan 0. 4877 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50 7 cos 0. 8910 0. 8902 0. 8894 0. 8886 0. 8878 0. 8870 0. 8862 0. 8854 0. 8846 0. 88 6 tan 0. 5095 0. 5117 0. 5139 0. 5161 0. 5184 0. 5206 0. 5228 0. 5250 0. 5272 0. 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | .      |       |         |         |                   |         |         |          |         |         |         | 0, 46  |
| 5 cos tan 0.9063 0.9056 0.9048 0.9041 0.9033 0.9026 0.9018 0.9011 0.9003 0.89   0.4663 0.4684 0.4706 0.4727 0.4748 0.4770 0.4791 0.4813 0.4834 0.488   sin 0.4384 0.4399 0.4415 0.4431 0.4446 0.4462 0.4478 0.4478 0.4493 0.4509 0.45   cos 0.8988 0.8980 0.8973 0.8965 0.8957 0.8949 0.8942 0.8934 0.8926 0.89   tan 0.4877 0.4899 0.4921 0.4942 0.4964 0.4986 0.5008 0.5029 0.5051 0.50   sin 0.4540 0.4555 0.4571 0.4586 0.4602 0.4017 0.4033 0.4648 0.4664 0.40   cos 0.8910 0.8902 0.8894 0.8886 0.8878 0.8870 0.8862 0.8854 0.8846 0.88   tan 0.5005 0.5117 0.5139 0.5161 0.5184 0.5206 0.5228 0.5250 0.5272 0.52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |       | 0.4337  | 0 4343  |                   |         |         |          |         |         |         |        |
| tan 0. 4663 0. 4684 0. 4706 0. 4727 0. 4748 0. 4770 0. 4791 0. 4813 0. 4834 0. 48  sin 0. 4384 0. 4399 0. 4415 0. 4431 0. 4446 0. 4462 0. 4478 0. 44793 0. 4509 0. 45  cos 0. 8988 0. 8980 0. 8973 0. 8965 0. 8957 0. 8949 0. 8942 0. 8934 0. 8926 0. 89  tan 0. 4877 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50  sin 0. 4540 0. 4555 0. 4571 0. 4586 0. 4602 0. 4017 0. 4033 0. 4648 0. 4664 0. 40  cos 0. 8910 0. 8902 0. 8894 0. 8886 0. 8878 0. 8870 0. 8862 0. 8854 0. 8846 0. 88  tan 0. 5095 0. 5117 0. 5139 0. 5161 0. 5184 0. 5206 0. 5228 0. 5250 0. 5272 0. 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | .      |       |         |         |                   |         |         |          |         |         |         |        |
| sin 0. 4384 0. 4399 0. 4415 0. 4431 0. 4446 0. 4462 0. 4478 0. 4493 0. 4509 0. 45 0. 8988 0. 8980 0. 8973 0. 8965 0. 8957 0. 8949 0. 8942 0. 8934 0. 8926 0. 89 tan 0. 4877 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50 0. 50 0. 8910 0. 8902 0. 8894 0. 8886 0. 8878 0. 8870 0. 8802 0. 8854 0. 8846 0. 88 1 0. 5095 0. 5017 0. 5184 0. 5006 0. 5028 0. 5250 0. 5272 0. 52 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278 0. 5278  | . >    |       |         |         |                   |         |         |          |         |         |         | 0.89   |
| 6 cos tan 0.8988 0.8980 0.8973 0.8965 0.8957 0.8949 0.8942 0.8934 0.8926 0.89   0.4877 0.4899 0.4921 0.4942 0.4964 0.4986 0.5008 0.5029 0.5051 0.50   sin 0.4540 0.4555 0.4571 0.4586 0.4602 0.4017 0.4033 0.4648 0.4664 0.40   cos 0.8910 0.8902 0.8894 0.8886 0.8878 0.8870 0.8862 0.8854 0.8866 0.88   tan 0.5095 0.5117 0.5139 0.5161 0.5184 0.5206 0.5228 0.5250 0.5272 0.52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        | tan   | 0. 4663 | 0.4684  | 0. 4706           | 0. 4727 | 0. 4748 | 0. 4770  | 0, 4791 | 0. 4813 | 0. 4834 | 0. 48  |
| 6 cos 0.8988 0.8980 0.8973 0.8965 0.8957 0.8949 0.8942 0.8934 0.8926 0.89   tan 0.4877 0.4899 0.4921 0.4942 0.4964 0.4986 0.5008 0.5029 0.5051 0.50   sin 0.4540 0.4555 0.4571 0.4586 0.4602 0.4017 0.4033 0.4648 0.4664 0.40   cos 0.8910 0.8902 0.8894 0.8886 0.8878 0.8870 0.8862 0.8854 0.8846 0.88   tan 0.5055 0.5117 0.5139 0.5161 0.5184 0.5206 0.5228 0.5250 0.5272 0.52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        | sin   | 0. 4384 | 0. 4399 | 0. 4415           | 0, 4431 | 0. 4446 | 0. 4462  | 0. 4478 | 0. 4493 | 0. 4509 | 0. 45  |
| tan 0. 4877 0. 4899 0. 4921 0. 4942 0. 4964 0. 4986 0. 5008 0. 5029 0. 5051 0. 50  sin 0. 4540 0. 4555 0. 4571 0. 4586 0. 4602 0. 4017 0. 4033 0. 4648 0. 4664 0. 40  cos 0. 8910 0. 8902 0. 8894 0. 8886 0. 8878 0. 8870 0. 8802 0. 8854 0. 8846 0. 88  tan 0. 5095 0. 5117 0. 5139 0. 5161 0. 5184 0. 5206 0. 5228 0. 5250 0. 5272 0. 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 6      | COS   | 0.8988  | 0.8980  | 0.8973            | 0.8965  | 0.8957  |          |         |         |         | 0.89   |
| 7 cos 0.8910 0.8902 0.8894 0.8886 0.8878 0.8870 0.8862 0.8854 0.8846 0.88<br>tan 0.5095 0.5117 0.5139 0.5161 0.5184 0.5206 0.5228 0.5250 0.5272 0.52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        | tan   | 0. 4877 | 0.4899  |                   |         |         |          |         |         |         | 0. 50  |
| 7 cos 0.8910 0.8902 0.8894 0.8886 0.8878 0.8870 0.8862 0.8854 0.8846 0.88<br>tan 0.5095 0.5117 0.5139 0.5161 0.5184 0.5206 0.5228 0.5250 0.5272 0.52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        | sin   | 0 4540  | 0 4555  | 0.4571            | 0 4586  | 0.4602  | 0.4617   | 0.4633  | 0 4640  | 0 4664  | 0.4:   |
| tan 0.5095 0.5117 0.5139 0.5161 0.5184 0.5206 0.5228 0.5250 0.5272 0.52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 7      |       |         |         |                   |         |         |          |         |         |         |        |
| func -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |       |         |         |                   |         |         |          |         |         |         |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -      |       | 0. 3073 | 0. 5117 | 0. 5139           | 0. 5161 | U. 7184 | 0. 5206  | 0, 5448 | U. 7470 | 0.5272  | U. 525 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | - 1    |       | 0.00    | 0.1°    | 0. 2 <sup>0</sup> | 0.30    | 0. 4°   | 0.50     | 0. 60   | 0.70    | 0.8°    | 0.9    |

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|-----|------------|---------|---------|-------------------|-------------------|---------|---------|---------|---------|---------|---------|
| ,   | func-      | 0.0°    | 0.10    | 0. 20             | 0. 3 <sup>o</sup> | 0.40    | 0.50    | 0.60    | 0.70    | 0.80    | 0.90    |
| eg  | tion       | 0.0     | 0. 1    | 0. 2-             | 0. 3              | 0. 4.   | 0. 5    | 0, 0    | 0, 7    | 0.0     | 0. 7    |
|     | -:-        | 0. 4695 | 0.4710  | 0. 4726           | 0. 4741           | 0. 4756 | 0. 4772 | 0. 4787 | 0. 4802 | 0.4818  | 0. 4833 |
| 8   | sin        |         | 0. 8821 | 0. 8813           | 0. 8805           | 0. 8796 | 0. 8788 | 0. 8780 | 0. 8771 | 0. 8763 | 0. 8755 |
| ٥   | COS        | 0.8829  | 0. 5340 | 0. 5362           | 0. 5384           | 0. 5407 | 0. 5430 | 0. 5452 | 0. 5475 | 0. 5498 | 0. 5520 |
| - 1 | tan        | 0. 5317 | 0. 5340 | 0. 5362           | 0. 5364           | 0. 5407 | 0. 5430 | 0. 3436 | 0. 5475 | 0, 5476 | 0. 5520 |
|     | sin        | 0. 4848 | 0. 4863 | 0. 4879           | 0. 4894           | 0. 4909 | 0. 4924 | 0. 4939 | 0. 4955 | 0.4970  | 0. 4985 |
| 9   | COS        | 0.8746  | 0.8738  | 0.8729            | 0.8721            | 0.8712  | 0.8704  | 0.8695  | 0.8686  | 0.8678  | 0.8669  |
|     | tan        | 0. 5543 | 0.5566  | 0.5589            | 0.5612            | 0. 5635 | 0.5658  | 0.5681  | 0.5704  | 0. 5727 | 0. 5750 |
|     | sin        | 0. 5000 | 0. 5015 | 0. 5030           | 0. 5045           | 0. 5060 | 0. 5075 | 0. 5090 | 0. 5105 | 0. 5120 | 0, 5135 |
| 0   | cos        | 0. 8660 | 0. 8652 | 0.8643            | 0.8634            | 0. 8625 | 0.8616  | 0.8607  | 0.8599  | 0. 8590 | 0. 8581 |
|     | tan        | 0. 5774 | 0. 5797 | 0. 5820           | 0. 5844           | 0. 5867 | 0. 5890 | 0. 5914 | 0. 5938 | 0. 5961 | 0. 5989 |
|     | sin        | 0.5150  | 0.5165  | 0, 5180           | 0. 5195           | 0. 5210 | 0. 5225 | 0. 5240 | 0. 5255 | 0. 5270 | 0. 5284 |
| 1   | cos        | 0. 8572 | 0. 8563 | 0.8554            | 0. 8545           | 0. 8536 | 0. 8526 | 0. 8517 | 0. 8508 | 0. 8499 | 0. 8490 |
| •   | tan        | 0. 6009 | 0. 6032 | 0.6056            | 0.6080            | 0.6104  | 0.6128  | 0. 6152 | 0.6176  | 0.6200  | 0. 6224 |
|     | sin        | 0. 5299 | 0. 5314 | 0. 5329           | 0. 5344           | 0. 5358 | 0, 5373 | 0. 5388 | 0. 5402 | 0. 5417 | 0, 5432 |
| 2   | cos        | 0. 8480 | 0. 8471 | 0. 8462           | 0. 8453           | 0. 8443 | 0, 8434 | 0. 8425 | 0. 8415 | 0. 8406 | 0. 8396 |
| -   | tan        | 0. 6249 | 0.6273  | 0.6297            | 0. 6322           | 0. 6346 | 0. 6371 | 0. 6395 | 0.6420  | 0. 6445 | 0.6469  |
|     | -:-        | 0. 5446 | 0. 5461 | 0, 5476           | 0, 5490           | 0. 5505 | 0. 5519 | 0. 5534 | 0. 5548 | 0. 5563 | 0. 5577 |
| 3   | sin        | 1       |         |                   | 0. 8358           | 0. 8348 | 0. 8339 | 0. 8329 | 0. 8320 | 0. 8310 | 0. 8300 |
| 3   | cos<br>tan | 0. 8387 | 0.8377  | 0.8368            | 0.6569            | 0.6594  | 0.6619  | 0.6644  | 0. 6669 | 0.6694  | 0. 6720 |
|     |            |         |         | 0 5/21            | 0.5/05            | 0.5/50  | 0.54/4  | 0 5/70  | 0.5403  | 0, 5707 | 0. 5721 |
|     | sin        | 0.5592  | 0. 5606 | 0.5621            | 0. 5635           | 0. 5650 | 0. 5664 | 0. 5678 | 0. 5693 |         |         |
| 4   | cos        | 0. 8290 | 0.8281  | 0.8271            | 0.8261            | 0. 8251 | 0. 8241 | 0. 8231 | 0. 8221 | 0. 8211 | 0. 8202 |
|     | tan        | 0.6745  | 0.6771  | 0.6796            | 0. 6822           | 0.6847  | 0.6873  | 0.6899  | 0.6924  | 0.6950  | 0. 6976 |
|     | sin        | 0. 5736 | 0.5750  | 0.5764            | 0. 5779           | 0. 5793 | 0.5807  | 0. 5821 | 0. 5835 | 0.5850  | 0. 5864 |
| 5   | cos        | 0.8192  | 0.8181  | 0.8171            | 0.8161            | 0.8151  | 0.8141  | 0.8131  | 0.8121  | 0.8111  | 0.8100  |
| -   | tan        | 0.7002  | 0.7028  | 0.7054            | 0.7080            | 0.7107  | 0.7133  | 0.7159  | 0.7186  | 0. 7212 | 0. 7239 |
|     | sin        | 0. 5878 | 0. 5892 | 0. 5906           | 0. 5920           | 0. 5934 | 0. 5948 | 0. 5962 | 0. 5976 | 0. 5990 | 0.6004  |
| 36  | cos        | 0.8090  | 0.8080  | 0, 8070           | 0. 8059           | 0.8049  | 0.8039  | 0.8028  | 0.8018  | 0.8007  | 0, 7997 |
| ,,, | tan        | 0. 7265 | 0. 7292 | 0.7319            | 0. 7346           | 0. 7373 | 0.7400  | 0.7427  | 0.7454  | 0.7481  | 0. 7508 |
|     |            | 0.6018  | 0. 6032 | 0. 6046           | 0.6060            | 0, 6074 | 0. 6088 | 0.6101  | 0, 6115 | 0, 6129 | 0, 6143 |
| -   | sin        | 0. 7986 | 0. 7976 | 0. 7965           | 0.7955            | 0. 7944 | 0. 7934 | 0. 7923 | 0. 7912 | 0. 7902 | 0. 7891 |
| 7   | tan        | 0. 7536 | 0. 7563 | 0.7590            | 0.7618            | 0. 7646 | 0. 7673 | 0. 7701 | 0. 7729 | 0. 7757 | 0. 7785 |
|     |            |         |         |                   |                   |         |         |         | - /     |         |         |
|     | sin        | 0.6157  | 0.6170  | 0.6184            | 0.6198            | 0.6211  | 0.6225  | 0.6239  | 0.6252  | 0. 6266 | 0. 6280 |
| 8   | COS        | 0.7880  | 0.7869  | 0. 7859           | 0.7848            | 0. 7837 | 0. 7826 | 0.7815  | 0.7804  | 0. 7793 | 0. 7782 |
|     | tan        | 0. 7813 | 0. 7841 | 0. 7869           | 0. 7898           | 0.7926  | 0. 7954 | 0.7983  | 0.8012  | 0. 8040 | 0. 8069 |
|     | sin        | 0. 6293 | 0.6307  | 0.6320            | 0.6334            | 0.6347  | 0.6361  | 0.6374  | 0.6388  | 0.6401  | 0.641   |
| 19  | cos        | 0.7771  | 0. 7760 | 0.7749            | 0.7738            | 0.7727  | 0.7716  | 0. 7705 | 0.7694  | 0. 7683 | 0. 7672 |
|     | tan        | 0.8098  | 0.8127  | 0.8156            | 0. 8185           | 0.8214  | 0.8243  | 0.8273  | 0.8302  | 0. 8332 | 0. 836  |
|     | sin        | 0.6428  | 0.6441  | 0.6455            | 0.6468            | 0.6481  | 0.6494  | 0.6508  | 0.6521  | 0.6534  | 0.6547  |
| 10  | cos        | 0.7660  | 0.7649  | 0.7638            | 0.7627            | 0.7615  | 0.7604  | 0.7593  | 0.7581  | 0.7570  | 0.7559  |
|     | tan        | 0.8391  | 0.8421  | 0.8451            | 0.8481            | 0.8511  | 0.8541  | 0.8571  | 0.8601  | 0.8632  | 0. 866  |
|     | sin        | 0, 6561 | 0.6574  | 0, 6587           | 0,6600            | 0.6613  | 0, 6626 | 0.6639  | 0.6652  | 0. 6665 | 0.6678  |
| 1   | cos        | 0.7547  | 0, 7536 | 0, 7524           | 0.7513            | 0.7501  | 0.7490  | 0.7478  | 0.7466  | 0, 7455 | 0.744   |
|     | tan        | 0.8693  | 0. 8724 | 0.8754            | 0.8785            | 0.8816  | 0.8847  | 0.8878  | 0.8910  | 0.8941  | 0.897   |
|     | func-      |         |         |                   |                   |         | 0       | 2 / 2   | 0.70    | 0.00    | 0.00    |
| deg | tion       | 0.0°    | 0.10    | 0. Z <sup>o</sup> | 0.3°              | 0.40    | 0. 5°   | 0.60    | 0.70    | 0.8°    | 0.90    |

B-268

| - 1 | func- |         |         |         |         |         |         |         |         |         | (      |
|-----|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|
| deg | tion  | 0. 0°   | 0.10    | 0. 2°   | 0. 30   | 0.40    | 0.50    | 0.60    | 0. 70   | 0.80    | 0.90   |
|     | sin   | 0. 6691 | 0.6704  | 0.6717  | 0.6730  | 0.6743  | 0.6756  | 0.6769  | 0.6782  | 0.6794  | 0.680  |
| 42  | cos   | 0.7431  | 0.7420  | 0.7408  | 0.7396  | 0.7385  | 0.7373  | 0.7361  | 0.7349  | 0.7337  | 0.732  |
|     | tan   | 0. 9004 | 0. 9036 | 0. 9067 | 0. 9099 | 0. 9131 | 0. 9163 | 0. 9195 | 0. 9228 | 0. 9260 | 0. 929 |
|     | sin   | 0.6820  | 0.6833  | 0.6845  | 0.6858  | 0. 6871 | 0.6884  | 0. 6896 | 0.6909  | 0.6921  | 0. 693 |
| 43  | cos   | 0.7314  | 0.7302  | 0.7290  | 0.7278  | 0.7266  | 0.7254  | 0.7242  | 0.7230  | 0.7218  | 0.720  |
|     | tan   | 0. 9325 | 0. 9358 | 0. 9391 | 0.9424  | 0.9457  | 0.9490  | 0. 9523 | 0.9556  | 0. 9590 | 0. 962 |
| - 1 | sin   | 0.6947  | 0. 6959 | 0.6972  | 0.6984  | 0. 6997 | 0. 7009 | 0. 7022 | 0.7034  | 0. 7046 | 0. 705 |
| 44  | cos   | 0.7193  | 0.7181  | 0.7169  | 0.7157  | 0.7145  | 0.7133  | 0.7120  | 0.7108  | 0.7096  | 0.708  |
| -   | tan   | 0. 9657 | 0. 9691 | 0.9725  | 0. 9759 | 0. 9793 | 0. 9827 | 0. 9861 | 0. 9896 | 0.9930  | 0. 996 |
|     | sin   | 0. 7071 | 0. 7083 | 0. 7096 | 0.7108  | 0.7120  | 0. 7133 | 0.7145  | 0. 7157 | 0.7169  | 0.718  |
| 45  | cos   | 0.7071  | 0.7059  | 0.7046  | 0.7034  | 0.7022  | 0.7009  | 0.6997  | 0.6984  | 0.6972  | 0.695  |
| .   | tan   | 1.0000  | 1.0035  | 1.0070  | 1.0105  | 1.0141  | 1.0176  | 1. 0212 | 1.0247  | 1.0283  | 1.031  |
|     | sin   | 0.7193  | 0. 7206 | 0. 7218 | 0. 7230 | 0. 7242 | 0.7254  | 0. 7266 | 0. 7278 | 0. 7290 | 0.730  |
| 46  | cos   | 0.6947  | 0.6934  | 0.6921  | 0.6909  | 0.6896  | 0.6884  | 0.6871  | 0.6858  | 0.6845  | 0.683  |
|     | tan   | 1. 0355 | 1.0392  | 1.0428  | 1.0464  | 1. 0501 | 1. 0538 | 1.0575  | 1.0612  | 1.0649  | 1. 068 |
|     | sin   | 0. 7314 | 0. 7325 | 0.7337  | 0.7349  | 0.7361  | 0.7373  | 0. 7385 | 0. 7396 | 0. 7408 | 0. 742 |
| 47  | COB   | 0.6820  | 0.6807  | 0.6794  | 0.6782  | 0.6769  | 0.6756  | 0.6743  | 0.6730  | 0.6717  | 0.670  |
|     | tan   | 1.0724  | 1.0761  | 1. 0799 | 1.0837  | 1.0875  | 1.0913  | 1.0951  | 1.0990  | 1. 1028 | 1. 106 |
| Ì   | sin   | 0.7431  | 0.7443  | 0.7455  | 0.7466  | 0.7478  | 0.7490  | 0.7501  | 0.7513  | 0.7524  | 0.753  |
| 48  | cos   | 0.6691  | 0.6678  | 0.6665  | 0.6652  | 0.6639  | 0.6626  | 0.6613  | 0.6600  | 0.6587  | 0.657  |
|     | tan   | 1.1106  | 1. 1145 | 1. 1184 | 1. 1224 | 1. 1263 | 1. 1303 | 1. 1343 | 1. 1383 | 1. 1423 | 1. 146 |
|     | sin   | 0.7547  | 0. 7559 | 0.7570  | 0.7581  | 0. 7593 | 0.7604  | 0. 7615 | 0.7627  | 0. 7638 | 0.764  |
| 49  | cos   | 0.6561  | 0.6547  | 0.6534  | 0.6521  | 0.6508  | 0.6494  | 0.6481  | 0.6468  | 0.6455  | 0, 644 |
| -   | tan   | 1. 1504 | 1. 1544 | 1. 1585 | 1. 1626 | 1. 1667 | 1. 1708 | 1. 1750 | 1. 1792 | 1. 1833 | 1. 187 |
|     | sin   | 0. 7660 | 0. 7672 | 0.7683  | 0.7694  | 0.7705  | 0.7716  |         | 0.7738  | 0.7749  | 0.776  |
| 50  | cos   | 0.6428  | 0.6414  | 0.6401  | 0.6388  | 0.6374  | 0.6361  | 0.6347  | 0.6334  | 0.6320  | 0.630  |
|     | tan   | 1. 1918 | 1. 1960 | 1, 2002 | 1. 2045 | 1. 2088 | 1. 2131 | 1. 2174 | 1. 2218 | 1. 2261 | 1. 230 |
|     | sin   | 0. 7771 | 0.7782  | 0.7793  | 0.7804  | 0.7815  | 0.7826  | 0.7837  | 0.7848  | 0.7859  | 0. 786 |
| 51  | cos   | 0.6293  | 0.6280  | 0.6266  | 0.6252  | 0.6239  | 0. 6225 |         | 0.6198  | 0.6184  | 0.617  |
|     | tan   | 1. 2349 | 1. 2393 | 1. 2437 | 1. 2482 | 1. 2527 | 1. 2572 | 1. 2617 | 1. 2662 | 1. 2708 | 1. 275 |
|     | sin   | 0. 7880 | 0.7891  | 0.7902  | 0.7912  | 0.7923  | 0.7934  | 0.7944  | 0.7955  | 0.7965  | 0. 797 |
| 52  | cos   | 0.6157  | 0.6143  | 0.6129  | 0.6115  | 0.6101  | 0.6088  | 0.6074  | 0.6060  | 0.6046  | 0.603  |
|     | tan   | 1. 2799 | 1. 2846 | 1. 2892 | 1. 2938 | 1. 2985 | 1. 3032 | 1. 3079 | 1. 3127 | 1. 3175 | 1. 322 |
|     | sin   | 0. 7986 | 0. 7997 | 0.8007  | 0.8018  |         | 0. 8039 | 0.8049  | 0.8059  | 0.8070  | 0. 808 |
| 53  | cos   | 0.6018  | 0.6004  | 0.5990  | 0.5976  |         | 0.5948  |         | 0.5920  | 0. 5906 | 0.589  |
|     | tan   | 1. 3270 | 1. 3319 | 1. 3367 | 1. 3416 | 1. 3465 | 1. 3514 | 1. 3564 | 1. 3613 | 1. 3663 | 1. 371 |
|     | sin   | 0. 8090 | 0. 8100 | 0.8111  | 0.8121  | 0.8131  | 0.8141  | 0.8151  | 0. 8161 | 0.8171  | 0.818  |
| 54  | cos   | 0.5878  | 0.5864  | 0.5850  | 0.5835  | 0.5821  | 0.5807  | 0. 5793 | 0. 5779 | 0. 5764 | 0. 575 |
|     | tan   | 1. 3764 | 1. 3814 | 1. 3865 | 1. 3916 | 1. 3968 | 1. 4019 | 1. 4071 | 1. 4124 | 1. 4176 | 1. 422 |
|     | sin   | 0.8192  | 0.8202  | 0.8211  | 0. 8221 | 0. 8231 | 0. 8241 | 0.8251  | 0. 8261 | 0.8271  | 0. 828 |
| 55  | cos   | 0. 5736 | 0.5721  | 0.5707  | 0.5693  | 0. 5678 | 0.5664  | 0.5650  | 0. 5635 | 0. 5621 | 0. 560 |
|     | tan   | 1. 4281 | 1, 4335 | 1. 4388 | 1. 4442 | 1. 4496 | 1. 4550 | 1.4605  | 1.4659  | 1. 4715 | 1.477  |
|     | func- | -       |         |         |         |         | _       |         |         |         |        |

| 1an   3,4674   3,5105   3,5339   3,5576   3,5816   3,6059   3,6305   3,6554   3,6806   3,7062   3,6305   3,6554   3,6806   3,7062   3,6305   3,6554   3,6806   3,7062   3,6305   3,6554   3,6806   3,7062   3,6305   3,6554   3,6806   3,7062   3,6305   3,6554   3,6806   3,7062   3,6305   3,6554   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,7062   3,6806   3,6806   3,7062   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,6806   3,68   | 74  | COS  | 0. 2756 | 0. 274  |           |           | 0. 9632 |         |                   | 0. 9646 | 0. 9650 | 0. 9655 | 32          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|---------|---------|-----------|-----------|---------|---------|-------------------|---------|---------|---------|-------------|
| sin 0.973 0.9703 0.9707 0.9711 0.9715 0.9720 0.9724 0.9728 0.9722 0.9736 0.9740 0.9740 0.008 0.2419 0.2402 0.2885 0.2368 0.2351 0.2334 0.2317 0.2300 0.2284 0.2267 tan 4.0108 4.0408 4.0713 4.1022 4.1335 4.1653 4.1976 4.2303 4.2635 4.2972 0.9744 0.9748 0.9748 0.9755 0.9759 0.9763 0.9767 0.9770 0.9774 0.9778 0.9744 0.9748 0.9751 0.9755 0.9759 0.9763 0.9767 0.9770 0.9774 0.9778 0.2096 tan 4.3315 4.3662 4.4015 4.4374 4.4737 4.5107 4.5483 4.5864 4.0252 4.6646 0.2147 0.2130 0.2113 0.2096 tan 4.3315 4.3662 4.4015 4.4374 4.4737 4.5107 4.5483 4.5864 4.0252 4.6646 0.2147 0.2130 0.2113 0.2096 tan 4.7046 4.7453 4.7867 4.8288 4.8716 4.9152 4.9594 5.0045 5.0504 5.0970 0.9789 0.9792 0.9796 0.9799 0.9803 0.9806 0.9810 0.9810 0.9813 0.9810 0.9820 0.9823 0.9825 0.9829 0.9833 0.9836 0.9839 0.9842 0.9845 0.9859 0.9839 0.9836 0.9839 0.9842 0.9845 0.9859 0.9839 0.9836 0.9839 0.9842 0.9845 0.9859 0.9839 0.9830 0.9839 0.9842 0.9845 0.9859 0.9839 0.9830 0.9830 0.9839 0.9842 0.9845 0.9859 0.9830 0.9830 0.9859 0.9842 0.9859 0.9830 0.9859 0.9848 0.9851 0.9854 0.9857 0.9868 0.9868 0.9869 0.9869 0.9871 0.9754 tan 5.1446 5.1929 5.2422 5.2924 5.3435 5.3955 5.4486 5.5026 5.5578 5.6140 0.0000 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0 |     | tan  | 3. 4874 | 3, 510  | 5 3. 5339 | 3. 5576   | 3. 5816 | 3. 6059 | 3. 6305           | 3. 6554 | 3 6806  |         |             |
| sin 0.973 0.9703 0.9707 0.9711 0.9715 0.9720 0.9724 0.9728 0.9722 0.9736 0.9740 0.9740 0.008 0.2419 0.2402 0.2885 0.2368 0.2351 0.2334 0.2317 0.2300 0.2284 0.2267 tan 4.0108 4.0408 4.0713 4.1022 4.1335 4.1653 4.1976 4.2303 4.2635 4.2972 0.9744 0.9748 0.9748 0.9755 0.9759 0.9763 0.9767 0.9770 0.9774 0.9778 0.9744 0.9748 0.9751 0.9755 0.9759 0.9763 0.9767 0.9770 0.9774 0.9778 0.2096 tan 4.3315 4.3662 4.4015 4.4374 4.4737 4.5107 4.5483 4.5864 4.0252 4.6646 0.2147 0.2130 0.2113 0.2096 tan 4.3315 4.3662 4.4015 4.4374 4.4737 4.5107 4.5483 4.5864 4.0252 4.6646 0.2147 0.2130 0.2113 0.2096 tan 4.7046 4.7453 4.7867 4.8288 4.8716 4.9152 4.9594 5.0045 5.0504 5.0970 0.9789 0.9792 0.9796 0.9799 0.9803 0.9806 0.9810 0.9810 0.9813 0.9810 0.9820 0.9823 0.9825 0.9829 0.9833 0.9836 0.9839 0.9842 0.9845 0.9859 0.9839 0.9836 0.9839 0.9842 0.9845 0.9859 0.9839 0.9836 0.9839 0.9842 0.9845 0.9859 0.9839 0.9830 0.9839 0.9842 0.9845 0.9859 0.9839 0.9830 0.9830 0.9839 0.9842 0.9845 0.9859 0.9830 0.9830 0.9859 0.9842 0.9859 0.9830 0.9859 0.9848 0.9851 0.9854 0.9857 0.9868 0.9868 0.9869 0.9869 0.9871 0.9754 tan 5.1446 5.1929 5.2422 5.2924 5.3435 5.3955 5.4486 5.5026 5.5578 5.6140 0.0000 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0 | ĺ   | sin  |         |         |           |           |         |         |                   | 0. 9690 | 0.9694  | 0. 9699 |             |
| sin 0.973 0.9703 0.9707 0.9711 0.9715 0.9720 0.9724 0.9728 0.9722 0.9736 0.9740 0.9740 0.008 0.2419 0.2402 0.2885 0.2368 0.2351 0.2334 0.2317 0.2300 0.2284 0.2267 tan 4.0108 4.0408 4.0713 4.1022 4.1335 4.1653 4.1976 4.2303 4.2635 4.2972 0.9744 0.9748 0.9748 0.9755 0.9759 0.9763 0.9767 0.9770 0.9774 0.9778 0.9744 0.9748 0.9751 0.9755 0.9759 0.9763 0.9767 0.9770 0.9774 0.9778 0.2096 tan 4.3315 4.3662 4.4015 4.4374 4.4737 4.5107 4.5483 4.5864 4.0252 4.6646 0.2147 0.2130 0.2113 0.2096 tan 4.3315 4.3662 4.4015 4.4374 4.4737 4.5107 4.5483 4.5864 4.0252 4.6646 0.2147 0.2130 0.2113 0.2096 tan 4.7046 4.7453 4.7867 4.8288 4.8716 4.9152 4.9594 5.0045 5.0504 5.0970 0.9789 0.9792 0.9796 0.9799 0.9803 0.9806 0.9810 0.9810 0.9813 0.9810 0.9820 0.9823 0.9825 0.9829 0.9833 0.9836 0.9839 0.9842 0.9845 0.9859 0.9839 0.9836 0.9839 0.9842 0.9845 0.9859 0.9839 0.9836 0.9839 0.9842 0.9845 0.9859 0.9839 0.9830 0.9839 0.9842 0.9845 0.9859 0.9839 0.9830 0.9830 0.9839 0.9842 0.9845 0.9859 0.9830 0.9830 0.9859 0.9842 0.9859 0.9830 0.9859 0.9848 0.9851 0.9854 0.9857 0.9868 0.9868 0.9869 0.9869 0.9871 0.9754 tan 5.1446 5.1929 5.2422 5.2924 5.3435 5.3955 5.4486 5.5026 5.5578 5.6140 0.0000 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0.1500 0 |     |      |         |         |           |           |         |         |                   |         |         |         | Z >         |
| 5 cos 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     | tan  | 3, 7321 | 3, 758  | 3 3. 7848 | 3.8118    | 3, 8391 | 3. 8667 | 3 8947            | 3. 9232 | 3. 9520 | 3. 9812 | -           |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |      |         |         |           |           |         |         |                   |         |         |         |             |
| Sin   0,9744   0,9748   0,9751   0,9755   0,9759   0,9767   0,9770   0,9770   0,9774   0,9778   0,9778   0,978   0,2250   0,2232   0,2215   0,2198   0,2181   0,2164   0,2147   0,2130   0,2113   0,2096   1,315   1,3562   1,4015   1,4374   1,4737   1,5107   1,548   1,5844   1,6252   1,6646   1,315   1,3662   1,4015   1,4374   1,4737   1,5107   1,5494   1,977   0,1959   0,1942   0,1925   1,316   1,315   1,4364   1,7046   1,743   1,7646   1,743   1,7646   1,742   1,814   1,164   1,8157   1,8140   1,8122   0,1805   0,1788   0,1771   0,1754   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   1,816   | 6   |      |         |         |           |           |         |         |                   |         |         |         |             |
| 7 cos 0, 2250 0, 2232 0, 2215 0, 2181 0, 2181 0, 2184 0, 2147 0, 2130 0, 2113 0, 2096 tan 4, 3315 4, 3662 4, 4015 4, 4374 4, 4737 4, 5107 4, 5483 4, 5864 4, 6252 4, 6646 sin 0, 9781 0, 9785 0, 9789 0, 9792 0, 9796 0, 9799 0, 9803 0, 9806 0, 9810 0, 9813 0, 2079 0, 2062 0, 2045 0, 2028 0, 2011 0, 1994 0, 1977 0, 1959 0, 1942 0, 1925 tan 4, 7046 4, 7453 4, 7867 4, 8288 4, 8716 4, 9152 4, 9594 5, 0045 5, 0504 5, 0970 cos 0, 1908 0, 1891 0, 1874 0, 1857 0, 1840 0, 1822 0, 1805 0, 1788 0, 1771 0, 1754 tan 5, 1446 5, 1929 5, 2422 5, 2924 5, 3435 5, 3955 5, 4486 5, 5026 5, 5578 5, 6140 cos 0, 1736 0, 1719 0, 1702 0, 1685 0, 1686 0, 1683 0, 1616 0, 1599 0, 1582 tan 5, 6713 5, 7297 5, 7894 5, 8502 5, 9124 5, 9758 6, 0405 6, 1066 6, 1742 6, 2432 sin 0, 9877 0, 9880 0, 9882 0, 9885 0, 9886 0, 9893 0, 9895 0, 9898 0, 9901 cos 0, 1594 1, 1547 0, 1530 0, 1581 0, 1495 0, 1478 0, 1461 0, 1444 0, 1426 0, 1409 tan 5, 1318 6, 3859 6, 4596 6, 5550 6, 65550 6, 65550 6, 5550 6, 5546 6, 5546 6, 5936 6, 5936 6, 5936 6, 5936 6, 5936 7, 0264 cos 0, 1392 0, 1374 0, 1357 0, 1340 0, 1323 0, 1495 0, 1478 0, 1461 0, 1444 0, 1426 0, 1409 tan 6, 1318 6, 3859 6, 4596 6, 5550 6, 6152 6, 6012 6, 7720 6, 8548 6, 9395 7, 0264 cos 0, 1392 0, 1374 0, 1357 0, 1340 0, 1323 0, 1305 0, 1288 0, 1271 0, 1253 0, 1236 tan 7, 1154 7, 2066 7, 3002 7, 3962 7, 4947 7, 5958 7, 6996 7, 8062 7, 9158 8, 0285 tan 9, 1444 9, 8768 9, 8488 10, 02 10, 20 10, 39 10, 58 10, 78 10, 99 11, 20 10, 1184 0, 1167 0, 1149 0, 1132 0, 1115 0, 1097 0, 1080 0, 1063 tan 9, 5144 9, 6768 9, 8448 10, 02 10, 20 10, 39 10, 58 10, 78 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, 99 11, 20 10, |     | tan  | 4. 0108 | 4, 040  | 8 4, 0713 | 4, 1022   | 4. 1335 | 4. 1653 | 4. 1976           | 4. 2303 | 4. 2635 | 4. 2972 |             |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     | sin  | 1       |         |           |           |         |         |                   |         |         |         | ١.          |
| Sin   0.9781   0.9785   0.9789   0.9792   0.9796   0.9799   0.9803   0.9806   0.9810   0.9813   0.2079   0.2062   0.2045   0.2028   0.2011   0.1994   0.1977   0.1959   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1925   0.1942   0.1942   0.1925   0.1942   0.1942   0.1925   0.1942   0.1942   0.1925   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1942   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.1944   0.19   | 7   |      | 1       |         |           |           |         |         |                   |         |         |         |             |
| 8 cos   0.9781   0.9785   0.9785   0.9789   0.9792   0.9796   0.9790   0.9803   0.9806   0.9810   0.9813   0.9816   0.0926   0.0262   0.0265   0.0262   0.0265   0.0262   0.0265   0.0262   0.0265   0.0262   0.0265   0.0262   0.0265   0.0262   0.0265   0.0262   0.0265   0.0262   0.0265   0.0262   0.0265   0.0265   0.0262   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.0265   0.02 |     | tan  | 4. 3315 | 4. 366  | 2 4.4015  | 4. 4374   | 4. 4737 | 4. 5107 | 4. 5483           | 4, 5864 | 4. 6252 | 4. 6646 | <b>D</b>    |
| Cos   0.1908   0.1891   0.1874   0.1874   0.1840   0.1822   0.1805   0.1788   0.1771   0.1754   0.1874   0.1874   0.1872   0.1873   0.1874   0.1872   0.1873   0.1874   0.1874   0.1874   0.1873   0.1873   0.1871   0.1874   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.18   |     | sin  | 0. 9781 | 0.978   |           |           |         |         |                   |         | 0.9810  | 0. 9813 |             |
| Cos   0.1908   0.1891   0.1874   0.1874   0.1840   0.1822   0.1805   0.1788   0.1771   0.1754   0.1874   0.1874   0.1872   0.1873   0.1874   0.1872   0.1873   0.1874   0.1874   0.1874   0.1873   0.1873   0.1871   0.1874   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.18   | 8   |      |         |         |           |           |         |         |                   |         |         |         | W           |
| Cos   0.1908   0.1891   0.1874   0.1874   0.1840   0.1822   0.1805   0.1788   0.1771   0.1754   0.1874   0.1874   0.1872   0.1873   0.1874   0.1872   0.1873   0.1874   0.1874   0.1874   0.1873   0.1873   0.1871   0.1874   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.18   |     | tan  | 4. 7046 | 4. 745  | 3 4. 7867 | 4. 8288   | 4. 8716 | 4. 9152 | 4. 9594           | 5. 0045 | 5. 0504 | 5. 0970 |             |
| Cos   0.1908   0.1891   0.1874   0.1874   0.1840   0.1822   0.1805   0.1788   0.1771   0.1754   0.1874   0.1874   0.1872   0.1873   0.1874   0.1872   0.1873   0.1874   0.1874   0.1874   0.1873   0.1873   0.1871   0.1874   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1873   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.1875   0.18   |     | sin  | 0. 9816 | 0. 982  | 0.9823    | 0. 9825   | 0. 9829 | 0. 9833 | 0. 9836           | 0. 9839 | 0. 9842 | 0. 9845 |             |
| sin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 9   |      |         |         |           |           |         |         |                   |         |         |         |             |
| Cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     | tan  | 5. 1446 | 5. 192  | 9 5. 2422 | 2 5. 2924 | 5. 3435 | 5. 3955 | 5. 4486           | 5. 5026 | 5. 5578 | 5. 6140 |             |
| tan   5. 6713   5. 7297   5. 7894   5. 8502   5. 9124   5. 9758   6. 0405   6. 1066   6. 1742   6. 2432     sin   0. 9877   0. 9880   0. 9882   0. 9885   0. 9888   0. 9890   0. 9893   0. 9895   0. 9898   0. 9900     tan   6. 3138   6. 3859   6. 4596   6. 5350   6. 6122   6. 6912   6. 7720   6. 8548   6. 9395   7. 0264     sin   0. 9903   0. 9905   0. 9907   0. 9910   0. 9912   0. 9914   0. 9917   0. 9919   0. 9921   0. 9923     cos   0. 1392   0. 1374   0. 1357   0. 1340   0. 1323   0. 1305   0. 1288   0. 1271   0. 1253   0. 1236     tan   7. 1154   7. 2066   7. 3002   7. 3962   7. 4947   7. 5958   7. 6996   7. 8062   7. 9158   8. 0285     sin   0. 9925   0. 9928   0. 9930   0. 9932   0. 9934   0. 9938   0. 9940   0. 9942   0. 9943     cos   0. 1219   0. 1201   0. 1184   0. 1167   0. 1149   0. 1132   0. 1115   0. 1097   0. 1080   0. 1063     tan   8. 1443   8. 2036   8. 3863   8. 5126   8. 6427   8. 7769   8. 9152   9. 0579   9. 2052   9. 3572      sin   0. 9945   0. 9947   0. 9949   0. 9951   0. 9952   0. 9954   0. 9955   0. 9957   0. 9959   0. 9960     d cos   0. 1045   0. 1028   0. 1011   0. 0993   0. 0958   0. 0941   0. 0924   0. 0906   0. 0889     tan   9. 5144   9. 6768   9. 8448   10. 02   10. 20   10. 39   10. 58   10. 78   10. 99   11. 20     sin   0. 9962   0. 9963   0. 9965   0. 9966   0. 9968   0. 9969   0. 9971   0. 9972   0. 9973   0. 9974     cos   0. 0872   0. 0854   0. 0837   0. 0819   0. 0802   0. 0785   0. 0750   0. 0750   0. 0752   0. 0751     sin   0. 9976   0. 9977   0. 9978   0. 9979   0. 9980   0. 9991   0. 9992   0. 9993   0. 9993   0. 9993   0. 9993   0. 9994   0. 9994   0. 9992   0. 9993   0. 9993   0. 9993   0. 9993   0. 9993   0. 9994   0. 9994   0. 9994   0. 9994   0. 9994   0. 9995   0. 9995   0. 9995   0. 9995   0. 9996   0. 9997   0. 9997   0. 9997   0. 9998   0. 9998   0. 9997   0. 9997   0. 9997   0. 9998   0. 9998   0. 9997   0. 09997   0. 09997   0. 09998   0. 09997   0. 09997   0. 09997   0. 09998   0. 09997   0. 09997   0. 09998   0. 09997   0. 09997   0. 00192   0. 00192  | - 1 | sin  | 0. 9848 | 0.985   | 1 0.9854  | 0.9857    | 0. 9860 | 0. 9863 | 0. 9866           | 0. 9869 | 0. 9871 | 0. 9874 | ∣тп         |
| sin   0, 9877   0, 9880   0, 9882   0, 9885   0, 9888   0, 9890   0, 9893   0, 9895   0, 9898   0, 9900   0, 1504   1, 1547   0, 1530   0, 1513   0, 1495   0, 1478   0, 1461   0, 1444   0, 1426   0, 1409   0, 3138   6, 3859   6, 4596   6, 5350   6, 6122   6, 6912   6, 7720   6, 8548   6, 9395   7, 0264   0, 9300   0, 9905   0, 9907   0, 9910   0, 9912   0, 9914   0, 9917   0, 9919   0, 9921   0, 9923   0, 1392   0, 1374   0, 1357   0, 1340   0, 1323   0, 1305   0, 1288   0, 1271   0, 1253   0, 1236   tan   7, 1154   7, 2066   7, 3002   7, 3962   7, 4947   7, 5958   7, 6996   7, 8062   7, 9158   8, 0285   sin   0, 9925   0, 9928   0, 9930   0, 9932   0, 9934   0, 9938   0, 9940   0, 9942   0, 9943   0, 9942   0, 9943   0, 1219   0, 1201   0, 1184   0, 1187   0, 1149   0, 1132   0, 1115   0, 1097   0, 1080   0, 1063   tan   8, 1443   8, 2036   8, 3863   8, 5126   8, 6427   8, 7769   8, 9152   9, 0579   9, 2052   9, 3572   0, 1045   0, 1028   0, 1045   0, 1028   0, 1011   0, 0993   0, 0976   0, 0958   0, 0941   0, 0924   0, 0906   0, 0889   0, 9945   0, 9945   0, 9945   0, 9945   0, 9945   0, 9945   0, 9945   0, 9945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, 0945   0, | 0   |      |         |         |           |           |         |         |                   |         |         |         |             |
| Sin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     | tan  | 5. 6713 | 5. 729  | 7 5. 7894 | 5. 8502   | 5. 9124 | 5. 9758 | 6. 0405           | 6. 1066 | 6. 1742 | 6. 2432 | I∃          |
| Sin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     | sin  | 0. 9877 | 0, 988  | 0.9882    | 2 0. 9885 | 0.9888  | 0. 9890 | 0. 9893           | 0. 9895 | 0. 9898 | 0 9900  | D           |
| Sin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1   |      | - 1     |         |           |           |         |         |                   |         |         |         | _           |
| Sin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     | tan  | 6. 3138 | 6 3859  | 9 6 4596  | 6. 5350   | 6. 6122 | 6. 6912 | 6. 7720           | 6.8548  | 6. 9395 | 7. 0264 | ା ଦ         |
| Sin   0.9925   0.9928   0.9930   0.9932   0.9934   0.9938   0.9938   0.9940   0.9942   0.9943   0.1219   0.1201   0.1184   0.1167   0.1149   0.1132   0.1115   0.1097   0.1080   0.1063   0.1063   0.1219   0.1201   0.1184   0.1167   0.1149   0.1132   0.1115   0.1097   0.1080   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.0645   0.0628   0.0610   0.0593   0.9963   0.9984   0.9985   0.9985   0.9985   0.0640   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0685   0.0688   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.06   |     | sin  | 0. 9903 | 0.990   | 5 0.9907  | 0.9910    | 0 9912  | 0. 9914 | 0. 9917           | 0. 9919 | 0. 9921 | 0. 9923 |             |
| Sin   0.9925   0.9928   0.9930   0.9932   0.9934   0.9938   0.9938   0.9940   0.9942   0.9943   0.1219   0.1201   0.1184   0.1167   0.1149   0.1132   0.1115   0.1097   0.1080   0.1063   0.1063   0.1219   0.1201   0.1184   0.1167   0.1149   0.1132   0.1115   0.1097   0.1080   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.0645   0.0628   0.0610   0.0593   0.9963   0.9984   0.9985   0.9985   0.9985   0.0640   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0685   0.0688   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.06   | 2   |      |         |         |           |           |         |         |                   |         |         |         | $\subseteq$ |
| Sin   0.9925   0.9928   0.9930   0.9932   0.9934   0.9938   0.9938   0.9940   0.9942   0.9943   0.1219   0.1201   0.1184   0.1167   0.1149   0.1132   0.1115   0.1097   0.1080   0.1063   0.1063   0.1219   0.1201   0.1184   0.1167   0.1149   0.1132   0.1115   0.1097   0.1080   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.1063   0.0645   0.0628   0.0610   0.0593   0.9963   0.9984   0.9985   0.9985   0.9985   0.0640   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0628   0.0660   0.0593   0.0576   0.0558   0.0564   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0688   0.0685   0.0685   0.0688   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.0685   0.06   |     | tan  | 7. 1154 | 7. 206  | 6 7. 3002 | 7. 3962   | 7. 4947 | 7. 5958 | 7. 6996           | 7, 8062 | 7. 9158 | 8. 0285 |             |
| 3 cos tan 0.1219 0.1201 0.1184 0.1167 0.1149 0.1132 0.1115 0.1097 0.1080 0.1063 8.1443 8.2036 8.3863 8.5126 8.6427 8.7769 8.9152 9.0579 9.2052 9.3572   Function 0.0° 0.1° 0.2° 0.3° 0.4° 0.5° 0.6° 0.7° 0.8° 0.9° 0.9° 0.9° 0.9° 0.9° 0.9° 0.9° 0.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     | sin  | 0. 9925 | 0. 9921 | 8 0.9930  | 0.9932    | 0.9934  | 0. 9936 | 0 9938            | 0. 9940 | 0. 9942 | 0 9943  |             |
| Sin   0.9945   0.9947   0.9949   0.9951   0.9952   0.9954   0.9958   0.9945   0.9957   0.9959   0.9958   0.9945   0.9958   0.9958   0.9958   0.9945   0.9958   0.9958   0.9945   0.9958   0.9958   0.9945   0.9958   0.9958   0.9945   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.9958   0.99   | 3   |      | 0. 1219 | 0.120   | 0.1184    | 0.1167    |         |         |                   | 0.1097  | 0 1080  | 0. 1063 |             |
| sin 0.9945 0.9947 0.9949 0.9951 0.9952 0.9954 0.9950 0.9957 0.9959 0.9960 0.1045 0.1028 0.1011 0.0993 0.0976 0.0958 0.0941 0.0924 0.0906 0.0889 tan 9.5144 9.6768 9.8448 10.02 10.20 10.39 10.58 10.78 10.99 11.20 sin 0.9962 0.9963 0.9965 0.9966 0.9968 0.9969 0.9971 0.9972 0.9973 0.9974 tan 11.43 11.66 11.91 12.16 12.43 12.71 13.00 13.30 13.62 13.95 tan 0.9976 0.9977 0.9978 0.9979 0.9980 0.9981 0.9982 0.9983 0.9984 0.9985 tan 14.30 14.67 15.06 15.46 15.89 16.35 16.83 17.34 17.89 18.46 sin 0.9986 0.9987 0.9988 0.9989 0.9990 0.9991 0.9992 0.9993 0.9993 0.9993 tan 19.08 19.74 20.45 21.20 22.02 22.90 23.86 24.90 26.03 27.27 sin 0.9994 0.9995 0.9995 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 0.9998 0.0410 0.0384 0.0384 0.0386 tan 19.08 19.74 20.45 21.20 22.02 22.90 23.86 24.90 26.03 27.27 sin 0.9994 0.9995 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 0.9998 0.9999 0.9997 0.9997 0.9998 0.9998 0.9998 0.9999 0.9997 0.9997 0.9997 0.9998 0.9998 0.9999 0.9997 0.9997 0.9997 0.9998 0.9998 0.9998 0.9999 0.9997 0.9997 0.9997 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.999 | -   | tan  | 8. 1443 | 8. 2036 | b 8, 3863 | 8. 5126   | 8. 6427 | 8. 7769 | 8. 9152           | 9. 0579 | 9. 2052 | 9.3572  |             |
| sin 0.9945 0.9947 0.9949 0.9951 0.9952 0.9954 0.9950 0.9957 0.9959 0.9960 0.1045 0.1028 0.1011 0.0993 0.0976 0.0958 0.0941 0.0924 0.0906 0.0889 tan 9.5144 9.6768 9.8448 10.02 10.20 10.39 10.58 10.78 10.99 11.20 sin 0.9962 0.9963 0.9965 0.9966 0.9968 0.9969 0.9971 0.9972 0.9973 0.9974 tan 11.43 11.66 11.91 12.16 12.43 12.71 13.00 13.30 13.62 13.95 tan 0.9976 0.9977 0.9978 0.9979 0.9980 0.9981 0.9982 0.9983 0.9984 0.9985 tan 14.30 14.67 15.06 15.46 15.89 16.35 16.83 17.34 17.89 18.46 sin 0.9986 0.9987 0.9988 0.9989 0.9990 0.9991 0.9992 0.9993 0.9993 0.9993 tan 19.08 19.74 20.45 21.20 22.02 22.90 23.86 24.90 26.03 27.27 sin 0.9994 0.9995 0.9995 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 0.9998 0.0410 0.0384 0.0384 0.0386 tan 19.08 19.74 20.45 21.20 22.02 22.90 23.86 24.90 26.03 27.27 sin 0.9994 0.9995 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 0.9998 0.9999 0.9997 0.9997 0.9998 0.9998 0.9998 0.9999 0.9997 0.9997 0.9997 0.9998 0.9998 0.9999 0.9997 0.9997 0.9997 0.9998 0.9998 0.9998 0.9999 0.9997 0.9997 0.9997 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.999 |     |      | 0 00    | 0.10    | 0. 20     | 0 30      | 0 40    | 0.50    | 0. b <sup>o</sup> | 0 70    | 0. 80   | 0 90    | 12          |
| Cos 0.1045 0.1028 0.1011 0.0993 0.0976 0.0958 0.0941 0.0924 0.0906 0.0889 tan 9.5144 9.6768 9.8448 10.02 10.20 10.39 10.58 10.78 10.99 11.20 sin 0.9962 0.9963 0.9965 0.9966 0.9968 0.9969 0.9971 0.9972 0.9973 0.9974 cos 0.0872 0.0854 0.0837 0.0819 0.0802 0.0785 0.0767 0.0750 0.0732 0.0715 tan 11.43 11.66 11.91 12.16 12 43 12.71 13.00 13.30 13.62 13.95 sin 0.9976 0.9977 0.9978 0.9979 0.9980 0.9981 0.9982 0.9983 0.9984 0.9984 0.9985 tan 14.30 14.67 15.06 15.46 15.89 16.35 16.35 16.35 18.31 17.34 17.89 18.46 sin 0.9986 0.9987 0.9988 0.9990 0.9990 0.9991 0.9992 0.9993 0.9993 0.9993 tan 19.08 19.74 20.45 21.20 22.02 22.90 23.86 24.90 26.03 27.27 sin 0.9994 0.9995 0.9995 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 0.9998 0.9999 0.9999 0.9997 0.9997 0.9998 0.9998 0.9998 0.0410 0.0384 0.0366 0.0366 0.0419 0.0410 0.0384 0.0366 0.0419 0.0410 0.0384 0.0366 0.0366 0.0389 0.0389 0.0389 0.0998 0.9997 0.9997 0.9997 0.9997 0.9998 0.9998 0.9998 0.9999 0.9997 0.9997 0.9997 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0.9999 0 | 1   |      |         |         |           |           |         |         |                   |         |         |         |             |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     | - 1  |         |         |           |           |         |         |                   |         |         | 4.1     | 1           |
| 5 cos tan 1.43 11.66 11.91 12.16 12 43 12.71 13.00 13.30 13.62 13.95 11.43 11.66 11.91 12.16 12 43 12.71 13.00 13.30 13.62 13.95 13.95 14.30 13.96 13.95 14.30 14.67 15.06 15.46 15.89 16.35 16.35 16.35 17.34 17.89 18.46 15.89 16.35 18.30 17.34 17.89 18.46 15.89 16.35 18.30 17.34 17.89 18.46 17.89 18.46 18.30 18.67 15.06 15.46 15.89 16.35 18.30 17.34 17.89 18.46 15.89 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18. | - 1 |      |         |         |           |           |         |         |                   |         |         |         |             |
| 5 cos tan 1.43 11.66 11.91 12.16 12 43 12.71 13.00 13.30 13.62 13.95 11.43 11.66 11.91 12.16 12 43 12.71 13.00 13.30 13.62 13.95 13.95 14.30 13.96 13.95 14.30 14.67 15.06 15.46 15.89 16.35 16.35 16.35 17.34 17.89 18.46 15.89 16.35 18.30 17.34 17.89 18.46 15.89 16.35 18.30 17.34 17.89 18.46 17.89 18.46 18.30 18.67 15.06 15.46 15.89 16.35 18.30 17.34 17.89 18.46 15.89 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18.30 18. |     |      |         |         |           |           |         |         |                   |         |         |         |             |
| 6 cos 1 0. 9976 0. 9977 0. 9978 0. 9948 0. 9988 0. 0628 0. 0610 0. 0593 0. 0593 0. 0576 0. 0558 0. 0541 cos 1 4. 30 14. 67 15. 06 15. 46 15. 89 16. 35 16 83 17 34 17. 89 18. 46 cos 0. 0523 0. 0506 0. 0488 0. 0471 0. 0454 0. 0436 0. 0419 0. 0401 0. 0384 0. 0366 cos 0. 0523 0. 0506 0. 0488 0. 0471 0. 0454 0. 0436 0. 0419 0. 0401 0. 0384 0. 0366 cos 0. 0523 0. 0506 0. 0488 0. 0471 0. 0454 0. 0436 0. 0419 0. 0401 0. 0384 0. 0366 cos 0. 0389 0. 9998 0. 9998 0. 9998 0. 9998 0. 9998 0. 9998 0. 03997 0. 03997 0. 03997 0. 03998 0. 9998 0. 03998 0. 0349 0. 0332 0. 0314 0. 0297 0. 0279 0. 0262 0. 0244 0. 0227 0. 0209 0. 0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | - 1 | - 1  |         |         |           |           |         |         |                   |         |         |         |             |
| 6 cos 1 0. 9976 0. 9977 0. 9978 0. 9948 0. 9988 0. 0628 0. 0610 0. 0593 0. 0593 0. 0576 0. 0558 0. 0541 cos 1 4. 30 14. 67 15. 06 15. 46 15. 89 16. 35 16 83 17 34 17. 89 18. 46 cos 0. 0523 0. 0506 0. 0488 0. 0471 0. 0454 0. 0436 0. 0419 0. 0401 0. 0384 0. 0366 cos 0. 0523 0. 0506 0. 0488 0. 0471 0. 0454 0. 0436 0. 0419 0. 0401 0. 0384 0. 0366 cos 0. 0523 0. 0506 0. 0488 0. 0471 0. 0454 0. 0436 0. 0419 0. 0401 0. 0384 0. 0366 cos 0. 0389 0. 9998 0. 9998 0. 9998 0. 9998 0. 9998 0. 9998 0. 03997 0. 03997 0. 03997 0. 03998 0. 9998 0. 03998 0. 0349 0. 0332 0. 0314 0. 0297 0. 0279 0. 0262 0. 0244 0. 0227 0. 0209 0. 0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     | - 1  |         |         |           |           |         |         |                   |         |         |         |             |
| 6 cos 1 0. 9976 0. 9977 0. 9978 0. 9948 0. 9988 0. 0628 0. 0610 0. 0593 0. 0593 0. 0576 0. 0558 0. 0541 cos 1 4. 30 14. 67 15. 06 15. 46 15. 89 16. 35 16 83 17 34 17. 89 18. 46 cos 0. 0523 0. 0506 0. 0488 0. 0471 0. 0454 0. 0436 0. 0419 0. 0401 0. 0384 0. 0366 cos 0. 0523 0. 0506 0. 0488 0. 0471 0. 0454 0. 0436 0. 0419 0. 0401 0. 0384 0. 0366 cos 0. 0523 0. 0506 0. 0488 0. 0471 0. 0454 0. 0436 0. 0419 0. 0401 0. 0384 0. 0366 cos 0. 0389 0. 9998 0. 9998 0. 9998 0. 9998 0. 9998 0. 9998 0. 03997 0. 03997 0. 03997 0. 03998 0. 9998 0. 03998 0. 0349 0. 0332 0. 0314 0. 0297 0. 0279 0. 0262 0. 0244 0. 0227 0. 0209 0. 0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1.0 |      |         |         |           |           |         |         |                   |         |         |         | C           |
| sin 0.9994 0.9995 0.9995 0.9996 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 8 cos 0.0349 0.0332 0.0314 0.0297 0.0279 0.0262 0.0244 0.0227 0.0209 0.0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     | - 1  |         |         |           |           |         |         |                   |         |         |         | نے ا        |
| sin 0.9994 0.9995 0.9995 0.9996 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 8 cos 0.0349 0.0332 0.0314 0.0297 0.0279 0.0262 0.0244 0.0227 0.0209 0.0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | - 1 |      |         |         |           |           |         |         |                   |         |         |         |             |
| sin 0.9994 0.9995 0.9995 0.9996 0.9996 0.9997 0.9997 0.9997 0.9997 0.9998 0.9998 8 cos 0.0349 0.0332 0.0314 0.0297 0.0279 0.0262 0.0244 0.0227 0.0209 0.0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ta  | in I | 9. 30   | 14.0/   | 19.00     | 10.40     | 17.89   | 10. 35  | 10 83             | 17 34   | 17.89   | 10.40   |             |
| sin 0.9994 0.9995 0.9995 0.9996 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 8 cos 0.0349 0.0332 0.0314 0.0297 0.0279 0.0262 0.0244 0.0227 0.0209 0.0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | s   | in   | 0.9986  | 0.9987  | 0.9988    | 0.9989    | 0.9990  | 0. 9990 | 0. 9991           | 0.9992  | 0.9993  | 0. 9993 |             |
| sin 0.9994 0.9995 0.9995 0.9996 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 8 cos 0.0349 0.0332 0.0314 0.0297 0.0279 0.0262 0.0244 0.0227 0.0209 0.0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | - 1 |      |         |         |           |           |         |         |                   |         |         |         | 2           |
| sin 0.9994 0.9995 0.9995 0.9996 0.9996 0.9997 0.9997 0.9997 0.9998 0.9998 8 cos 0.0349 0.0332 0.0314 0.0297 0.0279 0.0262 0.0244 0.0227 0.0209 0.0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ta  | ւո ի | 9.08    | 19.74   | 20. 45    | 21.20     | 22. 02  | 22. 90  | 23.86             | 24. 90  | 26. đ3  | 27. 27  | (1)         |
| 8 cos 0.0349 0.0332 0.0314 0.0297 0.0279 0.0262 0.0244 0.0227 0.0209 0.0192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | s   | in   | 0. 9994 | 0. 9995 | 0. 9995   | 0. 9996   | 0.9996  | 0. 9997 | 0. 9997           | 0. 9997 | 0. 9998 | 0. 9998 | •           |
| tan 28.64 30.14 31.82 33.69 35.80 38.19 40.92 44.07 47.74 52.08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     | os   | 0.0349  | 0.0332  | 0.0314    | 0.0297    | 0.0279  | 0. 0262 | 0.0244            |         |         |         |             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ta  | ın 2 | 8.64    | 30.14   | 31.82     | 33.69     | 35. 80  | 38. 19  | 40.92             | 44. 07  | 47.74   | 52. 08  |             |

0.9998 0.9999 0.9999 0.9999 0.9999 1.000 1.000 1.000 1.000 1.000

0.50

0.60

0.8°

0.70

0.9°

cos 0.0175 0.0157 0.0140 0.0122 0.0105 0.0087 0.0070 0.0052 0.0035 0.0017 57. 29 63. 66 71. 62 81. 85 95. 49 114. 6 143. 2 191. 0 286. 5 573. 0

0.3° 0.4°

0. Z<sup>o</sup>

0.10

0. 20 0. 30 0. 40 0. 50 0. 60

cos 0.2924 0 2907 2 2900 0 2874 0.2857 0 2840 0 2823 0 2807 0 2790 0 2773 tan 3.3700 3.2014 3.3122 3.3332 3.3544 3.3759 3.3977 3.4197 3.4420 3.4646 0. 9613 0. 9617 0. 9622 0. 9627 0. 9632 0. 9636 0. 9641 0. 9646 0. 9650 0. 9655

10. 956 2 0. 9568 0. 9573 0. 9578 0. 9583 0. 9588 0. 9593 0. 9598 0 9603 0. 9608

0.70

0.80

0.90

0.1°

deg tion

511:

S11.

sin

tan func

deg tion

0.00

| Sin   0,8290   0,8300   0,8310   0,8320   0,8329   0,8339   0,8348   0,8358   0,8368   0,8368   0,5572   0,5577   0,5553   0,5548   0,5514   0,5517   0,5505   0,5490   0,5476   1,5282   0,5406   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,5476   0,54   | 0.               | 0.8°    | 0.70    | 0.60     | 0.5°     | 0. <b>4</b> °     | 0. 3 <sup>0</sup> | 0. 20   | 0.10    | 0.00    | func-<br>tion | deg |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------|---------|----------|----------|-------------------|-------------------|---------|---------|---------|---------------|-----|
| 56 cos 0. 5992 0. 5577 0. 5563 0. 5548 0. 5534 0. 5519 0. 5509 0. 5469 0. 5476 tan 1. 4826 1. 4882 1. 4938 1. 4994 1. 5051 1. 5108 1. 5166 1. 5224 1. 5282    sin 0. 8387 0. 8396 0. 8406 0. 8415 0. 8425 0. 8434 0. 8443 0. 3443 0. 3443 1. 510 0. 5462 tan 1. 5399 1. 5458 1. 5517 1. 5577 1. 5637 1. 5637 1. 5577 1. 5575 1. 5818 1. 5880 0. 5344 0. 5329 1. 5458 1. 5517 1. 5577 1. 5637 1. 5697 1. 5757 1. 5818 1. 5880 0. 5299 0. 5284 0. 5270 0. 5255 0. 5240 0. 5225 0. 5210 0. 5195 0. 5180 1. 6003 1. 6066 1. 6128 1. 6191 1. 6255 1. 6319 1. 6383 1. 6447 1. 6512 1. 6103 1. 6066 1. 6128 1. 6191 1. 6255 1. 6319 1. 6383 1. 6447 1. 6512 1. 6103 1. 6643 1. 6709 1. 6775 1. 6842 1. 6909 0. 5075 0. 5000 0. 5045 0. 5030 1. 6643 1. 6709 1. 6775 1. 6842 1. 6909 0. 5075 0. 5000 0. 5045 0. 5030 1. 6643 1. 6709 1. 6775 1. 6842 1. 6909 0. 5075 0. 5000 0. 5045 0. 5030 1. 6664 0. 8669 0. 8669 0. 4970 0. 4995 0. 4970 0. 4995 0. 4979 0. 4995 0. 4979 0. 4995 0. 4979 0. 4995 0. 4972 0. 4995 0. 4972 0. 4995 0. 4972 0. 4995 0. 4972 0. 4995 0. 4993 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0. 4994 0 |                  |         |         |          |          |                   |                   |         | 0.0300  | 0.0300  |               |     |
| tan   1, 4826   1, 4882   1, 4998   1, 4994   1, 5051   1, 5108   1, 5166   1, 5224   1, 5282   1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0. 83            |         |         |          |          |                   |                   |         |         |         |               |     |
| sin   0.8387   0.8396   0.8406   0.8415   0.8425   0.8434   0.8443   0.8453   0.8462   0.8417   0.5402   0.5388   0.5373   0.5358   0.5344   0.5329   1.5599   1.55458   1.5517   1.5577   1.5637   1.5637   1.5637   1.55757   1.5818   1.5818   1.5880   0.8480   0.8490   0.8499   0.8508   0.8517   0.8526   0.8526   0.8536   0.8545   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8545   0.8554   0.8554   0.8554   0.8554   0.8554   0.8554   0.8543   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8643   0.8642   0.8643   0.8643   0.8643   0.8643   0.8643   0.8642   0.8642   0.6909   0.8678   0.8576   0.8506   0.8669   0.8678   0.8695   0.8704   0.8712   0.8722   0.8724   0.8721   0.8722   0.8723   0.8721   0.8722   0.8723   0.8721   0.8722   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8721   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.8723   0.   | 0. 54            |         |         |          |          |                   |                   |         |         |         |               | '°  |
| tan 1. 5399 1. 5456 0. 5432 0. 5417 0. 5402 0. 5388 0. 5373 0. 5358 0. 5344 0 5329 tan 1. 5399 1. 5458 1. 5517 1. 5577 1. 5637 1. 5697 1. 5575 1. 5818 1. 5880 1. 6880 0. 8490 0. 8499 0. 8508 0. 8517 0. 8526 0. 8536 0. 8545 0. 8545 0. 8546 tan 1. 6003 1. 6066 1. 6128 1. 6191 1. 6255 1. 6319 1. 6383 1. 6447 1. 6512 1. 6103 1. 6006 1. 6128 1. 6191 1. 6255 1. 6319 1. 6383 1. 6447 1. 6512 1. 6103 1. 6006 1. 6128 1. 6191 1. 6255 1. 6319 1. 6383 1. 6447 1. 6512 1. 626 1. 6103 1. 6006 1. 6128 1. 6191 1. 6255 1. 6319 1. 6383 1. 6447 1. 6512 1. 626 1. 6103 1. 6006 1. 6128 1. 6191 1. 6255 1. 6319 1. 6383 1. 6447 1. 6512 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1. 626 1 | 1. 53            | 1. 5282 | 1. 5224 | 1.5166   | 1.5108   | 1.5051            | 1. 4994           | 1. 4938 | 1. 4082 | 1. 4626 | tan           |     |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.84             | 0.8462  | 0.8453  | 0.8443   | 0.8434   | 0.8425            | 0.8415            | 0.8406  | 0.8396  | 0. 8387 | #in           |     |
| Sin   0.8480   0.8490   0.8499   0.8508   0.8517   0.8526   0.8536   0.8545   0.8554   tan   1.6003   1.6066   1.6128   1.6191   1.6255   1.6319   1.6383   1.6447   1.6512   1.6513   1.6303   1.6467   1.6512   1.6313   1.6383   1.6447   1.6512   1.6313   1.6487   1.6513   1.6383   1.6447   1.6512   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513   1.6513    | 0.53             | 0 5329  | 0. 5344 | 0.5358   | 0.5373   | 0.5388            | 0. 5402           | 0.5417  | 0.5432  | 0. 5446 | COS           | 7   |
| 88 cas 0. 5299 0. 5284 0. 5270 0. 5255 0. 5240 0. 5225 0. 5210 0. 5195 0. 5180 1. 61003 1. 6006 1. 6128 1. 6191 1. 6255 1. 6319 1. 6383 1. 6447 1. 6512    sin 0. 8572 0. 8581 0. 8590 0. 8599 0. 8607 0. 8616 0. 8625 0. 8634 0. 8643    ocas 0. 5150 0. 5135 0. 5120 0. 5105 0. 5090 0. 5075 0. 5060 0. 5045 0. 5030    tan 1. 6643 1. 6709 1. 6775 1. 6842 1. 6909 1. 6977 1. 7045 1. 7113 1. 7182    sin 0. 8660 0. 8669 0. 8678 0. 8686 0. 8695 0. 8704 0. 8712 0. 8721 0. 8729    ocas 0. 5000 0. 4985 0. 4970 0. 4955 0. 4939 0. 4924 0. 4909 0. 4884 0. 4879    tan 1. 7321 1. 7391 1. 7461 1. 7532 1. 7603 1. 7675 1. 7747 1. 7820 1. 7883    sin 0. 8746 0. 8755 0. 8763 0. 8771 0. 8780 0. 8788 0. 8796 0. 8805 0. 8813    cos 0. 4848 0. 4833 0. 4818 0. 4802 0. 4787 0. 4772 0. 4756 0. 4741 0. 4726    tan 1. 8040 1. 8115 1. 8190 1. 8265 1. 8341 1. 8418 1. 8495 1. 8572 1. 8650    sin 0. 8829 0. 8838 0. 8846 0. 8854 0. 8854 0. 8854 0. 8854 0. 8854 0. 8854 0. 8545    cos 0. 4695 0. 4679 0. 4664 0. 4648 0. 4633 0. 4617 0. 4002 0. 4586 0. 4571    tan 1. 8807 1. 8887 1. 8967 1. 9047 1. 9128 1. 9210 1. 7929 1. 9375 1. 9458    sin 0. 8910 0. 8918 0. 8926 0. 8934 0. 8942 0. 8949 0. 8957 0. 8965 0. 8973    cos 0. 4540 0. 4524 0. 4509 0. 4493 0. 4478 0. 4472 0. 4446 0. 4431 0. 4415    tan 1. 9626 1. 9711 1. 9797 1. 9883 1. 9970 2. 0057 2. 0145 2. 0233 2. 0335    sin 0. 8988 0. 8996 0. 9003 0. 9011 0. 9018 0. 9026 0. 9033 0. 9041 0. 9048    tan 2. 9633 0. 9040 0. 4195 0. 4179 0. 4163 0. 4147 0. 4131 0. 4115 0. 4099    tan 2. 1445 2. 1543 2. 1642 2. 1742 2. 1842 2. 1943 2. 2045 2. 2148 2. 2251 1  sin 0. 9063 0. 9070 0. 9078 0. 9085 0. 9092 0. 9100 0. 9107 0. 9114 0. 9121    cos 0. 4067 0. 4051 0. 4035 0. 4019 0. 4003 0. 3987 0. 3971 0. 3955 0. 3939    tan 2. 2460 2. 2566 2. 2673 2. 2778 2. 2889 2. 2998 2. 3109 2. 2248 0. 2332 2. 23332 1  sin 0. 9336 0. 9342 0. 9348 0. 9355 0. 9391 0. 9040 0. 9311 0. 9317 0. 9323 0  cos 0. 3346 0. 3350 0. 3318 0. 3351 0. 3351 0. 3358 0. 3352 0. 3368 0. 3469 0. 3469 0. 3469 0. 3469 0. 3469 0. 3469 0. 3469 0. 3469 0. | 1. 59            | 1.5880  | 1. 5818 | 1.5757   | 1.5697   | 1.5637            | 1.5577            | 1.5517  | 1.5458  | 1. 5399 | tan           |     |
| 88 cas 0. 5299 0. 5284 0. 5270 0. 5255 0. 5240 0. 5225 0. 5210 0. 5195 0. 5180 1. 61003 1. 6006 1. 6128 1. 6191 1. 6255 1. 6319 1. 6383 1. 6447 1. 6512    sin 0. 8572 0. 8581 0. 8590 0. 8599 0. 8607 0. 8616 0. 8625 0. 8634 0. 8643    ocas 0. 5150 0. 5135 0. 5120 0. 5105 0. 5090 0. 5075 0. 5060 0. 5045 0. 5030    tan 1. 6643 1. 6709 1. 6775 1. 6842 1. 6909 1. 6977 1. 7045 1. 7113 1. 7182    sin 0. 8660 0. 8669 0. 8678 0. 8686 0. 8695 0. 8704 0. 8712 0. 8721 0. 8729    ocas 0. 5000 0. 4985 0. 4970 0. 4955 0. 4939 0. 4924 0. 4909 0. 4884 0. 4879    tan 1. 7321 1. 7391 1. 7461 1. 7532 1. 7603 1. 7675 1. 7747 1. 7820 1. 7883    sin 0. 8746 0. 8755 0. 8763 0. 8771 0. 8780 0. 8788 0. 8796 0. 8805 0. 8813    cos 0. 4848 0. 4833 0. 4818 0. 4802 0. 4787 0. 4772 0. 4756 0. 4741 0. 4726    tan 1. 8040 1. 8115 1. 8190 1. 8265 1. 8341 1. 8418 1. 8495 1. 8572 1. 8650    sin 0. 8829 0. 8838 0. 8846 0. 8854 0. 8854 0. 8854 0. 8854 0. 8854 0. 8854 0. 8545    cos 0. 4695 0. 4679 0. 4664 0. 4648 0. 4633 0. 4617 0. 4002 0. 4586 0. 4571    tan 1. 8807 1. 8887 1. 8967 1. 9047 1. 9128 1. 9210 1. 7929 1. 9375 1. 9458    sin 0. 8910 0. 8918 0. 8926 0. 8934 0. 8942 0. 8949 0. 8957 0. 8965 0. 8973    cos 0. 4540 0. 4524 0. 4509 0. 4493 0. 4478 0. 4472 0. 4446 0. 4431 0. 4415    tan 1. 9626 1. 9711 1. 9797 1. 9883 1. 9970 2. 0057 2. 0145 2. 0233 2. 0335    sin 0. 8988 0. 8996 0. 9003 0. 9011 0. 9018 0. 9026 0. 9033 0. 9041 0. 9048    tan 2. 9633 0. 9040 0. 4195 0. 4179 0. 4163 0. 4147 0. 4131 0. 4115 0. 4099    tan 2. 1445 2. 1543 2. 1642 2. 1742 2. 1842 2. 1943 2. 2045 2. 2148 2. 2251 1  sin 0. 9063 0. 9070 0. 9078 0. 9085 0. 9092 0. 9100 0. 9107 0. 9114 0. 9121    cos 0. 4067 0. 4051 0. 4035 0. 4019 0. 4003 0. 3987 0. 3971 0. 3955 0. 3939    tan 2. 2460 2. 2566 2. 2673 2. 2778 2. 2889 2. 2998 2. 3109 2. 2248 0. 2332 2. 23332 1  sin 0. 9336 0. 9342 0. 9348 0. 9355 0. 9391 0. 9040 0. 9311 0. 9317 0. 9323 0  cos 0. 3346 0. 3350 0. 3318 0. 3351 0. 3351 0. 3358 0. 3352 0. 3368 0. 3469 0. 3469 0. 3469 0. 3469 0. 3469 0. 3469 0. 3469 0. 3469 0. | 0. 85            | 0 8554  | 0 8545  | 0 8536   | 0 8526   | 0.8517            | 0.8508            | 0 8499  | 0.8490  | 0.8480  | ein           |     |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |         |         |          |          |                   |                   |         |         |         |               | 8   |
| Cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.65             |         |         |          |          |                   |                   |         |         |         |               | _   |
| Cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |         |         |          |          |                   |                   |         |         |         |               | - 1 |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |         |         |          |          |                   |                   |         |         |         |               | .   |
| Sin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.50             |         |         |          |          |                   |                   |         |         | 1       |               | 9   |
| cos    | 1.72             | 1. /102 | 1. /113 | 1. 7045  | 1.0911   | 1. 0909           | 1.0042            | 1.0775  | 1.0107  | 1.0043  | tan           | i   |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.87             | 0.8729  | 0.8721  | 0.8712   | 0.8704   | 0.8695            | 0.8686            |         |         |         | #in           |     |
| sin cos tan 1.862                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.48             |         |         |          |          |                   |                   |         |         |         |               | 0   |
| 1 cos tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1. 79            | 1. 7893 | 1.7820  | 1.7747   | 1. 7675  | 1. 7603           | 1. 7532           | 1. 7461 | 1. 7391 | 1.7321  | tan           |     |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0. 88            | 0. 8813 | 0. 8805 | 0. 8796  | 0. 8788  | 0. 8780           | 0. 8771           | 0. 8763 | 0. 8755 | 0. 8746 | sin           |     |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0. 47            |         |         |          |          |                   |                   |         | 0. 4833 |         |               | 1   |
| cos         0. 46695         0. 46679         0. 46648         0. 4648         0. 4633         0. 46617         0. 4602         0. 4886         0. 4871           sin         0. 8910         0. 8918         0. 8926         0. 8944         0. 8949         0. 8957         0. 8965         0. 8936           cos         0. 4524         0. 4599         0. 4493         0. 4478         0. 4462         0. 4441         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4426         0. 4352         0. 4337         0. 4310         0. 4226         0. 4226         0. 4326         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.87             |         | 1.8572  | 1.8495   | 1.8418   | 1.8341            | 1.8265            | 1.8190  | 1.8115  | 1.8040  | tan           |     |
| cos         0. 46695         0. 46679         0. 46648         0. 4648         0. 4633         0. 46617         0. 4602         0. 4886         0. 4871           sin         0. 8910         0. 8918         0. 8926         0. 8944         0. 8949         0. 8957         0. 8965         0. 8936           cos         0. 4524         0. 4599         0. 4493         0. 4478         0. 4462         0. 4441         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4411         0. 4426         0. 4352         0. 4337         0. 4310         0. 4226         0. 4226         0. 4326         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226         0. 4226                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0. 89            | 0.8804  | 0 8886  | 0 8878   | 0 8870   | 0.8862            | 0.8854            | 0 8846  | 0.8838  | 0 8829  | ain           |     |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0. 45            |         |         |          |          |                   |                   |         |         |         |               | 2   |
| Sin   0.8910   0.8918   0.8926   0.8934   0.8942   0.8949   0.8957   0.8965   0.8973   0.4540   0.4524   0.4509   0.4493   0.4478   0.4462   0.4446   0.4431   0.4415   1.9626   1.9711   1.9797   1.9883   1.9970   2.0057   2.0145   2.0233   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0344   2.0324   2.0325   2.0953   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0954   2.0955   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.0959   2.09   | 1.95             |         |         |          |          |                   |                   |         |         |         |               | _   |
| Cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |         |         |          |          |                   |                   |         |         |         |               |     |
| tan   1.9626   1.9711   1.9797   1.9883   1.9970   2.0057   2.0145   2.0233   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.0323   2.03   | 0. 89            |         |         |          |          |                   |                   |         |         |         |               | .   |
| Sin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0. 43            |         |         |          |          |                   |                   |         |         |         |               | 3   |
| Cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2. 04            | 2. 0323 | 2. 0233 | 2. 0145  | 2. 0057  | 1. 9970           | 1. 9883           | 1. 9797 | 1. 9711 | 1. 9626 | tan           |     |
| tan 2.0503 2.0594 2.0686 2.0778 2.0872 2.0965 2.1060 2.1155 2.1251  sin 0.9063 0.9070 0.9078 0.9085 0.9092 0.9100 0.9107 0.9114 0.9121 0.426 0.4210 0.4195 0.4179 0.4163 0.4147 0.4131 0.4115 0.4099 0.4181 0.415 0.4099 0.4181 0.415 0.4099 0.4181 0.415 0.4099 0.4181 0.415 0.4099 0.4181 0.9181 0.415 0.4099 0.4181 0.9181 0.415 0.4099 0.4181 0.9181 0.415 0.4099 0.4181 0.9181 0.415 0.4099 0.4181 0.9181 0.4181 0.4115 0.4099 0.4181 0.9181 0.9181 0.9184 0.9191 0.4081 0.4067 0.4051 0.4055 0.4019 0.4003 0.3987 0.3971 0.3955 0.3939 0.4181 0.4067 0.4051 0.4035 0.4019 0.4003 0.3987 0.3971 0.3955 0.3939 0.4181 0.3907 0.3881 0.3885 0.3889 0.3883 0.3827 0.3811 0.3795 0.3778 0.3978 0.3997 0.3891 0.3875 0.3875 0.3883 0.3827 0.3811 0.3795 0.3778 0.3778 0.3959 0.3949 0.3891 0.3875 0.3899 0.3843 0.3827 0.3811 0.3795 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0.3778 0. | 0.90             | 0. 9048 | 0.9041  | 0. 9033  | 0. 9026  | 0.9018            | 0. 9011           | 0.9003  | 0. 8996 | 0. 8988 | sin           |     |
| sin 0.9063 0.9070 0.9078 0.9085 0.9092 0.9100 0.9107 0.9114 0.9121 cos 0.4226 0.4210 0.4195 0.4179 0.4163 0.4147 0.4131 0.4115 0.4099 tan 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 degree 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 degree 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 degree 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 degree 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 degree 2.1452 2.1460 2.2566 2.2673 2.2781 2.2889 2.2998 2.3109 2.3220 2.3332 degree 2.2460 2.2566 2.2673 2.2781 2.2889 2.2998 2.3109 2.3220 2.3332 degree 2.3559 2.3673 2.3789 2.3906 2.4023 2.4142 2.4262 2.4383 2.4504 degree 2.3559 2.3673 2.3789 2.3906 2.4023 2.4142 2.4262 2.4383 2.4504 degree 2.3559 2.3673 2.3789 2.3906 2.4023 2.4142 2.4262 2.4383 2.4504 degree 2.4751 2.4876 2.5002 2.5129 2.5257 2.5386 2.5517 2.5649 2.5782 degree 2.4871 2.4876 2.5002 2.5129 2.5257 2.5386 2.5517 2.5649 2.5782 degree 2.4871 2.4876 2.5002 2.5129 2.5257 2.5386 2.5517 2.5649 2.5782 degree 2.4871 2.4876 2.5002 2.5129 2.5257 2.5386 2.5517 2.5649 2.5782 degree 2.4871 2.4876 2.5002 2.5129 2.5257 2.5386 2.5517 2.5649 2.5782 degree 2.5612 2.66187 2.6625 2.6464 2.6605 2.6746 2.6889 2.7034 2.7179 degree 2.5625 2.6464 2.6605 2.6746 2.6889 2.7034 2.7179 degree 2.7475 2.7625 2.7776 2.7929 2.8083 2.8239 2.8339 2.8339 2.8556 2.8716 degree 2.7475 2.7625 2.7776 2.7929 2.8083 2.8239 2.8397 2.8556 2.8716 degree 2.9042 2.9208 2.9339 0.3223 0.3206 0.3190 0.3173 0.3156 0.3140 0.3123 degree 2.9042 2.9208 2.9339 0.3223 0.3204 0.3007 0.2990 0.2974 0.2957 degree 2.908 2.9074 0.3057 0.3040 0.3024 0.3007 0.2990 0.2974 0.2957 degree 2.908 2.9074 0.3057 0.3040 0.3024 0.3007 0.2990 0.2974 0.2957 degree 2.908 2.3057 0.3040 0.3024 0.3007 0.2990 0.2974 0.2957 degree 2.908 2.3050 0.3064 0.3007 0.2990 0.2974 0.2957 degree 2.908 2.90 | 0. 42            | 0. 4258 | 0.4274  | 0. 4289  | 0. 4305  | 0. 4321           | 0.4337            | 0.4352  | 0. 4368 | 0. 4384 | COB           | 4   |
| 5 cos tan 2.426 0.4210 0.4195 0.4179 0.4163 0.4147 0.4131 0.4115 0.4099 tan 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 2.1445 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 2.1445 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 2.148 2.2251 2.1445 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 2.148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.1485 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2251 2.1485 2.2251 2.2460 2.2566 2.2673 2.2781 2.2889 2.2998 2.3109 2.3220 2.3332 2.1412 2.2426 2.2426 2.3332 2.3332 2.1412 2.1426 2.2426 2.3332 2.3332 2.1412 2.1426 2.2426 2.14383 2.1450 2.3559 2.3673 2.3789 2.3906 2.4023 2.4142 2.4262 2.4383 2.4504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.1426 2.1426 2.1426 2.1426 2.142 | 2. 13            | 2. 1251 | 2. 1155 | 2. 1060  | 2. 0965  | 2. 0872           | 2. 0778           | 2. 0686 | 2. 0594 | 2. 0503 | tan           |     |
| 5 cos tan 2.426 0.4210 0.4195 0.4179 0.4163 0.4147 0.4131 0.4115 0.4099 tan 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 2.1445 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 2.1445 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 2.148 2.2251 2.1445 2.1445 2.1543 2.1642 2.1742 2.1842 2.1943 2.2045 2.2148 2.2251 2.148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.1485 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2045 2.2148 2.2251 2.1485 2.2251 2.1485 2.2251 2.2460 2.2566 2.2673 2.2781 2.2889 2.2998 2.3109 2.3220 2.3332 2.1412 2.2426 2.2426 2.3332 2.3332 2.1412 2.1426 2.2426 2.3332 2.3332 2.1412 2.1426 2.2426 2.14383 2.1450 2.3559 2.3673 2.3789 2.3906 2.4023 2.4142 2.4262 2.4383 2.4504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.14383 2.14504 2.1412 2.1426 2.1426 2.1426 2.1426 2.1426 2.1426 2.142 | 0. 91            | 0 9121  | 0 9114  | 0.9107   | 0.0100   | 0 9092            | 0 9085            | 0.9078  | 0.9070  | 0. 9063 | sin           |     |
| tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0. 40            |         |         |          |          |                   |                   |         |         | 1       | COS           | 5   |
| 6 com tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2. 23            |         |         |          |          |                   |                   |         | 2. 1543 | 2. 1445 | tan           |     |
| Cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0. 91            | 0.0101  | 0.0104  | 0.0170   | 0.0171   | 0.01/4            | 0.0153            | 0.0150  | 0.0142  | 0 0135  | -1            |     |
| tan 2. 2460 2. 2566 2. 2673 2. 2781 2. 2889 2. 2998 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3332 2. 3109 2. 3220 2. 3239 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. 3230 2. | 0. 39            |         |         |          |          |                   |                   |         |         |         |               | ۷.  |
| Sin   0,9212   0,9218   0,9219   0,9225   0,9232   0,9239   0,9245   0,9252   0,9259   0,3648   0,3877   0,3891   0,3875   0,3859   0,3843   0,3827   0,3811   0,3795   0,3778   0,3778   0,3759   0,3778   0,3759   0,3778   0,3759   0,3778   0,3759   0,3778   0,3759   0,3778   0,3759   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,3778   0,37   | 2. 34            |         |         |          |          |                   |                   |         |         |         |               | "   |
| cos tan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |         |         |          |          |                   |                   |         |         |         |               | - 1 |
| tan 2. 3559 2. 3673 2. 3789 2. 3906 2. 4023 2. 4142 2. 4262 2. 4383 2. 4504 2. 818                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0. 92            |         |         |          |          |                   |                   |         |         | 1       |               | .   |
| 8 in cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0. 370<br>2. 467 |         |         |          |          |                   |                   |         |         |         |               | 1   |
| 8 cos tan 2. 4751 2. 4876 2. 5002 2. 5129 2. 5257 2. 5366 2. 5517 2. 5649 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5782 2. 5 | £. 10            | 2. 4304 | 2. 4303 | £. 4506  | 2. 4142  | 2. 4023           | 2. 3700           | 4. 3107 | 2. 3013 | 2. 3337 |               |     |
| tan 2. 4751 2. 4876 2. 5002 2. 5129 2. 5257 2. 5386 2. 5517 2. 5649 2. 5782 2. 5886 2. 5517 2. 5649 2. 5782 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. 5886 2. | 0. 93            |         |         |          |          |                   |                   |         |         |         |               |     |
| ### 8in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0. 360           |         |         |          |          |                   |                   |         |         |         |               | 8   |
| 9 cos tan 2.6051 2.6167 2.6351 0.3535 0.3518 0.3502 0.3486 0.3469 0.3453 0   2.6051 2.6167 2.6325 2.6464 2.6605 2.6746 2.6889 2.7034 2.7179 2    sin 0.9397 0.9403 0.9409 0.9415 0.9421 0.9426 0.9432 0.9438 0.9444 0   0.3420 0.3404 0.3387 0.3371 0.3355 0.3338 0.3322 0.3305 0.3289 0   2.7475 2.7625 2.7776 2.7929 2.8083 2.8239 2.8397 2.8556 2.8716 2    sin 0.9455 0.9461 0.9466 0.9472 0.9478 0.9483 0.9489 0.9494 0.9500 0   1 cos 0.3256 0.3239 0.3223 0.3206 0.3190 0.3173 0.3156 0.3140 0.3123 0   2.9042 2.9208 2.9375 2.9544 0.9714 2.9887 3.0061 3.0237 3.0415    sin 0.9511 0.9516 0.9521 0.9527 0.9532 0.9537 0.9542 0.9548 0.9553 0   2 cos 0.3090 0.3074 0.3057 0.3040 0.3024 0.3007 0.2990 0.2974 0.2957 0   tan 3.0777 3.0961 3.1146 3.1334 3.1524 3.1716 3.1910 3.2106 3.2305 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2. 59            | 2, 5/82 | 2. 5649 | 2. 5517  | 2. 5386  | 2. 5257           | 2. 5129           | 2. 5002 | 2. 48/6 | 2. 4/51 | tan           |     |
| tan 2.6051 2.6187 2.6325 2.6464 2.6605 2.6746 2.6889 2.7034 2.7179 2.6187 2.6325 2.6464 2.6605 2.6746 2.6889 2.7034 2.7179 2.6187 2.605 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 2.6187 | 0. 93            | 0. 9385 | 0. 9379 | 0. 9373  | 0. 9367  | 0.9361            | 0.9354            | 0. 9348 | 0.9342  | 0. 9336 | sin           |     |
| sin 0.9397 0.9403 0.9409 0.9415 0.9421 0.9426 0.9432 0.9438 0.9444 0.05 0.3420 0.3404 0.3387 0.3371 0.3355 0.3338 0.3322 0.3305 0.3289 0.05 0.05 0.3420 0.3404 0.3387 0.3371 0.3355 0.3338 0.3322 0.3305 0.3289 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0. 34:           |         |         |          |          |                   |                   |         |         |         |               | 9   |
| 0 cos tan 2.7475 2.7625 2.7776 2.7929 2.8083 2.8239 2.8397 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8716 2.8556 2.8556 2.8716 2.8556 2.8556 2.8716 2.8556 2.8716 2.8556 2.8556 2.8716 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 2.8556 | 2. 73            | 2. 7179 | 2. 7034 | 2. 6889  | 2. 6746  | 2. 6605           | 2. 6464           | 2. 6325 | 2.6187  | 2. 6051 | tan           | - ! |
| tan 2. 7475 2. 7625 2. 7776 2. 7929 2. 8083 2. 8239 2. 8397 2. 8556 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. 8716 2. | 0.94             |         |         |          |          |                   |                   |         |         |         |               |     |
| sin 0. 9455 0. 9461 0. 9466 0. 9472 0. 9478 0. 9483 0. 9489 0. 9494 0. 9500 ( 1 cos 0. 3256 0. 3239 0. 3223 0. 3206 0. 3190 0. 3173 0. 3156 0. 3140 0. 3123 ( 2. 9042 2. 9208 2. 9375 2. 9544 0. 9714 2. 9887 3. 0061 3. 0237 3. 0415 ( 3. n 0. 9511 0. 9516 0. 9521 0. 9527 0. 9532 0. 9537 0. 9542 0. 9548 0. 9553 ( 4. cos 0. 3090 0. 3074 0. 3057 0. 3040 0. 3024 0. 3007 0. 2990 0. 2974 0. 2957 ( 4. n 3. 0777 3. 0961 3. 1146 3. 1334 3. 1524 3. 1716 3. 1910 3. 2106 3. 2305 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |         |         |          |          |                   |                   |         |         |         |               | 0   |
| 1 cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2. 88            | 2, 8716 | 2. 8556 | 2. 8397  | 2, 8239  | 2.8083            | 2. 7929           | 2. 7776 | 2. 7625 | 2. 7475 | tan           |     |
| 1 cos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0. 950           | 0. 9500 | 0.9494  | 0. 9489  | 0. 9483  | 0. 9478           | 0. 9472           | 0. 9466 | 0.9461  | 0. 9455 | នរព           |     |
| tan 2. 9042 2. 9208 2. 9375 2. 9544 0. 9714 2. 9887 3. 0061 3. 0237 3. 0415 3.  sin 0. 9511 0. 9516 0. 9521 0. 9527 0. 9532 0. 9537 0. 9542 0. 9548 0. 9553 ( cos 0. 3090 0. 3074 0. 3057 0. 3040 0. 3024 0. 3007 0. 2990 0. 2974 0. 2957 ( tan 3. 0777 3. 0961 3. 1146 3. 1334 3. 1524 3. 1716 3. 1910 3. 2106 3. 2305 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0. 310           |         |         |          |          |                   |                   |         |         |         |               | 1   |
| 2 cos 0. 3090 0. 3074 0. 3057 0. 3040 0. 3024 0. 3007 0. 2990 0. 2974 0. 2957 ( 3. 0777 3. 0961 3. 1146 3. 1334 3. 1524 3. 1716 3. 1910 3. 2106 3. 2305 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3. 05            |         |         |          |          |                   |                   |         |         | 2. 9042 | tan           |     |
| 2 cos 0. 3090 0. 3074 0. 3057 0. 3040 0. 3024 0. 3007 0. 2990 0. 2974 0. 2957 ( 3. 0777 3. 0961 3. 1146 3. 1334 3. 1524 3. 1716 3. 1910 3. 2106 3. 2305 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |         |         |          |          |                   |                   | 0.0531  | 0.0511  | 0.511   |               |     |
| tan 3.0777 3.0961 3.1146 3.1334 3.1524 3.1716 3.1910 3.2106 3.2305                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0. 95            |         |         |          |          |                   |                   |         |         |         |               | ,   |
| func-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0. 294<br>3. 250 |         |         |          |          |                   |                   |         |         |         |               | ۷   |
| func-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | اد ک ,د          | 5, 2307 | 5. 2100 | 2. 1711/ | 2, 1,110 | 51.1567           | 2                 | 3       |         |         |               | _   |
| eg tion 0.0° 0.1° 0.2° 0.3° 0.4° 0.5° 0.6° 0.7° 0.8°                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.9              | 0.80    | 0. 7°   | 0. 6°    | 0. 5°    | 0. 4 <sup>0</sup> | 0. 3°             | 0. 2°   | 0. 1°   | 0. 0°   |               |     |

# Squares/Cubes/Square Roots/Cube Roots

|          |              |                  |                  |                  |            |                |                    | ,                  | ,                |            |                |                      |                    |                  |            | -                |                      |         |                  |
|----------|--------------|------------------|------------------|------------------|------------|----------------|--------------------|--------------------|------------------|------------|----------------|----------------------|--------------------|------------------|------------|------------------|----------------------|---------|------------------|
| No.      | Square       | Cube             | Square<br>Root   | Cuhe<br>Root     | No.        | Square         | Cube               | Square<br>Boot     | Cubs             | No.        | Square         | Cube                 | Square<br>Bool     | Cube<br>Beet     | No         | Square           | Cubo                 | See:    | Eubo<br>Baat     |
| 1        | 1            | 1                | 1.0000           | 1.0000           | 96         | 9216           | 884736             |                    | 4.5789           | 193<br>194 | 37249<br>37636 | 7189057<br>7301384   | 13.8924<br>13.9284 |                  | 290        | 84100            | 24389000             | 17.0294 | 6.6191           |
| 2        | 4            | 8                | 1.4142           | 1.2599           | 97<br>98   | 9409<br>9604   | 912673<br>941192   |                    | 4.5947<br>4.6104 | 195        | 38025          | 7414875              | 13.9642            | 5.7989           | 291<br>292 | 84681<br>85264   | 24642171<br>24897088 |         | 6.6267<br>6.6343 |
| 3        | 9            | 27               | 1.7321           | 1.4423           | 99         | 9801           | 970299             | 9.9499             | 4.6261           | 196<br>197 | 38416<br>38809 | 7529536<br>7645373   | 14.0000<br>14.0357 |                  | 293        | 85849            | 25153757             | 17.1172 | 6.6419           |
| 4<br>5   | 16<br>25     | 64<br>125        | 2.0000           | 1.5874           | 100        | 10000          | 1000000            | 10.0000            | 4.6416           | 198        | 39204          | 7762392              | 14.0712            |                  | 294        | 86436<br>87025   | 25412184             |         | 6.6494           |
| 6        | 36           | 216              | 2.4495           | 1.8171           | 101        | 10201          | 1030301            | 10.4099            | 4.6570           | 199        | 39601          | 7880599              | 14.1067            | 5.8383           | 295<br>296 | 87616            | 25672375<br>25934336 |         |                  |
| 7        | 49           | 343              | 2.6458           | 1.9129           | 102<br>103 | 10404<br>10609 | 1061208<br>1092727 | 10.0995<br>10.1489 |                  | 200        | 40000          | 8000000              | 14.1421            | 5.8480           | 297        | 88209            | 26198073             | 17.2337 | 6.6719           |
| 8<br>9   | 64<br>81     | 512<br>729       | 2.8284<br>3.0000 | 2.0000           | 104        | 10816          | 1124864            | 10.1980            | 4.7027           | 201<br>202 | 40401<br>40804 | 8120601<br>8242408   |                    |                  | 298<br>299 | 88804<br>89401   | 26463592<br>26730899 |         |                  |
| 9        | 01           |                  |                  |                  | 105<br>106 | 11025<br>11236 | 1157625<br>1191016 | 10.2470<br>10.2956 |                  | 203        | 41209          | 8365427              |                    |                  |            |                  |                      |         |                  |
| 10<br>11 | 100<br>121   | 1000<br>1331     |                  | 2.1544           | 107        | 11449          | 1225043            | 10.3441            |                  | 204        | 41616          | 8489664              | 14.2829            | 5.8868           | 300<br>301 | 90000            | 27000000<br>27270901 |         |                  |
| 12       | 144          | 1728             |                  | 2.2894           | 108<br>109 | 11664<br>11881 | 1259712<br>1295029 | 10.3923            |                  | 205<br>206 | 42025<br>42436 | 8615125<br>8741816   |                    | 5.9059           | 302        | 91204            | 27543608             | 17.3781 | 6.7092           |
| 13       | 169          | 2197             |                  | 2.3513           | 109        | 11001          | 1293029            | 10.4403            | 4.7709           | 207        | 42849          | 8869743              | 14.3875            | 5.9155           | 303<br>304 | 91809<br>92416   | 27818127<br>28094464 |         |                  |
| 14       | 196          | 2744             |                  | 2.4101           | 110        | 12100          | 1331000            | 10.4881            |                  | 208<br>209 | 43264<br>43681 | 8998912<br>9129329   |                    | 5.9250<br>5.9345 | 305        | 93025            | 28372625             | 17.4642 | 6.7313           |
| 15<br>16 | 225<br>256   | 3375<br>4096     |                  | 2.4662<br>2.5198 | 111<br>112 | 12321<br>12544 | 1367631            | 10.5357            |                  |            |                |                      |                    |                  | 306<br>307 | 93636<br>94249   | 28652616<br>28934443 |         |                  |
| 17       | 289          | 4913             | 4.1231           | 2.5713           | 113        | 12769          | 1442897            | 10.6301            |                  | 210<br>211 | 44100<br>44521 | 9261000<br>9393931   |                    | 5.9439<br>5.9533 | 308        | 94864            | 29218112             | 17.5499 | 6.7533           |
| 18       | 324          | 5832             |                  | 2.6207           | 114<br>115 | 12996<br>13225 | 1481544<br>1520875 | 10.6771            |                  | 212        | 44944          | 9528128              | 14.5602            | 5.9627           | 309        | 95481            | 29503629             | 17.5784 | 6,7606           |
| 19       | 361          | 6859             | 4.3589           | 2.6684           | 116        | 13456          | 1560896            | 10.7703            | 4.8770           | 213<br>214 | 45369<br>45796 | 9663597<br>9800344   |                    |                  | 310        | 96100            |                      | 17.6068 |                  |
| 20       | 400          | 8000             |                  | 2.7144           | 117<br>118 | 13689          | 1601613<br>1643032 | 10.8167<br>10.8628 |                  | 215        | 46225          | 9938375              | 14.6629            | 5.9907           | 311<br>312 | 96721<br>97344   | 30080231<br>30371328 |         |                  |
| 21<br>22 | 441<br>484   | 9261<br>10648    | 4.5826<br>4.6904 | 2.7589           | 119        | 14161          | 1685159            | 10.9087            |                  | 216        | 46656          | 10077696<br>10218313 |                    |                  | 313        | 97969            | 30664297             |         |                  |
| 23       | 529          | 12167            |                  | 2.8439           | 120        | 14400          | 1728000            | 10.9545            | 4.9324           | 217<br>218 | 47089<br>47524 | 10218313             |                    |                  | 314        | 98596            | 30959144<br>31255875 |         |                  |
| 24       | 576          | 13824            | 4.8990           | 2.8845           | 121        | 14641          | 1771561            |                    | 4.9461           | 219        | 47961          | 10503459             | 14.7986            | 6.0277           | 315<br>316 | 99225<br>99856   | 31255875             |         |                  |
| 25       | 625          | 15625            | 5.0000           |                  | 122<br>123 | 14884<br>15129 | 1815848<br>1860867 | 11.0454<br>11.0905 |                  | 220        | 48400          | 10648000             | 14.8324            | 6.0368           | 317        | 100489           | 31855013             | 17.8045 | 6.8185           |
| 26<br>27 | 676<br>729   | 17576<br>19683   | 5.0990<br>5.1962 | 2.9625<br>3.0000 | 124        | 15376          | 1906624            | 11.1355            | 4.9866           | 221        | 48841          | 10793861             | 14.8661            | 6.0459           | 318<br>319 | 101124           | 32157432<br>32461759 |         |                  |
| 28       | 784          | 21952            | 5.2915           |                  | 125<br>126 | 15625<br>15876 | 1953125<br>2000376 | 11.1803            |                  | 222<br>223 | 49284<br>49729 | 10941048             |                    |                  | 320        | 102400           | 32768000             |         |                  |
| 29       | 841          | 24389            | 5.3852           | 3.0723           | 127        | 16129          | 2048383            | 11.2694            | 5.0265           | 224        | 50176          | 11239424             | 14.9666            | 6.0732           | 321        | 103041           | 33076161             | 17.9165 | 6.8470           |
| 30       | 900          | 27000            | 5.4772           | 3.1072           | 128<br>129 | 16384<br>16641 | 2097152<br>2146689 |                    | 5.0397<br>5.0528 | 225<br>226 | 50625<br>51076 | 11390625<br>11543176 |                    |                  | 322<br>323 | 103684<br>104329 | 33386248<br>33698267 |         |                  |
| 31       | 961          | 29791            | 5.5678           |                  | 147        | 10041          |                    | 11.0010            | 0.0040           | 227        | 51529          | 11697083             | 15.0665            | 6.1002           | 324        | 104329           | 34012224             |         |                  |
| 32<br>33 | 1024<br>1089 | 32768<br>35937   | 5.6569<br>5.7446 | 3.1748           | 130<br>131 | 16900<br>17161 | 2197000<br>2248091 |                    | 5.0658<br>5.0788 | 228<br>229 | 51984<br>52441 | 11852352<br>12008989 | 15.0997            | 6.1091           | 325        | 105625           | 34328125             |         |                  |
| 34       | 1156         | 39304            | 5.8310           |                  | 132        | 17424          | 2299968            |                    | 5.0916           | 24.7       | 32441          |                      |                    |                  | 326<br>327 | 106276<br>106929 | 34645976<br>34965783 |         |                  |
| 35       | 1225         | 42875            | 5.9161           | 3.2711           | 133        | 17689          | 2352637<br>2406104 | 11.5326<br>11.5758 | 5.1045           | 230<br>231 | 52900<br>53361 | 12167000<br>12326391 |                    |                  | 328        | 107584           | 35287552             |         |                  |
| 36       | 1296         | 46656            | 6.0000           |                  | 134<br>135 | 17956<br>18225 | 2460375            | 11.6190            |                  | 232        | 53824          | 12487168             | 15.2315            | 6.1446           | 329        | 108241           | 35611289             | 18.1384 | 0.9034           |
| 37<br>38 | 1369<br>1444 | 50653<br>54872   | 6.0828           |                  | 136        | 18496          | 2515456            | 11.6619            |                  | 233        | 54289          | 12649337<br>12812904 |                    |                  | 330        | 108900           | 35937000             |         |                  |
| 39       | 1521         | 59319            | 6.2450           |                  | 137<br>138 | 18769<br>19044 | 2571353<br>2628072 | 11.7047            |                  | 234<br>235 | 54756<br>55225 | 12977875             |                    |                  | 331<br>332 | 109561<br>110224 | 36264691<br>36594368 |         |                  |
| 40       | 1600         | 64000            | 6.3246           | 3.4200           | 139        | 19321          | 2685619            | 11.7898            |                  | 236        | 55696          | 13144256             |                    |                  | 333        | 110889           | 36926037             | 18.2483 | 6.9313           |
| 41<br>42 | 1681<br>1764 | 68921<br>74088   | 6.4031<br>6.4807 | 3.4482<br>3.4760 | 140        | 19600          | 2744000            | 11.8322            | 5 1925           | 237<br>238 | 56169<br>56644 | 13312053<br>13481272 |                    |                  | 334<br>335 | 111556<br>112225 | 37259704<br>37595375 |         |                  |
| 43       | 1849         | 79507            | 6.5574           | 3.5034           | 141        | 19881          | 2803221            | 11.8743            | 5.2048           | 239        | 57121          | 13651919             |                    |                  | 336        | 112896           | 37933056             |         |                  |
| 44       | 1936         | 85184<br>91125   | 6.6332<br>6.7082 | 3.5303<br>3.5569 | 142        | 20164<br>20449 | 2863288<br>2924207 | 11.9164            |                  | 240        | 57600          | 13824000             |                    |                  | 337        | 113569           | 38272753<br>38614472 |         |                  |
| 45<br>46 | 2025<br>2116 | 97336            | 6.7823           | 3.5830           | 143<br>144 | 20736          | 2985984            | 12.0000            | 5.2415           | 241<br>242 | 58081<br>58564 | 13997521             |                    |                  | 338<br>339 | 114244<br>114921 | 38958219             |         |                  |
| 47       | 2209         | 103823           | 6.8557<br>6.9282 | 3.6088<br>3.6342 | 145        | 21025          | 3048625<br>3112136 |                    | 5.2536<br>5.2656 | 243        | 59049          | 14348907             | 15.5885            | 6.2403           | ***        |                  | 20204000             | 18 4301 | 6.0705           |
| 48<br>49 | 2304<br>2401 | 110592<br>117649 | 7.0000           | 3.6593           | 146<br>147 | 21316<br>21609 | 3176523            |                    | 5.2776           | 244<br>245 | 59536<br>60025 | 14526784<br>14706125 |                    |                  | 340<br>341 | 115600           | 39304000<br>39651821 |         |                  |
|          |              |                  | 7.0711           | 3.6840           | 148        | 21904          | 3241792            |                    | 5.2896           | 246        | 60516          | 14886936             | 15.6844            | 6.2658           | 342        | 116964           | 40001688             | 18.4932 | 6.9932           |
| 50<br>51 | 2500<br>2601 | 125000<br>132651 | 7.1414           | 3.7084           | 149        | 22201          | 3307949            | i                  | 5.3015           | 247<br>248 | 61009<br>61504 | 15069223<br>15252992 |                    |                  | 343<br>344 | 117649<br>118336 | 40353607             |         |                  |
| 52       | 2704         | 140608           | 7.2111           | 3,8325           | 150<br>151 | 22500<br>22801 | 3375000<br>3442951 | 12.2474<br>12.2882 |                  | 249        | 62001          | 15438249             |                    |                  | 345        | 119025           | 41063625             |         |                  |
| 53<br>54 | 2809<br>2916 | 148877<br>157464 | 7.2801<br>7.3485 | 3.7563           | 152        | 23104          | 3511808            | 12.3288            | 5.3368           | 250        | 62500          | 15625000             | 15.8114            | 6.2996           | 346<br>347 | 119716           | 41421736<br>41781923 |         |                  |
| 55       | 3025         | 166375           | 7,4162           | 3.8030           | 153        | 23409          | 3581577<br>3652264 |                    | 5.3485<br>5.3601 | 251        | 63001          | 15813251             | 15.8430            | 6.3080           | 348        | 121104           | 42144192             | 18.6548 | 7.0338           |
| 56<br>57 | 3136<br>3249 | 175616<br>185193 | 7.4333<br>7.5498 | 3.8259<br>3.8485 | 154<br>155 | 24025          | 3723875            |                    | 5.3717           | 252<br>253 | 63504<br>64009 | 16003008             |                    |                  | 349        | 121801           | 42508549             | 18.6815 | 7.0406           |
| 58       | 3364         | 195112           | 7.6158           | 3.8709           | 156        | 24336          | 3796416            |                    | 5.3832           | 254        | 64516          | 16387064             | 15.9374            | 6.3330           | 350        | 122500           | 42875000             | 18.7083 |                  |
| 59       | 3481         | 205379           | 7.6811           | 3.8930           | 157<br>158 | 24649<br>24964 | 3869893<br>3944312 |                    | 5,3947           | 255        | 65025          | 16581375             |                    |                  | 351<br>352 | 123201           | 43243551<br>43614208 |         |                  |
| 60       | 3600         | 216000           | 7.7460           | 3.9149           | 159        | 25281          | 4019679°           |                    | 5.4175           | 256<br>257 | 65536<br>66049 | 16974593             |                    |                  | 353        | 124609           | 43986977             | 18.7883 | 7.0674           |
| 61<br>62 | 3721<br>3844 | 226981<br>238328 | 7.8102<br>7.8740 | 3.9365           | 160        | 25600          | 4096000            |                    | 5.4288           | 258        | 66564          | 17173512             | 16.0624            | 6.3661           | 354<br>355 | 125316<br>126025 | 44361864<br>44738875 |         |                  |
| 63       | 3969         | 250047           | 7.9373           | 3.9791           | 161<br>162 | 25921<br>26244 | 4173281            |                    | 5.4401           |            | 67081          | 17373979             | 16.0935            | 6.3743           | 356        | 126736           | 45118016             | 18.8680 | 7.0873           |
| 64<br>65 | 4096<br>4225 | 262114<br>274625 | 8.0000<br>8.0623 | 4.0000           | 163        | 26569          | 4251528<br>4330747 |                    | 5.4626           |            | 67600          | 17576000             | 16.1245            | 6.3825           | 357<br>358 | 127449<br>128164 | 45499293<br>45882712 |         |                  |
| 66       | 4356         | 287496           | 8.1240           | 4.0412           | 164<br>165 | 26896<br>27225 | 4410944            | 12.8062            | 5.4737<br>5.4848 | 261        | 68121          | 17779581             | 16.1555            | 6.3907           | 359        | 128881           | 46268279             |         |                  |
| 67       | 4489<br>4624 | 300763<br>314432 | 8,1854<br>8,2462 | 4.0615           | 166        | 27556          | 4492125<br>4574296 |                    | 5.4848           | 262<br>263 | 68644<br>69169 | 17984728             | 16.217.            | 6.4070           | 360        | 129600           | 46656000             | 18.9733 | 7,1138           |
| 68<br>69 | 4761         | 328509           | 8.3066           | 4.1016           | 167<br>168 | 27889          | 465746.1           |                    | 5.5069           | 264        | 69696          | 18399744             | 16.248             | 6.4151           | 361        | 130321           | 47045881             | 19.0000 | 7.1204           |
| 70       | 4900         | 343000           | 8.3666           | 4.1213           | 169        | 28224<br>28561 | 4741632<br>4826809 |                    | 5.5178<br>5.5288 | 265<br>266 | 70225<br>70756 | 18609625<br>18821096 |                    |                  | 362<br>363 |                  |                      |         |                  |
| 70<br>71 | 5041         | 357911           | 8.4261           | 4.1408           |            |                | ĺ                  | 1                  |                  | 267        | 71289          | 19034163             | 16.3401            | 6.4393           | 364        | 132496           | 48228544             | 19.0788 | 7.1400           |
| 72       | 5184         | 373248           | 8.4853           | 4.1602<br>4.1793 | 170<br>171 | 28900<br>29241 | 4913000<br>5000211 |                    | 5.5397           | 268<br>269 | 71824<br>72361 | 19248832<br>19465109 |                    |                  | 365<br>366 |                  |                      |         |                  |
| 73<br>74 | 5329<br>5476 | 389017<br>405224 | 8.5440<br>8.6023 | 4.1983           | 172        | 29584          | 5088448            | 13.1149            | 5.5613           |            |                |                      |                    |                  | 367        | 134689           | 49430863             | 19.1572 | 7.1596           |
| 75       | 5625         | 421875           | 8.6603           | 4.2172           | 173<br>174 | 29929<br>30276 | 5177717<br>5268024 | 13.1529            |                  | 270<br>271 | 72900<br>73441 | 19683000             |                    |                  | 368<br>369 |                  |                      |         |                  |
| 76<br>77 | 5776<br>5929 | 438976<br>456533 | 8.7178<br>8.7750 | 4.2358           | 175        | 30625          | 5359375            | 13.2288            | 5.5934           | 272        | 73984          | 20123648             | 16.4924            | 6.4792           |            |                  |                      |         |                  |
| 78       | 6084         | 474552           | 8.8318           | 4.2727           | 176<br>177 | 30976<br>31329 | 5451776<br>5545233 |                    | 5.6041           | 273<br>274 | 74529<br>75076 | 20346417             |                    |                  | 370        |                  |                      |         |                  |
| 79       | 6241         | 493039           | 8.8882           | 4.2908           | 178        | 31684          | 5639752            | 13.3417            | 5.6252           | 275        | 75625          | 20796875             | 16.583             | 6.5030           | 371<br>372 |                  |                      |         |                  |
| 80<br>81 | 6400<br>6561 | 512000<br>531441 | 9.0000           | 4.3089           | 179        | 32041          | 5735339            |                    | 5.6357           | 276<br>277 | 76176<br>76729 | 21024576             | 16.6132            | 6.5108           | 373        | 139129           | 51895117             | 19.3132 | 7.1984           |
| 82       | 6724         | 551368           | 9.0554           | 4.3445           | 180        | 32400          | 5832000            | 13.4164            | 5.6462           | 277        | 77284          | 21253933             |                    |                  | 374<br>375 |                  |                      |         |                  |
| 83       | 6889         | 571787           | 9.1104<br>9.1652 | 4.3621<br>4.3795 | 181        | 32761          | 5929741            | 13.4536            | 5.6567           | 279        | 77841          | 21717639             |                    |                  | 376        | 141376           | 53157376             | 19.3907 | 7.2177           |
| 84<br>85 | 7056<br>7225 | 592704<br>614125 | 9.1052           | 4,3968           | 182<br>183 | 33124<br>33489 | 6028568            | 13.4907            |                  | 280        | 78400          | 21952000             |                    |                  | 377<br>378 |                  |                      |         |                  |
| 86       | 7396         | 636056           | 9.2736           | 4.4140           | 184        | 33856          | 6229504            | 13.5647            | 5.6877           | 281        | 78961<br>79524 | 22188041<br>22425768 |                    |                  | 379        |                  |                      |         |                  |
| 87<br>88 | 7569<br>7744 | 658503<br>681472 | 9.3274<br>9.3808 | 4.4310<br>4.4480 | 185<br>186 | 34225<br>34596 | 6331625<br>6434856 | 13.6015            |                  | 282<br>283 | 80089          | 22425768             |                    |                  |            | 144400           |                      |         | İ                |
| 89       | 7921         | 704969           | 9.4340           | 4,4647           | 187        | 34969          | 6539203            | 13.6748            | 5.7185           | 284        | 80656          | 22906304             | 16.8523            | 6.5731           | 380<br>381 |                  |                      |         |                  |
| 90       | 8100         | 729000           | 9.4868           | 4.4814           | 188        | 35344          | 6644672            | 13.7113            |                  | 285<br>286 | 81225<br>81796 | 23149125             |                    |                  | 382        | 145924           | 55742968             | 19.544  | 7.2558           |
| 91       | 8281         | 753571           | 9.5394           | 4.4979           | 189        | 35721          | 6751269            | 13.7477            | 3.7388           | 287        | 82369          | 23639903             | 16.941             | 6.5962           | 383<br>384 |                  |                      |         |                  |
| 92<br>93 |              | 778688<br>804357 | 9.5917<br>9.6437 | 4.5144           | 190        | 36100          | 6859000            | 13.7840            |                  | 288<br>289 | 82944<br>83521 | 23887872<br>24137569 |                    |                  | 385        | 148225           | 57066625             | 19.6214 | 7,2748           |
| 94       | 8836         | 830584           | 9.6954           | 4.5468           | 191<br>192 | 36481<br>36864 | 6967871<br>7077888 | 13.8203<br>13.8564 |                  | 209        | 1 35581        |                      |                    | 1                | 386<br>387 |                  | 57512456<br>57960603 |         |                  |
| 95       |              | 857375           | 9.7468           | 4.5629           | ,          |                |                    |                    |                  |            |                |                      |                    |                  |            |                  |                      |         |                  |

# TECHNICAL DATA & INFORMATION

# Squares/Cubes/Square Roots/Cube Roots

| No.        | Square           | Cube                   | Square<br>Root | Cubo         | -          | . Square             | Cobo                                                                                                                           | Square<br>Boot | Cobe<br>Boot     | He.                                                         | Square           | Cubo                   | Square<br>Bool | Cube<br>Root     | No.        | Square           | Cuba                   | Square<br>Boat | Cube<br>Rest |
|------------|------------------|------------------------|----------------|--------------|------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|-------------------------------------------------------------|------------------|------------------------|----------------|------------------|------------|------------------|------------------------|----------------|--------------|
| 388        | 150544           | 58411072               | 19.6977        | $\leftarrow$ | 48         | 5   235225           | 114084125                                                                                                                      | 22 0227        |                  |                                                             |                  |                        | -              |                  | 677        | 458329           | 310288733              | -              | 0.7007       |
| 389        | 151321           | 58863869               |                |              | 48         | 5 236196             | 114791256                                                                                                                      | 22.0454        | 7.8622           | 580<br>581                                                  |                  | 195112000<br>196122941 |                |                  | 678        | 459684           | 311665752              | 26.0384        | 8.7850       |
| 390        | 152100           | 59319000               | 19.7484        | 7.3061       | 48<br>48   |                      | 115501303<br>116214272                                                                                                         |                |                  | 582                                                         | 338724           | 197137368              | 24.1247        | 8.3491           | 679        | 461041           | 313046839              | 26.0576        | 8.7893       |
| 391        | 152881           | 59776471               | 19.7737        | 7.3124       | 48         |                      | 116930169                                                                                                                      |                |                  | 583<br>584                                                  | 339889<br>341056 | 198155287<br>199176704 |                |                  | 680        | 462400           | 314432000              |                |              |
| 392<br>393 | 153664<br>154449 | 60236288<br>60698457   | 19.7990        | 7.3186       | 49         | 240100               | 117649000                                                                                                                      | 22 1359        | 7 8837           | 585                                                         | 342225           | 200201625              | 24.1868        | 8.3634           | 681<br>682 | 463761<br>465124 | 315821241<br>317214568 |                |              |
| 394        | 155236           | 61162984               | 19.8494        | 7.3310       | 49         | 1 241081             | 118370771                                                                                                                      | 22.1585        | 7.8891           | 586<br>587                                                  | 343396<br>344569 | 201230056<br>202262003 |                |                  | 683<br>684 | 466489<br>467856 | 318611987<br>320013504 |                |              |
| 395<br>396 | 156025<br>156816 |                        |                |              | 49<br>49   |                      | 119095488                                                                                                                      |                |                  | 588                                                         | 345744           | 203297472              | 24.2487        | 8.3777           | 685        | 469225           | 321419125              | 26.1725        | 8.8152       |
| 397<br>398 | 157609<br>158404 | 62570773               |                |              | 49         |                      | 120553784                                                                                                                      |                |                  | 589                                                         | 346921           | 204336469              | 24.2693        | 8.3825           | 686<br>687 | 470596<br>471969 | 322828856<br>324242703 |                |              |
| 399        | 159201           | 63044792<br>63521199   |                |              | 49<br>49   |                      | 121287375<br>122023936                                                                                                         |                |                  | 590                                                         | 348100           | 205379000              |                |                  | 688        | 473344           | 325660672              | 26.2298        | 8.8280       |
| 400        | 160000           | 64000000               | 20,0000        | 7 3681       | 49         |                      | 122763473<br>123505992                                                                                                         |                |                  | 591<br>592                                                  | 349281<br>350464 | 206425071              |                |                  | 689        | 474721           | 327082769              | 26.2488        | 8.8323       |
| 401        | 160801           | 64481201               | 20.0250        | 7.3742       | 49         |                      | 124251499                                                                                                                      |                |                  | 593                                                         | 351649           | 208527857              | 24.3516        | 8.4014           | 690        | 476100           | 328509000              |                |              |
| 402<br>403 | 161604<br>162409 | 64964808<br>65450827   |                |              | 50         | 250000               | 125000000                                                                                                                      | 22 3607        | 7 9370           | 594<br>595                                                  | 352836<br>354025 | 209584584<br>210644875 |                |                  | 691<br>692 | 477481<br>478864 | 329939371<br>331373888 |                |              |
| 404        | 163216           | 65939264               | 20.0998        | 7.3925       | 50         | 1 251001             | 125751501                                                                                                                      | 22.3830        | 7.9423           | 596<br>597                                                  | 355216<br>356409 | 211708736<br>212776173 | 24.4131        | 8.4155           | 693        | 480249           | 332812557              | 26,3249        | 8.8493       |
| 405<br>406 | 164025<br>164836 | 66430125<br>66923416   |                |              | 50:<br>50: |                      | 126506008<br>127263527                                                                                                         |                |                  | 598                                                         | 357604           | 213847192              | 24.4540        | 8.4249           | 694<br>695 | 481636<br>483025 | 334255384<br>335702375 |                |              |
| 407<br>408 | 165649<br>166464 | 67419143<br>67917312   |                |              | 50-        | 4 254016             | 128024064                                                                                                                      | 22.4499        | 7.9581           | 599                                                         | 358801           | 214921799              |                |                  | 696<br>697 | 484416<br>485809 | 337153536<br>338608873 |                |              |
| 409        | 167281           | 68417929               |                |              | 50:<br>50: |                      | 128787625<br>129554216                                                                                                         |                |                  | 600<br>601                                                  | 360000<br>361201 | 216000000              |                |                  | 698        | 487204           | 340068392              |                |              |
| 410        | 168100           | 68921000               | 20.2485        | 7.4290       | 50°<br>50° |                      | 130323843<br>131096512                                                                                                         |                |                  | 602                                                         | 362404           | 218167208              | 24.5357        | 8.4437           | 699        | 488601           | 341532099              | 26.4386        | 8.8748       |
| 411        | 168921           | 69426531               | 20.2731        | 7.4350       | 50         |                      | 131872229                                                                                                                      |                |                  | 603<br>604                                                  | 363609<br>364816 | 219256227<br>220348864 |                |                  | 700        | 490000           | 343000000              |                |              |
| 412<br>413 | 169744<br>170569 | 69934528<br>70444997   |                |              | 510        | 260100               | 132651000                                                                                                                      | 22 5832        | 7 9896           | 605                                                         | 366025           | 221445125              | 24.5967        | 8.4577           | 701<br>702 | 491401<br>492804 | 344472101<br>345948408 |                |              |
| 414<br>415 | 171396<br>172225 | 70957944<br>71473375   |                |              | 51         | 261121               | 133432831                                                                                                                      | 22.6053        | 7.9948           | 606<br>607                                                  | 367236<br>368449 | 222545016<br>223648543 |                |                  | 703        | 494209           | 347428927              | 26.5141        | 8.8917       |
| 416        | 173056           |                        |                |              |            | 2 262144             | 134217728<br>135005697                                                                                                         |                |                  | 608                                                         | 369664<br>370881 | 224755712<br>225866529 |                |                  | 704<br>705 | 495616<br>497025 | 348913664<br>350402625 |                |              |
| 417<br>418 | 173889           | 72511713               | 20.4206        | 7 4710       | 51-        | 4 264196             | 135796744                                                                                                                      | 22.6716        | 8.0104           | 609                                                         | 3/0881           |                        |                |                  | 706<br>707 | 498436<br>499849 | 351895816<br>353393243 |                |              |
| 419        | 175561           | 73034632<br>73560059   |                |              | 51:        | 5 265225<br>5 266256 | 136590875<br>137388096                                                                                                         |                |                  | 610                                                         | 372100<br>373321 | 226981000<br>228099131 |                |                  | 708        | 501264           | 354894912              | 26.6083        | 8.9127       |
| 420        | 176400           | 74088000.              |                |              | 51         | 267289               | 138188413                                                                                                                      | 22.7376        | 8.0260           | 612                                                         | 374544           | 229220928              | 24.7386        | 8.4902           | 709        | 502681           | 356400829              | 26.6271        | 8.9169       |
| 421        | 177241           | 74618461               | 20.5183        | 7.4948       | 519        |                      | 138991832<br>139798359                                                                                                         |                |                  | 613<br>614                                                  | 375769<br>376996 | 230346397<br>231475544 |                |                  | 710        | 504100           | 357911000              |                |              |
| 422<br>423 | 178084<br>178929 | 75151448<br>75686967   |                |              | 520        | 270400               | 140608000                                                                                                                      | 22 8035        | 8.0415           | 615                                                         | 378225           | 232608375              | 24.7992        | 8.5040           | 711<br>712 | 505521<br>506944 | 359425431<br>360944128 |                |              |
| 424        | 179776           | 76225024               | 20.5913        | 7.5126       | 52         | 271441               | 141420761                                                                                                                      | 22.8254        | 8.0466           | 616<br>617                                                  | 379456<br>380689 | 233744896<br>234885113 | 24.8193        | 8.5086           | 713        | 508369           | 362467097              | 26.7021        | 8.9337       |
| 425<br>426 | 180625<br>181476 | 76765625<br>77308776   |                |              | 522<br>523 |                      | 142236648<br>143055667                                                                                                         |                |                  | 618                                                         | 381924           | 236029032              | 24.8596        | 8.5178           | 714<br>715 | 509796<br>511225 | 363994344<br>365525875 |                |              |
| 427        | 182329           | 77854483               | 20.6640        | 7.5302       | 524        |                      | 143877824                                                                                                                      |                |                  | 619                                                         | 383161           | 237176659              | 24.8797        | 5.5224           | 716        | 512656           | 367061696              | 26.7582        | 8.9462       |
| 428<br>429 | 183184           | 78402752<br>78953589   |                |              | 525        | 275625               | 144703125                                                                                                                      | 22.9129        | 8.0671           | 620                                                         | 384400           | 238328000<br>239483061 |                |                  | 717<br>718 | 514089<br>515524 | 368601813<br>370146232 |                |              |
| 430        | 184900           | 79507000               | 20.7364        | 7 5479       | 526<br>527 |                      | 145531576<br>146363183                                                                                                         |                |                  | 621<br>622                                                  | 385641<br>386884 | 240641848              | 24.9399        | 8.5462           | 719        | 516961           | 371694959              | 26.8142        | 8.9587       |
| 431        | 185761           | 80062991               | 20.7605        | 7.5537       | 528<br>529 |                      | 147197952<br>148035889                                                                                                         |                |                  | 623<br>624                                                  | 388129<br>389376 | 241804367<br>242970624 | 24.9600        | 8.5408<br>8.5453 | 720<br>721 | 518400<br>519841 | 373248000<br>374805361 |                |              |
| 432<br>433 | 186624<br>187489 | 80621568<br>81182737   |                |              |            |                      |                                                                                                                                |                |                  | 625                                                         | 390625           | 244140625              | 25.0000        | 8.5499           | 722        | 521284           | 376367048              | 26.8701        | 8.9711       |
| 434        | 188356           | 81746504               | 20.8327        | 7.5712       | 530<br>531 |                      | 148877000                                                                                                                      |                |                  | 626<br>627                                                  | 391876<br>393129 | 245314376<br>246491883 |                |                  | 723<br>724 | 522729<br>524176 | 377933067<br>379503424 |                |              |
| 435<br>436 | 189225<br>190096 | 82312875<br>82881856   |                |              | 532        | 283024               | 150568768                                                                                                                      | 23.0651        | 8.1028           | 628                                                         | 394384           | 247673152              | 25.0599        | 8.5635           | 725        | 525625           | 381078125              | 26.9258        | 8.9835       |
| 437        | 190969<br>191844 | 83453453<br>84027672   | 20.9045        | 7.5886       | 533<br>534 |                      | 151419437<br>152273304                                                                                                         |                |                  | 629                                                         | 395641           | 248858189              | 25.0799        | 8.5081           | 726<br>727 | 527076<br>528529 | 382657176<br>384240583 |                |              |
| 438<br>439 | 192721           | 84604519               |                |              | 535        |                      | 153130375<br>153990656                                                                                                         |                |                  | 630                                                         | 396900           | 250047000<br>251239591 |                |                  | 728        | 529984           | 385828352              | 26.9815        | 8.9959       |
| 440        | 193600           | 85184000               | 20 9762        | 7 6050       | 530<br>531 |                      | 154854153                                                                                                                      | 23.1733        | 8.1281           | 631<br>632                                                  | 398161<br>399424 | 252435968              | 25.1396        | 8.5817           | 729        | 531441           | 387420489              | 27.0000        | 9.0000       |
| 441        | 194481           | 85766121               | 21.0000        | 7.6117       | 538<br>539 |                      | 155720872<br>156590819                                                                                                         |                |                  | 633                                                         | 400689<br>401956 | 253636137<br>254840104 | 25 1595        | 8.5862<br>8.5907 | 730<br>731 | 532900<br>534361 | 389017000              |                |              |
| 442<br>443 | 195364<br>196249 |                        |                |              |            |                      |                                                                                                                                |                |                  | 635                                                         |                  | 256047875              |                |                  | 732        | 535824           | 390617891<br>392223168 |                |              |
| 444<br>445 | 197136           | 87528384               | 21.0713        | 7.6289       |            | 291600               | 157464000<br>158340421                                                                                                         |                |                  | 636<br>637                                                  | 404496<br>405769 | 257259456              |                |                  | 733<br>734 | 537289<br>538756 | 393832837<br>395446904 |                |              |
| 446        | 198025<br>198916 | 88121125<br>88716536   |                |              | 542        |                      | 159220088<br>160103007                                                                                                         |                |                  | 638                                                         | 407044           | 258474853<br>259694072 |                |                  | 735        | 540225           | 397065375              | 27.1109        | 9.0246       |
| 447<br>448 | 199809<br>200704 | 89314623<br>89915392   |                |              | 543<br>544 |                      | 160989184                                                                                                                      |                |                  | 639                                                         | 408321           | 260917119              | 25.2784        | 8.6132           | 736<br>737 | 541696<br>543169 | 398688256<br>400315553 |                |              |
| 449        | 201601           | 90518849               |                |              | 54:<br>54  |                      | 161878625<br>162771336                                                                                                         |                |                  | 640<br>641                                                  | 409600<br>410881 | 262144000              |                |                  | 738        | 544644           | 401947272              | 27.1662        | 9.0369       |
| 450        | 202500           | 91125000               | 21.2132        | 7.6631       |            | 299209               | 163667323                                                                                                                      |                |                  | 642                                                         |                  | 263374721<br>264609288 |                |                  | 739        | 340121           | 403583419              | 27.1840        | 9.0410       |
| 451        | 203401           | 91733851<br>92345408   | 21.2368        | 7.6688       |            | 300304               | 164566592<br>165469149                                                                                                         |                |                  |                                                             | 413449<br>414736 | 265847707<br>267089984 | 25.3574        | 8.6312           | 740<br>741 | 547600<br>549081 | 405224000<br>406869021 |                |              |
| 452<br>453 | 204304<br>205209 |                        |                |              |            |                      |                                                                                                                                |                | i                | 645                                                         | 416025           | 268336125              | 25.3969        | 8.6401           | 742        | 550564           | 408518488              | 27.2397        | 9.0532       |
| 454<br>455 | 206116<br>207025 | 93576664               | 21.3073        | 7.6857       |            | 302500               | 166375000<br>167284151                                                                                                         |                |                  | 646<br>647<br>648<br>649                                    | 417316<br>418609 | 269586136<br>270840023 |                |                  |            |                  | 410172407<br>411830784 |                |              |
| 456        | 207936           | 94818816               | 21.3542        | 7.6970       |            | 304704<br>3 305809   | 168196608<br>169112377                                                                                                         |                |                  | 648                                                         | 419904           | 272097792              | 25.4558        | 8.6535           | 745        | 555025           | 413493625              | 27,2947        | 9.0654       |
| 457<br>458 | 208849           |                        |                |              |            |                      |                                                                                                                                |                |                  | 049                                                         | 721201           | 273359449              |                |                  | 746<br>747 | 556516<br>558009 | 415160936<br>416832723 | 27.3313        | 9.0735       |
|            | 210681           | 96702579               |                |              | 55         | 308025<br>5 309136   | 170953875<br>171879616                                                                                                         | 23.5584        | 8.2180           | 650<br>651<br>652<br>653<br>654<br>655<br>656<br>657<br>658 | 422500<br>423801 | 274625000<br>275894451 |                |                  | 748<br>749 | 559504           | 418508992<br>420189749 | 27.3496        | 9.0775       |
| 460        | 211600           |                        |                |              | 55         | 310249               | 172808693                                                                                                                      | 23.6008        | 8.2278           | 652                                                         | 425104           | 277167808<br>278445077 |                |                  |            |                  |                        |                |              |
| 461        | 212521<br>213444 | 97972181               | 21.4709        | 7.7250       | 55<br>55   | 311364               | 173741112                                                                                                                      | 23.6220        | 8.2327           | 653<br>654                                                  | 426409<br>427716 | 278445077<br>279726264 | 25.5539        | 8.6757           | 750<br>751 |                  | 421875000<br>423564751 |                |              |
| 463        | 214369           | 99252847               | 21.5174        | 7.7362       | 560        | 313600               | 175616000                                                                                                                      | 23.6643        | 8.2426           | 655                                                         | 429025           | 281011375              | 25.5930        | 8.6845           | 752        | 565504           | 425259008              | 27,4226        | 9.0937       |
|            | 215296           | 99897344<br>100544625  |                |              | 561<br>561 | 314721               | 176558481                                                                                                                      | 23.6854        | 8.2475           | 657                                                         | 430336<br>431649 | 282300416<br>283593393 |                |                  |            |                  | 426957777<br>428661064 |                |              |
| 466        | 217156           | 101194696              | 21.5870        | 7.7529       | 563        | 316969               | 178453547                                                                                                                      | 23.7276        | 8.2573           | 658                                                         | 432964<br>434281 | 284890312              | 25.6515        | 8.6978           | 755        | 570025           | 430368875              | 27.4773        | 9.1057       |
|            |                  | 101847563              |                |              | 564<br>565 | 318096               | 179406144                                                                                                                      | 23.7487        | 8.2621           | 039                                                         | 737201           | 286191179              | 25.0710        | 8.7022           |            |                  | 432081216<br>433798093 |                |              |
|            |                  | 103161709              |                |              | 566        | 320356               | 175516000<br>176558481<br>177504328<br>178453547<br>179406144<br>180362125<br>181321496<br>182284263<br>183250432<br>184220009 | 23.7908        | 8.2719           | 660                                                         | 435600           | 287496000<br>288804781 |                |                  | 758        | 574564           | 435519512<br>437245479 | 27.5318        | 9.1178       |
|            |                  | 103823000              |                |              | 567<br>568 | 321489<br>322624     | 182284263<br>183250432                                                                                                         | 23.8118        | 8.2768<br>8.2816 | 662                                                         | 438244           | 290117528              | 25.7294        | 8.7154           |            |                  |                        |                |              |
| 471<br>472 | 221841 222784    | 104487111<br>105154048 | 21.7025        | 7.7805       | 569        | 323761               | 184220009                                                                                                                      | 23.8537        | 8.2865           | 663<br>664                                                  | 439569<br>440896 | 291434247<br>292754944 |                |                  | 760<br>761 |                  | 438976000<br>440711081 |                |              |
| 473        | 223729           | 105823817              | 21.7486        | 7.7915       | 570        | 324900               | 185193000                                                                                                                      | 23.8747        | 8.2913           | 665                                                         | 442225           | 294079625              | 25.7876        | 8.7285           | 762        | 580644           | 442450728              | 27.6043        | 9.1338       |
|            |                  | 106496424<br>107171875 |                |              | 571        | 326041               | 186169411                                                                                                                      | 23.8956        | 8.2962           | 666<br>667                                                  | 443556<br>444889 | 295408296<br>296740963 |                |                  | 764        | 582169<br>583696 | 445943744              |                |              |
| 476        | 226576           | 107850176<br>108531333 | 21.8174        | 7.8079       | 573        | 328329               | 188132517                                                                                                                      | 23.9374        | 8.3059           | 660<br>661<br>662<br>663<br>664<br>665<br>666<br>667<br>668 | 446224           | 298077632              | 25.8457        | 8.7416           | 765        |                  | 447697125              | 27.6586        | 9.1458       |
| 478        | 228484           | 109215352              | 21.8632        | 7.8188       | 574<br>579 | 329476<br>330625     | 189119224<br>190109375                                                                                                         | 23.9583        | 8.3107           | 669                                                         | 447561           | 299418309              | 25.8650        | 8.7460           | 767        | 588289           | 449455096<br>451217663 | 27.6948        | 9.1537       |
| 479        | 229441           | 109902239              | 21.8861        | 7.8243       | 576        | 331776               | 185193000<br>186169411<br>187149248<br>188132517<br>189119224<br>190109375                                                     | 24.0000        | 8.3203           | 670                                                         |                  | 300763000              |                |                  |            |                  |                        | 27.7128        | 9.1577       |
|            | 230400           | 110592000              |                |              | 578        | 332929               | 192100033<br>193100552                                                                                                         | 24.0208        | 0.3231           | 672                                                         | 451584           | 302111711<br>303464448 |                |                  |            |                  |                        |                |              |
|            | 231361<br>232324 | 111284641<br>111980168 |                |              | 579        | 335241               | 194104539                                                                                                                      | 24.0624        | 8.3348           |                                                             | 452929           | 304821217<br>306182024 | 25.9422        | 8.7634           |            | 592900<br>594441 | 456533000<br>458314011 |                |              |
| 483        | 233289           | 112678587              | 21.9773        | 7.8460       |            |                      |                                                                                                                                |                |                  | 675                                                         | 455625           | 307546875              | 25.9808        | 8.7721           | 772        | 595984           | 460099648              | 27.7849        | 9.1736       |
| 484        | 239230           | 113379904              | 22.0000        | 7.8514       |            |                      |                                                                                                                                |                |                  | 676                                                         | 456976           | 308915776              | 26.0000        | 8.7764           | //3        | 34/324           | 461889917              | 47.8029        | у.1775       |

TECHNICAL DATA & INFORMATION

# Squares/Cubes/Square Roots/Cube Roots

| No.        | Square | Cubo                   | Square<br>East | Cubo<br>Boot                            | No         | Square   | Cubu                   | Square<br>Boat | Cube<br>Reel     |
|------------|--------|------------------------|----------------|-----------------------------------------|------------|----------|------------------------|----------------|------------------|
| 774        | 599076 | 463684824              | 27.8209        | 9 1815                                  | 831        | 690561   | 573856191              | 28.8271        | 9.4016           |
| 775        | 600625 | 465484375              | 27.8388        |                                         | 832        | 692224   | 575930368              | 28.8444        | 9.4053           |
| 776        | 602176 | 467288576              | 27.8568        |                                         | 833        | 693889   | 578009537              | 28.8617        | 9.4091           |
| 777        | 603729 | 469097433              | 27.8747        |                                         | 834        | 695556   | 580093704              | 28.8791        | 9.4129           |
| 778        | 605284 | 470910952              | 27.8927        | 9.1973                                  | 835        | 697225   | 582182875              | 28.8964        | 9.4166           |
| 779        | 606841 | 472729139              | 27.9106        |                                         | 836        | 698896   | 584277056              | 28.9137        | 9.4204           |
| 113        | 000071 | 4747433                | 27.3100        | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | 837        | 700569   | 586376253              | 28.9310        | 9.4241           |
| 780        | 608400 | 474552000              | 27.9285        | 9.2052                                  | 8.8        | 702244   | 588480472              | 28.9482        | 9.4279           |
| 781        | 609961 | 476379541              | 27.9464        | 9.2091                                  | 839        | 703921   | 590589719              | 28.9655        | 9.4316           |
| 782        | 611524 | 478211768              | 27.9643        | 9.2130                                  |            |          |                        |                |                  |
| 783        | 613089 | 480048687              | 27.9821        | 9.2170                                  | 840        | 705600   | 592704000              | 28.9828        |                  |
| 784        | 614656 | 481890304              | 28.0000        | 9.2209                                  | 841        | 707281   | 594823321              | 29.0000        | 9.4391           |
| 785        | 616225 | 483736625              | 28.0179        | 9.2248                                  | 842        | 708964   | 596947688              | 29.0172        | 9.4429           |
| 786        | 617796 | 485587656              | 28.0357        | 9.2287                                  | 843        | 710649   | 599077107              | 29.0345        | 9.4466           |
| 787        | 619369 | 487443403              | 28.0535        | 9.2326                                  | 844        | 712336   | 601211584              | 29.0517        | 9.4503           |
| 788        | 620944 | 489303872              | 28.0713        | 9.2365                                  | 845        | 714025   | 603351125              | 29.0689        | 9.4541           |
| 789        | 622521 | 491169069              | 28.0891        | 9.2404                                  | 846        | 715716   | 605495736              | 29.0861        | 9.4578<br>9.4615 |
|            |        |                        |                |                                         | 847        | 717409   | 607645423              | 29.1033        | 9.4652           |
| 790        | 624100 | 493039000              | 28.1069        | 9.2443                                  | 848        | 719104   | 609800192<br>611960049 | 29.1204        | 9.4690           |
| 791        | 625681 | 494913671              | 28.1247        | 9.2482                                  | 849        | 720801   | 011900049              | 29.1370        | 9.4090           |
| 792        | 627264 | 496793088              | 28,1425        | 9.2521                                  | 850        | 722500   | 614125000              | 29.1548        | 9.4727           |
| 793        | 528849 | 498677257              | 28.1603        | 9.2560                                  | 851        | 724201   | 616295051              | 29.1719        |                  |
| 794        | 630436 | 500566184              | 28.1780        | 9.2599                                  | 852        | 725904   | 618470208              | 29,1890        | 9 4801           |
| 795        | 632025 | 502459875              | 28.1957        | 9.2638                                  | 853        | 727609   | 620650477              | 29.2062        | 9,4838           |
| 796        | 633616 | 504358336              | 28.2135        |                                         | 854        |          | 622835864              |                |                  |
| 797        | 635209 | 506261573<br>508169592 |                |                                         | 855        |          | 625026375              | 29.2404        | 9.4912           |
| 798        | 636804 | 510082399              |                | 9.2793                                  | 856        | 732736   | 627222016              |                | 9.4949           |
| 799        | 638401 | 310002399              | 20.20011       | 9.2793                                  | 857        | 734449   | 629422793              |                | 9.4986           |
| 800        | 640000 | 512000000              | 28.2843        | 9.2832                                  | 858        | 736164   | 631628712              | 29.2916        | 9.5023           |
| 801        | 641601 | 513922401              |                | 9.2870                                  | 859        | 737881   | 633839779              |                | 9.5060           |
| 802        | 643204 | 515849608              | 28.3196        | 9.2909                                  |            |          |                        | ]              | 1                |
| 803        | 644809 | 517781627              | 28.3373        | 9,2948                                  | 860        | 739600   | 636056000              | 29.3258        | 9.5097           |
| 804        | 646416 | 519718464              | 28.3549        | 9.2986                                  | 861        | 741321   | 638277381              | 29.3428        | 9.5134           |
| 805        |        | 521660125              |                |                                         | 862        | 743044   | 640503928              |                | 9.5171           |
| 806        |        | 523606616              |                |                                         | 863        | 744769   | 642735647              |                | 9.5207           |
| 807        |        | 525557943              |                |                                         | 864        |          | 644972544              |                |                  |
| 808        |        | 527514112              |                |                                         | 865        |          | 647214625              |                | 9.5281           |
| 809        | 654481 | 529475129              | 28.4429        | 9.3179                                  | 866        |          | 649461896              |                |                  |
|            |        | 1                      |                |                                         | 867        |          | 651714363              |                |                  |
| 810        |        | 531441000              |                |                                         | 868        |          | 653972032              |                |                  |
| 811        |        | 533411791<br>535387328 |                |                                         | 869        | 75\$161  | 656234909              | 29.4788        | 9.5427           |
| 812        |        | 535387328              |                |                                         | 870        | 756900   | 658503000              | 29.4958        | 9.5464           |
| 813<br>814 |        | 53/30//9/              |                |                                         | 870        |          | 660776311              |                |                  |
| 815        |        | 541343375              |                |                                         | 872        |          | 663054848              |                |                  |
| 816        |        | 543338496              | 1              |                                         | 873        |          | 665338617              |                |                  |
| 817        |        |                        |                |                                         | 874        |          | 667627624              |                |                  |
| 818        |        | 547343432              |                |                                         | 875        |          | 669921875              |                |                  |
| 819        |        |                        |                |                                         | 876        |          | 672221376              |                |                  |
|            |        |                        |                |                                         | 877        |          | 574526133              |                |                  |
| 820        | 672400 | 551368000              | 28.6356        | 9.3599                                  | 878        | 770884   | 676836152              | 29.6311        | 9.5750           |
| 821        | 674041 | 553387661              |                |                                         | 879        | 772641   | 679151439              | 29.6479        | 9.5792           |
| 822        |        |                        | 28.670         | 9.3675                                  |            | !        |                        |                |                  |
| 823        | 677329 | 557441767              |                |                                         | 880        |          |                        |                |                  |
| 824        |        |                        |                |                                         | 881        |          | 683797841              |                |                  |
| 825        |        |                        |                |                                         | 882        |          | 686128968              |                |                  |
| 826        |        |                        |                |                                         | 883<br>884 |          | 688465387              |                |                  |
| 827        |        |                        |                |                                         | 885        |          | 693154125              |                |                  |
| 828        |        |                        |                |                                         |            |          | 695506456              |                |                  |
| 829        |        |                        |                |                                         | 007        |          |                        |                |                  |
| 830        | 688900 | 571787000              | 28.809         | 7 9.3978                                | 007        | 1 100109 | , 55700-103            |                | , 2.000          |

| No         | Square           | Cube                   | Square<br>Real     | Cube<br>Boot |
|------------|------------------|------------------------|--------------------|--------------|
| 888        | 788544           | 700227072              | 29.7993            | 9.6118       |
| 889        | 790321           | 702595369              | 29.8161            | 9.6154       |
|            |                  | 704969000              | 29.8329            | 9.6190       |
| 890<br>891 | 792100<br>793881 | 704969000              | 29.8329            | 9.6190       |
| 892        | 795664           | 709732288              | 29.8664            | 9.6262       |
| 893        | 797449           | 712121957              | 29.8831            | 9.6298       |
| 894        | 799236           | 714516984              | 29 8998            | 9.6334       |
| 895        | 801025           | 716917375              | 29.9166            | 9.6370       |
| 896        | 802816           | 719323136              | 29 9333            | 9.6406       |
| 897        | 804609           | 721734273              | 29 9500            | 9.6442       |
| 898        | 806404           | 724150792              | 29 9666            | 9.6477       |
| 899        | 808201           | 726572699              | 29 9833            | 9.6513       |
| 900        | 810000           | 729000000              | 30 0000            | 9.6549       |
| 901        | 811801           | 731432701              | 30 00 67           | 9.6585       |
| 902        | 813604           | 733870808              | 30.0333            | 9.6620       |
| 903        | 815409           | 736314327              | 30.0500            | 9.6656       |
| 904        | 817216           | 738763264              | 30 0666            | 9 6692       |
| 905        | 819025           | 741217625              | 30 0832            | 9.6727       |
| 906        | 820836           | 743677416              | 30 0998            | 9.6763       |
| 907        | 822649           | 746142643              | 30 1164            | 9.6799       |
| 908        | 824464           | 748613312              | 30.1330            | 9.6834       |
| 909        | 826281           | 751089429              | 30.1496            | 9.6870       |
| 910        | 828100           | 753571000              | 30.1662            | 9.6905       |
| 911        | 829921           | 756058031              | 30.1828            | 9.6941       |
| 912        | 831744           | 758550528              | 30.1993            | 9.6976       |
| 913        | 833569           | 761048497              | 30.2159            | 9.7012       |
| 914        | 835396           | 763551944<br>766060875 | 30.2324<br>30.2490 | 9.7017       |
| 915        | 837225           | 768575296              | 30.2490            | 9.7118       |
| 916<br>917 | 839056<br>840889 | 771095213              | 30.2820            | 9.7153       |
| 918        | 842724           | 773620632              | 30.2985            | 9.7188       |
| 919        | 844561           | 776151559              |                    | 9.7224       |
|            |                  | 778688000              | 30.3315            | 9.7259       |
| 920<br>921 | 846400<br>848241 | 781229961              | 30.3480            | 9.7294       |
| 921        | 850084           | 783777448              | 30.3645            | 9.7329       |
| 923        | 851929           | 786330467              | 30.3809            |              |
| 924        | 853776           | 788889024              | 30.3974            | 9.7400       |
| 925        | 855625           | 791453125              | 30.4138            | 9.743        |
| 926        | 857476           | 794022776              | 30.4302            | 9.747        |
| 927        | 859329           | 796597983              |                    | 9.750        |
| 928        | 861184           | 799178752              |                    |              |
| 929        | 863041           | 801765089              | 30.4795            | 9.757        |
| 930        | 864900           | 804357000              | 30.4959            | 9.761        |
| 931        | 866761           | 806954491              |                    |              |
| 932        | 868624           | 809557568              |                    | 9.768        |
| 933        | 870489           | 812166237              | 30.5450            |              |
| 934        | 872356           | 814780504              | 30.5614            | 9.775        |
| 935        | 874225           | 817400375              |                    |              |
| 936        | 876096           | 820025856              |                    |              |
| 937        | 877969           | 822656953              |                    |              |
| 938        | 879844           | 825293672              |                    |              |
| 939        | 881721           | 827936019              | 30.6431            | 9.792        |
|            |                  |                        | 1                  | .            |
| 940        | 883600           | 830584000              |                    |              |
| 941        | 885481           | 83323762               |                    |              |
| 942        | 887364           | 835896888              |                    |              |
| 943        | 889249           | 83856180               | 30.7083            | 9,806        |

|            | . 1    |           | Square  | Cube   |
|------------|--------|-----------|---------|--------|
| No         | Square | Cube      | Boot    | Post   |
| 1          |        |           |         | 0.0003 |
| 944        | 891136 | 841232384 | 30.7246 | 9.8097 |
| 945        | 893025 | 843908625 | 30.7409 | 9.8132 |
| 946        | 894916 | 846590536 | 30.7571 | 9.8167 |
| 947        | 896809 | 849278123 | 30.7734 | 9.8201 |
| 948        | 898704 | 851971392 | 30.7896 | 9.8236 |
| 949        | 900601 | 854670349 | 30.8058 | 9.8270 |
| 950        | 902500 | 857375000 | 30.8221 | 9.8305 |
| 951        | 904401 | 860085351 | 30.8383 | 9.8339 |
| 952        | 906304 | 862801408 | 30.8545 | 9.8374 |
| 953        | 908209 | 865523177 | 30.8707 | 9.8408 |
| 954        | 910116 | 868250664 | 30.8869 | 9.8443 |
| 955        | 912025 | 870983875 | 30.9031 | 9.8477 |
| 956        | 913936 | 873722816 | 30.9192 | 9.8511 |
| 957        | 915849 | 876467493 | 30.9354 | 9.8546 |
| 958        | 917764 | 879217912 | 30.9516 | 9.8580 |
| 959        | 919681 | 881974079 | 30.9677 | 9.8614 |
| 960        | 921600 | 884736000 | 30.9839 | 9.8648 |
| 961        | 923521 | 887503681 | 31.0000 | 9.8683 |
| 962        | 925444 | 890277128 | 31.0161 | 9.8717 |
| 963        | 927369 | 893056347 | 31.0322 | 9.8751 |
| 964        | 929296 | 895841344 | 31.0483 | 9.8785 |
| 965        | 931225 | 898632125 | 31.0644 | 9.8819 |
| 966        | 933156 | 901428696 | 31.0805 | 9.8854 |
| 967        | 935089 | 904231063 | 31.0966 | 9.8888 |
| 968        | 937024 | 907039232 | 31.1127 | 9.8922 |
| 969        | 938961 | 909853209 | 31.1288 | 9.8956 |
| 970        | 940900 | 912673000 | 31,1448 | 9.8990 |
| 971        | 942841 | 915498611 | 31.1609 | 9.9024 |
| 972        | 944784 | 918330048 | 31.1769 | 9.9058 |
| 973        | 946729 | 921167317 | 31.1929 | 9.9092 |
| 974        | 948676 | 924010424 | 31.2090 | 9.9126 |
| 975        | 950625 | 926859375 | 31.2250 | 9.9160 |
| 976        | 952576 | 929714176 | 31.2410 | 9.9194 |
| 977        | 954529 | 932574833 | 31.2570 | 9.9227 |
| 978        | 956484 | 935441352 | 31.2730 | 9.9261 |
| 979        | 958441 | 938313739 | 31.2890 | 9.9295 |
| 980        | 960400 | 941192000 | 31,3050 | 9.9329 |
| 981        | 962361 | 944076141 | 31.3209 | 9.9363 |
| 982        | 964324 | 946966168 | 31.3369 | 9.9396 |
| 983        | 966289 | 949862087 | 31.3528 | 9.9430 |
| 984        | 968256 | 952763904 | 31.3688 | 9.9464 |
| 985        | 970225 | 955671625 | 31.3847 | 9,9497 |
| 986        | 972196 | 958585256 | 31.4006 | 9.9531 |
| 987        | 974169 | 961504803 | 31.4166 | 9.9565 |
| 988        | 976144 | 964430272 | 31.4325 | 9.9598 |
| 989        | 978121 | 967361669 | 31,4484 | 9.9632 |
| 990        | 980100 | 970299000 | 31.4643 | 9.9666 |
| 991        | 982081 | 973242271 | 31.4802 | 9,9699 |
| 992        | 984064 | 976191488 | 31.4960 | 9.9733 |
| 993        | 986049 | 979146657 | 31.5119 | 9.9766 |
| 994        | 988036 | 982107784 | 31.5278 | 9.9800 |
| 995        | 990025 | 985074875 | 31.5436 | 9.9833 |
|            | 992016 | 988047936 | 31.5595 | 9.9860 |
| 996        |        |           |         |        |
| 996<br>997 | 994009 | 991026973 | 31.5753 | 9.990  |
|            |        |           |         | 9.9900 |

# TECHNICAL DATA & INFORMATION

# Prefixes & Symbols For Powers of TEN

| Multiples and<br>Submultiples<br>(Powers of Ten) | Prefixes | Symbols | 10-1  | deci  | d                                   |
|--------------------------------------------------|----------|---------|-------|-------|-------------------------------------|
|                                                  |          |         | 10    | deci  | u                                   |
| 10 12                                            | tera     | Т       | 10-2  | centi | c                                   |
| 109                                              | giga     | G       | 10-3  | milli | m                                   |
| 106                                              | mega     | М       | 10-6  | micro | μ                                   |
| 104                                              | myria    | Ма      | 10-9  | nano  | n                                   |
| 103                                              | kilo     | k       | 10-12 | pico  | p (formerly micromicro – $\mu\mu$ ) |
| 102                                              | hecto    | h       | 10-15 | femto | f                                   |
| 10                                               | deka     | da      | 10-18 | atto  | а                                   |

# **CLASSIFICATIONS OF EMISSIONS**

| Symbol     | Type of Transmission                                                   | P3f   | Telephon            | y. Pha        | ase (or position)                     |
|------------|------------------------------------------------------------------------|-------|---------------------|---------------|---------------------------------------|
| a. Ampl    | litude Modulated                                                       | P9    | modulat<br>Telephon | ed.<br>y. Pha | ase (or position)                     |
| A0         | Continuous wave, no modulation.                                        |       | modulat             | ed. Co        | omposite transmis-                    |
| Al         | Continuous-wave telegraphy. On-off                                     |       |                     | d case        | s not covered by                      |
|            | keying.                                                                |       | above.              |               |                                       |
| A2         | Telegraphy by keying of a modulating                                   |       |                     |               |                                       |
|            | audio frequency. Also by keying of                                     |       |                     |               |                                       |
|            | modulated emission.                                                    | d. Cl | assification o      | Time          | -Division Multiplex                   |
| A3         | Telephony. Double sideband, full carrier.                              |       | stems               | - I line      | -Division Multiplex                   |
| A3a        | Telephony. Single sideband, reduced                                    |       |                     |               | Action of Modu-                       |
|            | carrier.                                                               | Class | Name                | Code          | lating Signal                         |
| A3b        | Telephony. Two independent side-                                       |       |                     |               | July Carlotte                         |
|            | bands reduced carrier.                                                 | Α     | Pulse-time          | PTM           | Varies some char-                     |
| A4         | Facsimile.                                                             |       | modulation          |               | acteristic of pulse                   |
| A5         | Television.                                                            |       |                     |               | with respect to time.                 |
| A9         | Composite transmissions and cases                                      |       |                     |               |                                       |
|            | not covered by above.                                                  |       | Pulse-              | PPM           | Varies position                       |
| A9a        | Composite transmissions, reduced                                       |       | position            |               | (phase) of pulse on                   |
|            | carrier.                                                               |       | modulation          |               | time base.                            |
|            |                                                                        |       |                     |               |                                       |
|            |                                                                        |       | Pulse-              | PDM           | Varies width of                       |
| b. Frequ   | uency (or Phase) Modulated                                             |       | duration            |               | pulse (also called                    |
|            |                                                                        |       | modulation          |               | PWM, or Pulse-                        |
| F0         | Absence of modulation.                                                 |       |                     |               | Width Modulation).                    |
| Fl         | Telegraphy by frequency shift keying.                                  |       |                     |               |                                       |
|            | No modulation.                                                         |       | Pulse-shape         |               | Varies shape of                       |
| F2         | Telegraphy by keying of a modulating                                   |       | modulation          |               | pulse.                                |
|            | audio frequency. Also by keying of                                     |       | Deller              | DEM           | **                                    |
| F 3        | modulated emission.                                                    |       | Pulse-<br>frequency | PFM           | Varies pulse recur-                   |
| F3<br>F4   | Telephony.                                                             |       | modulation          |               | rence frequency.                      |
| F 4<br>F 5 | Facsimile.                                                             |       | modulation          |               |                                       |
|            | Television.                                                            | В     | Pulse-              | DAM           | Varios amplituda of                   |
| F9         | Composite transmissions and cases                                      | D     | amplitude           | FAM           | Varies amplitude of pulse—consists of |
|            | not covered by above.                                                  |       | modulation          |               | two types: one using                  |
|            |                                                                        |       | modulation          |               | unipolar pulses, the                  |
| a Dulas    | Modulated                                                              |       |                     |               | other using bipolar                   |
| c. Pulse   | Modulated                                                              |       |                     |               | pulses.                               |
| P0         | Absence of modulation intended to                                      |       |                     |               |                                       |
| FO         |                                                                        | С     | Pulse-code          | PCM           | Varies the makeup                     |
| Pl         | carry information (such as radar).                                     | _     | modulation          |               | of a series of pulses                 |
| PI         | Telegraphy. No modulating audio                                        |       |                     |               | and spaces. Indi-                     |
| P2d        | frequency.                                                             |       |                     |               | vidual systems are                    |
| PZU        | Telegraphy by keying an audio fre-                                     |       |                     |               | classified as follows:                |
|            | quency modulating the pulse in am-                                     |       |                     |               | Binary-pulse and                      |
| P2e        | plitude. Telegraphy by keying an audio fre-                            |       |                     |               | spaces, or positive                   |
| 126        |                                                                        |       |                     |               | and negative pulses.                  |
|            | quency modulating the width of the pulse.                              |       |                     |               | Ternary-positive                      |
| P2f        | •                                                                      |       |                     |               | pulses, negative                      |
|            | Telegraphy by keying an audio frequency modulating the phase (or posi- |       |                     |               | pulses, and spaces.                   |
|            |                                                                        |       |                     |               | N-ary-more com-                       |
| P3d        | tion) of the pulse.                                                    |       |                     |               | plex combinations of                  |
| P3a<br>P3e | Telephony, Width modulated.                                            |       |                     |               | pulses and spaces.                    |
| 2.26       | Telephony. Width modulated.                                            |       |                     |               |                                       |

# Sound Column Technical Aids

# Sound Column

The sound column is a unitized high-fidelity speaker system for commercial sound and public address applications. The speaker system components (direct-radiator cone speakers) are positioned one above the other, and in phase, to provide a broad horizontal and a narrow vertical dispersion pattern. It has the effect of a theoretical single, tall and elongated cone speaker positioned in a vertical plane. The advantage of this design is a resultant unusual sound pattern which reduces acoustic feedback and reverberation because floor and ceiling reflections are essentially eliminated. With such a restricted vertical dispersion pattern, the sound column is positioned and beamed to areas ONLY where the sound is needed. A second, and most important advantage, is the almost unlimited freedom in locating and placing microphones without resulting feedback. However, all sound columns are not alike, and therefore a so-called sound column with a vertical tier of cone speakers will not necessarily provide these advantages. University's designers and engineers, recognizing this, developed the exclusive Uniline\* to fully realize the benefits of this principle of speaker configuration. This was done with two highly significant proprietary Uniline characteristics:

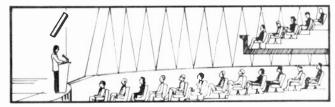
### 1. High Power-Handling Capacity

To compensate for the lower efficiency of cone speakers used in sound columns (the price you pay for extended frequency high-fidelity reproduction), University developed heavy-duty, high-power-handling, direct-radiator speakers especially for Uniline.

### 2. Acoustic Tapering

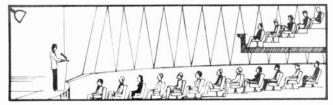
A University exclusive — the most perfect method yet devised to prevent excessive high-frequency beam effects and assure a balanced dispersion for uniform sound throughout the entire listening area. Acoustic tapering is accomplished by use of a crossover network which allows only the two center speakers, which have tweeters, to reproduce the high frequencies. This effectively shortens the column at the higher frequencies, thereby spreading these frequencies into a dispersion pattern more closely approximating the pattern of the low and mid frequencies.

\*Uniline is a registered trademark of University Sound



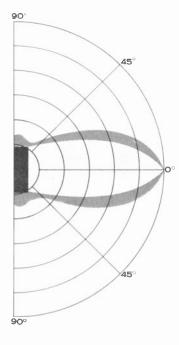
### UNILINE SPEAKER CONTOUR

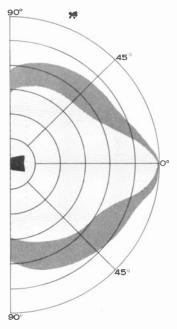
The above diagram shows the constant loudness contour for a Uniline sound column. With the Uniline column, exclusive "Acoustic Tapering" and the inherent distribution properties of the sound column combine to produce a uniform sound level for all portions of the auditorium, from front to back. No sound is lost, no portion of the audience is "blasted", no one strains to hear.



### CONVENTIONAL SPEAKER CONTOUR

The above diagram shows the constant loudness contour for a conventional speaker at representative mid-range frequencies, where the high-audibility P.A. "punch" is concentrated. With conventional speakers, the sound level falls off rapidly, "blasting" the audience nearest the speakers and leaving the rest of the audience straining to hear.





Sound Column Vertical Distribution Pattern. The diagram on left shows the typical sound distribution pattern of a University Uniline sound column. The darkest color area in the diagram indicates the maximum sound pressure levels. The lightest color area indicates the lowest sound pressure levels. This diagram also indicates areas of highfrequency response. Due to University's exclusive "Acoustic Tapering", the high-frequency response falls off in direct ratio to the shade of the diagram; i.e., darker areas indicate areas of maximum high-frequency response, lighter areas indicate progressively attenuated high-frequency response. Acoustic tapering causes the effective length of the sound column to be reduced at high frequencies, so that the proper amount of vertical dispersion is maintained at all frequencies.

Sound Column Horizontal Distribution Pattern. The diagram on left shows the typical horizontal sound distribution pattern of a University Uniline sound column. The darkest color area in the diagram indicates the maximum sound pressure levels. The lightest color area indicates the lowest sound pressure levels. This diagram also indicates areas of high-frequency response. The highfrequency response falls off in direct ratio to the shade of the diagram; i.e., darker areas indicate areas of maximum high-frequency response, lighter areas indicate progressively attenuated high-frequency

# **Technical Aids**

### SELECTING THE PROPER LOUDSPEAKER SYSTEM

This is not too difficult if a problem is approached in logical, step-by-step order. The Speaker System Design Chart will enable you to estimate the approximate power required for a given location, considering noise level, reverberation, speaker efficiency, and program material. Treat individual rooms, alcoves, partitioned areas, and any other areas cut off acoustically from sound sources as separate problems. Based upon initial cost, convenience of installation and servicing, disturbance considerations, if any, and architectural dictates (reverberation, sound absorption, etc.), it is then decided whether a "high level" or "low level" speaker system shall be laid out for the specific location in question. If high level, the larger trumpets and radial

### Selecting the Proper Loudspeaker System Continued

projectors with heavy duty driver units should be used, either singly at key points, or in a cluster at a central location. If a low level system is decided upon, the smaller paging and intercom type speakers will serve admirably. In either case, consideration should be given to the use of Uniline sound columns to take advantage of their unique properties. Knowing the power required to cover a given location, and the sound dispersion characteristics of the speakers being considered, the most suitable speaker and the number to be used is easily determined. Bear in mind that sound pressure is reduced approximately 6 dB below the previous level, each time the distance from the speaker is doubled. By laying out the speaker placement on a floor plan and tracing dispersion angles, the power at which each speaker must be operated, in order to cover the extremes, at a desired minimum level, can be estimated. Where music is involved, speakers capable of lower cutoff frequencies should be used to retain fidelity, irrespective of power considerations. On the other hand, where reverberation is particularly severe, fidelity may have to be compromised at the expense of the low-frequency response.

### SELECTING THE DRIVER

With the variety of University driver units available, many with valuable exclusive features, full consideration can be given to overall response, required sound pressure, versatility and cost. Page 3 describes the individual features of each model driver. Once the differences between drivers are understood, it is easy to see how various combinations provide tremendous flexibility.

Sound system installations — whether involving only a single amplifier delivering its entire power output to a single loud-speaker, or a group of amplifiers feeding varying amounts of power to numerous speakers — depend primarily for satisfactory operation on an **efficient** transfer of power from the amplifier to the speaker. The wires connecting an amplifier to its respective speakers are known as speaker transmission lines. In planning interconnection of loudspeakers, it must be determined if these lines are to be of low impedance or constant voltage for proper match to the amplifier output transformer.

### **LOW IMPEDANCE**

When the transmission lines are connected **directly** to one or more speaker voice coils, they are referred to as low-impedance lines. In general, where the distance between the amplifier and speakers is less than 200 feet, lines run at voice coil impedances are satisfactory. Figure 1 below indicates maximum practical distances.

Figure 1

Maximum Length of Line for 15% Power Loss
(Low Impedance Lines)

| Wire Size | Load Impedance |        |         |  |  |
|-----------|----------------|--------|---------|--|--|
| (B & S)   | 4 Ohms         | 8 Ohms | 16 Ohms |  |  |
| 14        | 125′           | 250'   | 450'    |  |  |
| 16        | 75'            | 150′   | 300′    |  |  |
| 18        | 50'            | 100′   | 200′    |  |  |
| 20        | 25'            | 50'    | 100′    |  |  |

### **CONSTANT VOLTAGE**

This method is based on the "Constant Voltage" amplifier, and simplifies to a great degree the computation of the proper transformer taps when varying sound levels are required. It permits the addition of speakers to an existing system, without recalculation of the load and source impedances. As long as the total power consumed by the loudspeakers is less than or equal to the amplifier power rating, a favorable load condition will always exist. It also permits a loudspeaker to be connected across a transmission line up to the capacity of that circuit with the same ease that electric lights are loaded on a power line. To use this method requires that a power amplifier incorporate an output transformer tap which will deliver 70.7V or 25V at the rated output of the amplifier.

# **Technical Aids**

The choice of 70.7V (referred to hereafter as 70V) took into consideration Underwriters' requirements which in many locations limit loudspeaker circuit voltage to a specified maximum unless wiring is run in conduit or BX.

Reference to a "70V loudspeaker distribution line" does not mean that the voltage on this circuit will always be 70V. It may be less when the system is operated at levels well below the rating of the amplifier. The 70V is the **maximum** voltage on a sine wave test signal for a given amount of distortion. This expresses the standard for rating amplifier power. Standardizing this voltage means that the voltage is the same for a low power amplifier as for a high power amplifier if rated under 100 watts.

When transformer taps are marked directly in "watts," no mathematics is required. Simply choose a transformer with the correct power tap and connect to the desired terminals. For transformers marked in impedance, follow the procedure below. Actual calculations are simple. One basic formula is used:

$$Z = \frac{E^2}{P}$$
 of required impedance =  $\frac{(Output \ voltage)^2}{desired \ power}$ 

so that for an amplifier employing a 70V output tap, the formula is reduced to:

required impedance = 
$$\frac{5000}{\text{desired power}}$$

For a system that may already be using a 25V constant wattage line, the formula would be:

required impedance 
$$=\frac{625}{\text{desired power}}$$

Figure 2
Quick Reference Chart for 70V Systems

|       | Guick Reference Chart for 70V Systems |            |                    |         |           |  |  |  |
|-------|---------------------------------------|------------|--------------------|---------|-----------|--|--|--|
|       | Wire Size A.W.G. for 1 dB (20%)       |            |                    |         |           |  |  |  |
|       | Load                                  | Power Loss |                    |         |           |  |  |  |
|       | Impedance                             |            | Length of Wire Run |         |           |  |  |  |
| Watts | (Ω)                                   | 125 ft.    | 250 ft.            | 500 ft. | 1,000 ft. |  |  |  |
| 10    | 500                                   | 33         | 30                 | 27      | 24        |  |  |  |
| 20    | 250                                   | 30         | 27                 | 24      | 21        |  |  |  |
| 30    | 167                                   | 28         | 25                 | 22      | 19        |  |  |  |
| 40    | 125                                   | 27         | 24                 | 21      | 18        |  |  |  |
| 50    | 100                                   | 26         | 23                 | 20      | 17        |  |  |  |
| 60    | 83.5                                  | 25         | 22                 | 19      | 16        |  |  |  |
| 70    | 71.4                                  | 24         | 21                 | 18      | 15        |  |  |  |
| 80    | 62.5                                  | 24         | 21                 | 18      | 15        |  |  |  |
| 90    | 55.5                                  | 23         | 20                 | 17      | 14        |  |  |  |
| 100   | 50                                    | 23         | 20                 | 17      | 14        |  |  |  |
| 125   | 40                                    | 22         | 19                 | 16      | 13        |  |  |  |
| 150   | 33.3                                  | 21         | 18                 | 15      | 12        |  |  |  |
| 175   | 28.6                                  | 21         | 18                 | 15      | 12        |  |  |  |
| 200   | 25                                    | 20         | 17                 | 14      | 11        |  |  |  |

### DRIVERS WITH BUILT-IN TRANSFORMERS

It is obvious from the foregoing, therefore, that where very long speaker lines are necessary, or the installation involves too many speakers to handle at voice coil impedances, drivers with built-in line-matching transformers such as Models ID40T and ID60T are the logical solution. In cases where a constant voltage 70V amplifying system is used, these same drivers will provide the proper power taps. If low-impedance operation is satisfactory, the ID30, ID40 or ID60 units can be used. If at a later date, it is decided to convert to high-impedance operation, transformers can be procured to make the change.

### JUDGING EFFICIENCY AND POWER REQUIREMENTS

There are many ways to approach this question in connection with selection of a companion driver unit. We suggest you first establish the horn on the basis of function. For example,



### Judging Efficiency and Power Requirements Continued

supposing the GH is selected for greatest **distance** coverage. If program is to consist mostly of speech, the ID30 would be adequate, providing 128 dB with 30 watts. By using a series capacitor, sound pressure would be 130 dB at 60 watts. Supposing, however, the area to be penetrated is quite noisy. The ID40 could provide 131 dB at 40 watts, and 134 dB at 80 watts. Need more? The ID75 will produce 138 dB at 75 watts, 140 dB at 150 watts with series capacitor. The influencing factors determining the selection of driver, **other** than sound pressure requirements, are amplifier power available and the cost of more amplifier power.

It's easy to see that on a watts-per-dollar basis, you can get more **sound** by using a more efficient driver than by pouring on more amplifier watts. For example, supposing you selected the PH trumpet because it offers the desired dispersion characteristics and meets frequency response requirements. The ID30 will yield 126 dB on the PH with 30 watts input. You need more? You can get a 60-watt amplifier instead, and obtain 129 dB by using a capacitor in series with the ID30. Or, the ID40 at only a few dollars more than the ID30, can be used with a PH to provide 131 dB at only 40 watts! If speech were still the only consideration and high sound pressure desired at a minimum cost, you might even consider the SMH with ID60 driver. That combination will produce 131 dB at 60 watts as against 130 dB using the ID30/GH combination at the same 60 watts (with series capacitor).

Obviously, University horn/driver combinations can be adapted to yield desired sound pressures. Once the **horn** has been selected on the basis of dispersion and frequency response characteristics, the driver should be selected to provide the sound pressure required. Bear in mind that as the smaller horns are used, dispersion increases and the available sound energy is more spread out. When exceptionally high powers are required, the University Super-Power speakers should be used.

### **ADJUSTING POWER CAPACITY AND CUTOFF**

When the low-frequency response of the input program to a loudspeaker is limited to essentially the operating range of the speaker, as established by the horn cutoff, the "adjusted" power capacity becomes twice its rated "full range" response. Figure 5 provides the value of the nonpolarized capacitor to be placed **in series** with the speaker in order to cause a rate of loss of about 3 dB at the point of horn cutoff. Capacitors for operation up to 25-watts input should have a "working voltage" rating of no less than 50; up to 50 watts input, 75 to 100; and up to 100 watts input or better, 150V to 175V.

 To determine the capacitor for a 70V (or 25V) "constant voltage" system, first determine the value of impedance which corresponds to the power tap being used.

Impedance =  $\frac{\text{(Voltage of system)}^2}{\text{wattage to speaker}}$ 

- If the impedance is known (or calculated according to the formula), find the correct level line on the chart by referring to the table which identifies the impedance being used.
- Find the horn cutoff on the horizontal scale of the chart, and intersect the selected level line at that point.
- Follow that point horizontally to the vertical scale and note the number thus indicated.
- Finally, multiply that number by the factor alongside the impedance level line in the table. The resulting answer is the value of capacitor in microfarads. Because of commercial availability, values within 10% will suffice.

**Note:** Add capacitor values can be achieved by paralleling capacitors to **add** value; or by placing capacitors in series to **reduce** values

When they are in series, the resulting value =  $\frac{1}{\frac{1}{C_a} + \frac{1}{C_b}}$ 

# **Technical Aids**

### SOUND PRESSURE LEVEL (SPL) CHARTS

Figures 3 and 4 illustrate the position of the calibrated microphone used to take the measurements shown in the tables. All measurements were taken at 4 feet on the acoustical axis. Figure 3 pertains to Tables 1 and 3. Figure 4 pertains to the radial horns in Table 2. All figures are in dB.\*

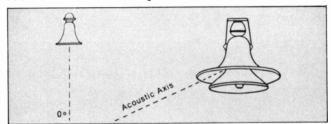


Figure 3 Diagram of On-Axis Readings for Tables 1 and 3.

Figure 4
Diagram of On-Axis
Readings for Table 2.

**Table 1. Directional Trumpets** 

| Drivers | GH  | LH  | PH  | SMH |
|---------|-----|-----|-----|-----|
| ID20    | 125 | 123 | 122 | 121 |
| ID30    | 128 | 126 | 126 | 125 |
| ID30T   | 128 | 126 | 126 | 125 |
| ID40A   | 131 | 129 | 127 | 126 |
| ID40T   | 131 | 129 | 127 | 126 |
| ID60    | 136 | 134 | 133 | 131 |
| ID60T   | 136 | 134 | 133 | 131 |
| ID75    | 138 | 136 | 135 | 133 |

Table 2. Radial Trumpets

| 14016 S. Vaniai Liniubere |     |     |  |  |  |
|---------------------------|-----|-----|--|--|--|
| Drivers                   | RLH | RSH |  |  |  |
| ID20                      | 113 | 110 |  |  |  |
| ID30                      | 117 | 113 |  |  |  |
| ID30T                     | 117 | 113 |  |  |  |
| ID40A                     | 120 | 117 |  |  |  |
| ID40T                     | 120 | 117 |  |  |  |
| 1D60                      | 122 | 119 |  |  |  |
| IDSOT                     | 122 | 119 |  |  |  |
| ID75                      | 124 | 122 |  |  |  |

Table 3. Wide-Angle and Special Purpose Horns

| Drivers | Cobretlex | CLH | SH  | 2WP |
|---------|-----------|-----|-----|-----|
| ID20    | 120       | 121 | 121 | 117 |
| ID30    | 123       | 124 | 123 | 121 |
| ID30T   | 123       | 124 | 123 | 121 |
| ID40A   | 126       | 128 | 125 | 122 |
| ID40T   | 126       | 128 | 125 | 122 |
| ID60    | 128       | 133 | 126 | 123 |
| ID60T   | 128       | 133 | 126 | 123 |
| ID75    | 130       | 134 | 132 | 129 |

\*A Note About SPL's. This is a significant and revealing measurement of the output level of a commercial P.A. loud-speaker. It is precisely evaluated on a specific basis to indicate the actual performance of a driver/horn combination with respect to its output for a given input. This SPL figure, given in dB, is vital to the designer of commercial sound installations. All readings shown were taken at rated power input.

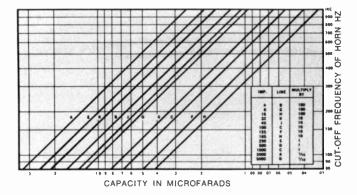
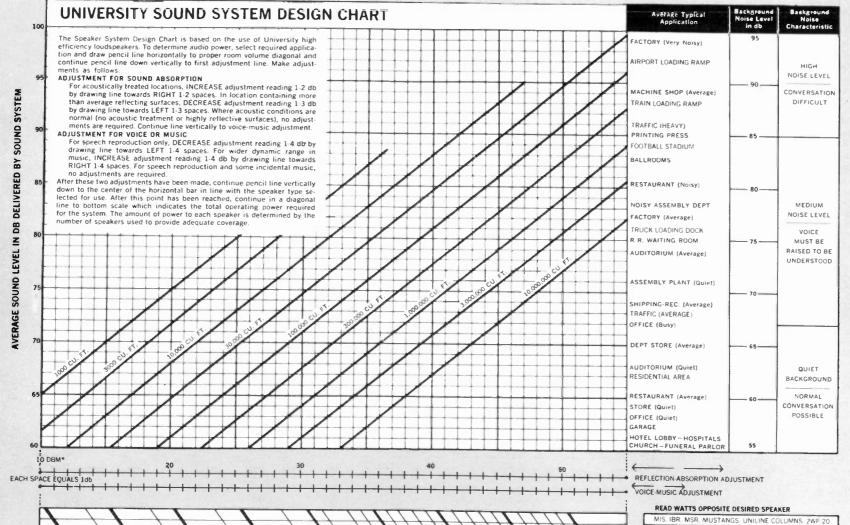


Figure 5
Values of Series Capacitor Required for Various
Cutoff Frequencies

MIL CMIL RLH ID 30 NM 2F MM 2TC CDBREFLEX ID 30 CLH ID 30 RPH ID 60 GM ID 20 SH ID 30 H ID 30 RPH ID 60 SMH ID 30 COBREFLEX ID 60 PH ID 30 LH ID 40 CLH ID 60 PH ID 40 CLH ID 75 SMH ID 60 PH ID 60 GH ID 60 LH ID 60 PH ID 60 GH ID 75 LH ID 75 PH ID 75



RATED AMPLIFIER POWER REQUIRED FOR UNIVERSITY SPEAKERS SHOWN AT RIGHT

\*DBM ZERO LEVEL .001 watt .

-277

10 12 16 20 24 30 40 48 60 80 100 120 160 200 240



### SUBPART B—CRITERIA FOR DETERMIN-ING WHETHER APPLICATIONS FOR RADIO TOWERS REQUIRE NOTIFICA-TION OF PROPOSED CONSTRUCTION TO FEDERAL AVIATION ADMINISTRA-TION

# §17.7 Antenna structures requiring notification to the FAA.

A notification to the Federal Aviation Administration is required, except as set forth in § 17.14, for any of the following construction or alteration:

- (a) Any construction or alteration of more than 60.96 meters (200 feet) in height above ground level at its site.
- (b) Any construction or alteration of greater height than an imaginary surface extending outward and upward at one of the following slopes:
- (1) 100 to 1 for a horizontal distance of 6.10 kilometers (20,000 feet) from the nearest point of the nearest runway of each airport specified in paragraph (d) of this section with at least one runway more than 0.98 kilometers (3,200 feet) in actual length, excluding helitorts.
- (2) 50 to 1 for a horizontal distance of 3.05 kilometers (10,000 feet) from the nearest point of the nearest runway of each airport specified in paragraph (d) of this section with its longest runway no more than 0.98 kilometers (3,200 feet) in actual length excluding helitorts.
- (3) 25 to 1 for a horizontal distance of 1.52 kilometers (5,000 feet) from the nearrest point of the near-est landing and takeoff area of each heliport specified in paragraph (d) of this section.
- (c) When requested by the FAA, any construction or alteration that would be in an instrument approach area (defined in the FAA standards governing instrument approach procedures) and available information indicates it might exceed an obstruction standard of the FAA.
- (d) Any construction or alteration on any of the following airports (including heliports):
- (1) An airport that is available for public use and is listed in the Airport Directory of the current Airman's Information Manual or in either the Alaska or Pacific Airman's Guide and Chart Supplement.
- (2) An airport under construction, that is the subject of a notice or proposal on file with the Federal Aviation Administration, and except for military airports, it is clearly indicated that the airport will be available for public use.
- (3) An airport that is operated by an armed force of the United States.

NOTE: Consideration to aeronautical facilities not in existence at the time of the filing of the application for radio facilities will be given only when proposed airport construction or improvement plans are on file with the Federal Aviation Administration as of the filing date of the application for such radio facilities.

### § 17.8 Establishment of antenna farm areas.

(a) Each antenna farm area will be established by an appropriate rule making proceeding, which may be commenced by the Commission on its own motion after consultation with the FAA, upon request of the FAA, or as a result of a petition filed by any interested person. After receipt of a petition from an interested person disclosing sufficient reasons to justify institution of a rule making proceeding, the Commission will request the advice of the FAA with respect to the considerations of menace to air navigation in terms of air safety which may be presented by the proposal. The written communication received from the FAA in response to the Commission's request shall be placed in the Commission's public rule making file containing the petition, and interested persons shall be allowed a period of 30 days within which to file statements with respect thereto. Such statements shall also be filed with the Administrator of the FAA with proof of such filing to be established in accordance with § 1.47 of this chapter. The Administrator of the FAA shall have a period of 15 days within which to file responses to such statements. If the Commission, upon consideration of the matters presented to it in accordance with the above procedure, is satisfied that establishment of the proposed antenna farm would constitute a menace to air navigation for reasons of air safety, rule making proceedings will not be instituted. If rule making proceedings are instituted, any person filing comments therein which concern the question of whether the proposed antenna farm will constitute a menace to air navigation shall file a copy of the comments with the Administrator of the FAA. Proof of such filing shall be established in accordance with § 1.47 of this chapter.

(b) Nothing in this subpart shall be construed to mean that only one antenna farm area will be designated for a community. The Commission will consider on a case-by-case basis whether or not more than one antenna farm area shall be designated for a particular community.

### § 17.9 Designated antenna farm areas.

The areas described in the following paragraphs of this section are established as antenna farm areas: [appropriate paragraphs will be added as necessary].

# $\S~17.10$ Antenna structures over 304.80 meters (1,000 feet).

Where one or more antenna farm areas have been designated for a community or communities (see § 17.9), the Commission will not accept for filing an application for a construction permit to construct a new station or to increase height or change antenna location of an existing station proposing the erection of an antenna structure over 1,000 feet above ground wiless:

- (a) It is proposed to locate the antenna structure in a designated antenna farm area, or
- (b) It is accompanied by a statement from the Federal Aviation Administration that the proposed structure will not constitute a menace to air navigation, or
- (c) It is accompanied by a request for waiver setting forth reasons sufficient, if true, to justify such a

### § 17.14 Certain antenna structures exempt from notification to the FAA.

A notification to the Federal Aviation Administration is not required for any of the following construction or alteration:

- (a) Any object that would be shielded by existing structures of a permanent and substantial character or by natural terrain or topographic features of equal or greater height, and would be located in the congested area of a city, town, or settlement where it is evident beyond all reasonable doubt that the structure so shielded will not adversely affect safety in air navigation. Applicants claiming such exemption under \$\frac{1}{2}\$ 17.14(a) shall submit a statement with their application to the FCC explaining basis in detail for their finding.
- (b) Any antenna structure of 6.10 meters (20 feet) or less in height except one that would increase the height of another antenna structure.
- (c) Any air navigation facility, airport visual approach or landing aid, aircraft arresting device, or meteorological device, of a type approved by the Administrator of the Federal Aviation Administration, the location and height of which is fixed by its functional purpose.

### § 17.17 Existing structures.

- (a) Nothing in the criteria in this subpart concerning antenna structures or locations shall apply to those structures authorized prior to September 5, 1967.
- (b) No change in any of these criteria or relocation of airports shall at any time impose a new restriction upon any then existing or authorized antenna structure or structures.

### SUBPART C—SPECIFICATIONS FOR OB-STRUCTION MARKING AND LIGHTING OF ANTENNA STRUCTURES

§ 17.21 Painting and lighting, when required.

Antenna structures shall be painted and lighted when:

(a) They exceed 60.96 meters (200 feet) in height above the ground or they require special aeronautical study.

(b) The Commission may modify the above requirement for painting and/or lighting of antenna structures, when it is shown by the applicant that the absence of such marking would not impair the safety of air navigation, or that a lesser marking requirement would insure the safety thereof.

### § 17.22 Particular specifications to be used.

Whenever painting and lighting are required, the Commission will assign painting and lighting specifications pursuant to the provisions of this subpart. If an antenna installation is of such a nature that its painting and lighting in accordance with these specifications are confusing, or endanger rather than assist airmen, or are otherwise inadequate, the Commission will specify the type of painting and lighting or other marking to be used in the individual situation.

# § 17.23 Specifications for the painting of antenna structures in accordance with § 17.21.

Except for antenna structures lighted in conformance with §§ 17.39, 17.40, 17.41 and 17.42. (High Intensity Obstruction Lighting), antenna structures shall be painted throughout their height with alternate bands of aviation surface orange and white, terminating with aviation surface orange bands at both top and bottom. The width of the bands shall be equal and approximately one-seventh the height of the structure, provided however, that the bands shall not be more than 30.48 meters (100 feet) nor less than 0.46 meters (1.5 feet) in width.

AVIATION RED OBSTRUCTION LIGHTING

### § 17.24 Specifications for the lighting of antenna structures up to and including 45.72 meters (150 feet) in height.

Antenna structures up to and including 150 feet in height above ground, which are required to be lighted as a result of notification to the FAA under § 17.7, shall be lighted as follows:

(a) There shall be installed at the top of the tower at least two 116- or 125-watt lamps (A21/TS) enclosed in aviation red obstruction light globes. The intensity of each lamp shall not be less than 32.5 candelas. The two lights shall burn simultaneously from sunset to sunrise and shall be positioned so as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach. A light sensitive control device or an astronomic dial clock and time switch may be used to control the obstruction lighting in lieu of manual control. When a light sensitive device is used, it shall be adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).

### § 17.25 Specifications for the lighting of antenna structures over 45.72 meters (150 feet) up to and including 91.44 meters (300 feet) in height.

- (a) Antenna structures over 45.72 meters (150 feet) up to and including 60.96 meters (200 feet) in height above ground, which are required to be lighted as a result of notification to the FAA under § 17.7 and antenna structures over 60.96 meters (200 feet) up to and including 91.44 meters (300 feet) in height above ground, shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red.) Where a rod or other construction of not more than 6,10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visi-



bility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.

- (2) At the approximate mid point of the overall height of the tower there shall be installed at least two 116- or 125-watt lamps (A21/TS) enclosed in aviation red obstruction light globes. The intensity of each lamp shall not be less than 32.5 candelas. Each light shall be mounted so as to insure unobstructed visibility of at least one light at each level from aircraft at any normal angle of approach.
- (3) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).
- § 17.26 Specifications for the lighting of antenna structures over 91.44 meters (300 feet) up to and including 137.16 meters (450 feet).
- (a) Antenna structures over 300 feet up to and including 450 feet in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red.) Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute, nor less than 12 flashes per minute, with a period of darkness equal to approximately onehalf of the luminous period.
- (2) On levels at approximately two-thirds and onethird of the overall height of the tower, there shall be installed at least two 116- or 125-watt lamps (A21/TS) enclosed in aviation red obstruction light globes. The intensity of each lamp shall not be less than 32.5 candelas. Each light shall be mounted so as to insure unobstructed visibility of at least one light at each level from aircraft at any normal angle of approach.
- (3) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).
- § 17.27 Specifications for the lighting of antenna structures over 137.16 meters (450 feet) up to and including 182.88 meters (600 feet) in height.
- (a) Antenna structures over 450 feet up to and including 600 feet in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 caudelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code bea-

con from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.

- (2) At approximately one-half of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event this beacon cannot be installed in a manner to insure unobstructed visibility of it from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately three-fourths and one-fourth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 024.31 lux (58 fc).
- § 17.28 Specifications for the lighting of antenna structures over 182.88 meters (600 feet) up to and including 228.60 meters (750 feet) in height.
- (a) Antenna structures over 182.88 meters (600 feet) up to and including 228.60 meters (750 feet) in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red.) Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.
- (2) At approximately two-fifths of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event this beacon cannot be installed in a manner to insure unobstructed visibility of it from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately four-fifths, three-fifths and one-fifth of the overall height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than

367.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc.).

- §17.29 Specifications for the lighting of antenna structures over 228.60 meters (750 feet) up to and including 274.32 meters (900 feet) in height.
- (a) Antenna structures over 750 feet up to and including 900 feet in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.
- (2) On levels at approximately two-thirds and one-third of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagnonally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately five-sixths, one-half, and one-sixth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).
- § 17.30 Specifications for the lighting of antenna structures over 274.32 meters (900 feet) up to and including 320.04 meters (1,050 feet) in height.
- (a) Antenna structures over 274.32 meters (900 feet) up to and including 320.04 meters (1,050 feet) in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of



the luminous period.

- (2) On levels at approximately four-sevenths and two-sevenths of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately six-sevenths, five-sevenths, three-sevenths and one-seventh of the overall height of the tower at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not iess than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).

### § 17.31 Specifications for the lighting of antenna structures over 320.04 meters (1,050 feet) up to and including 365.76 meters (1,200 feet) in height.

- (a) Antenna structures over 320.04 meters (1,050 feet) up to and including 365.76 meters (1,200 feet) in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.
- (2) On levels at approximately three-fourths, one-half and one-fourth of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal single of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagnoally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately seven-eighths, five-eighths, three-eighths, and one-eighth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).

- §17.32 Specifications for the lighting of antenna structures over 356.76 meters (1,200 feet) up to and including 411.48 meters (1,350 feet) in height.
- (a) Antenna structures over 356.76 meters (1,200 feet) up to and including 411.48 meters (1,350 feet) in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.
- (2) On levels at approximately two-thirds, fourninths, and two-ninths of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately eight-ninths, sevenninths, five-ninths, one-third and one-ninth of the overall height of the tower, at least one 116- or 125watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).

### § 17.33 Specifications for the lighting of antenna structures over 411.48 meters (1,350 feet) up to and including 457.20 meters (1,500 feet) in height.

- (a) Antenna structures over 411.48 meters (1,350 feet) up to and including 457.20 meters (1,520 feet) in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.
- (2) On levels at approximately four-fifths, three-fifths, two-fifths, and one-fifth of the overall height of

the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angles of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.

- (3) On levels at approximately nine-tenths, seventenths, one-half, three-tenths, and one-tenth of the over-all height of the tower, at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of 376.74 lux (35 fc) and turned off when the north sky illuminance level on a vertical surface rises to a level of not less than 624.31 lux (58 fc).
- § 17.34 Specifications for the lighting of antenna structures over 457.20 meters (1,500 feet) up to and including 502.92 meters (1,650 feet) in height above the ground.
- (a) Antenna structures over 457.20 meters (1,500 feet) up to and including 502.92 meters (1,650 feet) in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.
- (2) On levels at approximately eight-elevenths, six-elevenths, four-elevenths, and two-elevenths of the overall height of the tower, one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from the aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately ten-elevenths, nine-elevenths, seven-elevenths, five-elevenths, three-elevenths, and one-eleventh of the overall height of the tower at least one 116- or 125-watt lamps (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).



### § 17.35 Specifications for the lighting of antenna structures over 502.92 meters (1,650 feet) up to and including 548.64 meters (1,800 feet) in height.

- (a) Antenna structures over 502.92 meters (1,650 feet) up to and including 548.64 meters (1,800 feet) in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.
- (2) On levels at approximately five-sixths, two-thirds, one-half, one-third, and one-sixth of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately eleven-twelfths, three-fourths, seven-twelfths, five-twelfths, one-fourth and one-twelfth of the overall height of the tower at least one 118- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level not less than 376.74 light (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).

### § 17.36 Specifications for the lighting of antenna structures over 548.64 meters (1,800 feet) up to and including 594.36 meters (1,950 feet) in height.

- (a) Antenna structures over 548.64 meters (1,800 feet) up to and including 594.36 meters (1,950 feet) in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40 Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.

- (2) On levels at approximately ten-thirteenths, eight-thirteenths, six-thirteenths, four-thirteenths, and two-thirteenths of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagonally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately twelve-thirteenths, eleven-thirteenths, nine-thirteenths, seven-thirteenths, three-thirteenths, and one-thirteenth of the overall height of the tower at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level not less than 376.74 lux (35 fc) and turned off when the north sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).

### § 17.37 Specifications for the lighting of antenna structures over 594.36 meters (1,950 feet) up to and including 460.08 meters (2,100 feet) in height.

- (a) Antenna structures over 594.36 meters (1,950 feet) up to and including 460.08 meters (2,100 feet) in height above the ground shall be lighted as follows:
- (1) There shall be installed at the top of the structure one 300 m/m electric code beacon equipped with two 620- or 700-watt lamps (PS-40, Code Beacon type) both lamps to burn simultaneously, and equipped with aviation red color filters. The steady burning intensity shall not be less than 2,000 candelas (in red). Where a rod or other construction of not more than 6.10 meters (20 feet) in height and incapable of supporting this beacon is mounted on top of the structure and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there shall be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The beacons shall be equipped with a flashing mechanism producing not more than 40 flashes per minute nor less than 12 flashes per minute, with a period of darkness equal to approximately one-half of the luminous period.
- (2) On levels at approximately six-sevenths, five-sevenths, four-sevenths, three-sevenths, two-sevenths, and one-seventh of the overall height of the tower one similar flashing 300 m/m electric code beacon shall be installed in such position within the tower proper that the structural members will not impair the visibility of this beacon from aircraft at any normal angle of approach. In the event these beacons cannot be installed in a manner to insure unobstructed visibility of the beacons from aircraft at any normal angle of approach, there shall be installed two such beacons at each level. Each beacon shall be mounted on the outside of diagnonally opposite corners or opposite sides of the tower at the prescribed height.
- (3) On levels at approximately thirteen-fourteenths, eleven-fourteenths, nine-fourteenths, one half, five-fourteenths, three-fourteenths, and one-fourteenth of the overall height of the tower at least one 116- or 125-watt lamp (A21/TS) enclosed in an aviation red obstruction light globe shall be installed on each outside corner of the tower at each level. The intensity of each lamp shall not be less than 32.5 candelas.
- (4) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on when the north sky illuminance on a vertical surface falls to a level of not less than 367.74 lux (35 fc) and turned off when the north

sky illuminance on a vertical surface rises to a level of not less than 624.31 lux (58 fc).

### § 17.38 Specifications for the lighting of antenna structures over 640.08 meters (2,100 feet) in height.

Antenna structures over 640.08 meters (2,100 feet) in height above the ground shall be lighted in accordance with specifications to be determined by the Commission after aeronautical study which will include lighting recommendations.

### HIGH INTENSITY WHITE OBSTRUCTION LIGHTING

NOTE: When authorized by the Commission, high intensity white obstruction lighting will be used in lieu of obstruction marking and lighting specified in §§ 17.23 through 17.37.

In general, the number of levels of high intensity lighting specified is dependent upon the overall height of the skeletal frame or comparable main support structure, excluding antennas or similar appurtenances. A white capacitor discharge omoidirectional light is mounted on or adjacent to the appurtenance, if more than 6.10 meters (20 feet), to complement the lighting system.

Where a dual lighting system is employed, i.e., high intensity white obstruction lighting during daylight and red obstruction lighting at night, the omnidirectional high intensity light, if equipped with an aviation red color filter for nighttime illumination, may be used in lieu of the 300 mm top beacon specified in § 17.24(a) and subparagraph (a) (1) in §§ 17.25 through 17.37.

### § 17.39 Specifications for the high intensity lighting of antenna structures having a skeletal tower up to and including 91.44 meters (300 feet) in height.

Antenna structures having a skeletal tower or other main support structure up to and including 91.44 meters (300 feet) in helght shall be obstruction lighted as follows:

- (a) There shall be installed at the top of the skeletal tower or other main support structure three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformly about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to insure unobstructed viewing from aircraft at any normal angle of approach and so that the effective intensity of the full beam is not impaired by any structural members of the skeletal framework. The units will normally be adjusted so that the center of the beam is in the horizontal plane.
- (b) Where an antenna or similar appurtenance extends more than 6.10 meters (20 feet) above the skeletal tower or other main support structure, a white capacitor discharge omnidirectional light which conforms to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems, shall be mounted on the highest point. If the antenna or similar appurtenance is incapable of supporting the omnidirectional light, one or more lights shall be installed on a suitable adjacent support with the light(s) mounted no more than  $6.10 \ \mathrm{meters} \ (20 \ \mathrm{feet}) \ \mathrm{below} \ \mathrm{the} \ \mathrm{tip} \ \mathrm{of} \ \mathrm{the} \ \mathrm{appurtenance}.$ The light(s) shall be positioned so as to permit unobstructed viewing of at least one light from aircraft at any normal angle of approach. The light unit(s) shall emit a beam peak intensity around its periphery of approximately 20,000 candelas during daytime and twilight operation, and approximately 4,000 candelas at
- (c) All lights shall be synchronized to flash simultaneously at 40 pulses per minute. The light system shall be equipped with a light sensitive control device which shall face the north sky and cause the intensity steps to change automatically when the north sky illumination on a vertical surface is as follows:
- (1) Day to Twilight: This shall not occur before the illumination drops to 645.84 lux (60 fc), but shall occur before it drops below 322.92 lux (30 fc),
- (2) Twilight to Night: This shall not occur before the illumination drops to 53.82 lux (5 fc), but shall occur before it drops below 21.53 lux (2 fc).

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# **RULES AND REGULATIONS**

- (3) Night to Day: The intensity changes listed in subparagraphs (1) and (2) of this paragraph shall be reversed in transitioning from the night to day modes. Failure of the intensity step changing circuits shall cause all lights to operate in the high intensity mode or, the next brighter intensity step above that required for the period of operation.
- § 17.40 Specifications for the high intensity lighting of antenna structures having a skeletal tower over 91.44 meters (300 feet) up to and including 182.88 meters (600 feet) in height.

Antenna structures having a skeletal tower or other main support structure over 91.44 meters (300 feet) up to and including 182.88 meters (600 feet) in height shall be obstruction lighted as follows:

- (a) There shall be installed at the top of the skeletal tower or other main support structure three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformally about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to insure unobstructed viewing from aircraft at any normal angle of approach and so that the effective intensity of the full beam is not impaired by any structural members of the skeletal framework. The units will normally be adjusted so that the center of the beam is in the horizontal plane.
- (b) At the approximate ½ (midpoint) level of the skeletal tower there shall be installed an additional set of high intensity obstruction lights as in paragraph (a) of this section. The normal angular adjustment of the beam centers above the horizontal shall be 2 degrees. See Table under § 17.42.
- (c) Where an antenna or similar appurtenance extends more than 6.10 meters (20 feet) above the skeletal tower or other main support structure, a white capacitor discharge omnidirectional light which conforms to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems, shall be mounted on the highest point. If the antenna or similar appurtenance is incapable of supporting the omnidirectional light, one or more lights shall be installed on a suitable adjacent support with the light(s) mounted no more than 6.10 meters (20 feet) below the tip of the appurtenance. The light(s) shall be positioned so as to permit unobstructed viewing of at least one light from aircraft at any normal angle of approach. The light unit(s) shall emit a beam peak intensity around its periphery of approximately 20,000 candelas during daytime and twilight operation, and approximately 4,000 candelas at night.
- (d) All lights shall be synchronized to flash simultaneously at 40 pulses per minute. The light system shall be equipped with a light sensitive control device which shall face the north sky and cause the intensity steps to change automatically when the north sky lilumination on a vertical surface is as follows:
- (1) Day to Twilight: This shall not occur before the illumination drops to 645.84 lux (60 fc), but shall occur before it drops below 322.92 lux (30 fc).
- (2) Twilight to Night: This shall not occur before the illumination drops to 53.82 lux (5 fc), but shall occur before it drops below 21.53 lux (2 fc).
- (3) Night to Day: The intensity changes listed in subparagraph (1) and (2) of this paragraph shall be reversed in transitioning from the night to day modes. Failure of the intensity step changing circuits shall cause all lights to operate in the high intensity mode or the next brighter intensity step above that required for the period of operation.
- § 17.41 Specifications for the high intensity lighting of antenna structures having a skeletal tower over 182.88 meters (600 feet) up to and including 304.80 meters (1,000 feet) in height.

Antenna structures having a skeletal tower or other

main support structures over 182.88 meters (600 feet) up to and including 304.80 meters (1,000 feet) in height shall be obstruction lighted as follows:

- (a) There shall be installed at the top of the skeletal tower or other main support structure three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformly about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to insure unobstructed viewing from aircraft at any normal angle of approach and so that the effective intensity of the full beam is not impaired by any structural members of the skeletal framework. The units will normally be adjusted so that the center of the beam is in the horizontal nlane.
- (b) At the approximate 1/4 and 2/4 levels of the skeletal tower there shall be installed additional sets of high intensity obstruction lights as in paragraph (a) of this section. The normal angular adjustment of the beam centers above the horizontal shall be 2 degrees at the 1/4 level and one degree at the 2/4 level. See Table under \$ 17.42.
- (c) Where a rod or similar appurtenance extends more than 6.10 meters (20 feet) above the skeletal tower or other main support structure, a white capacitor discharge omnidirectional light which conforms to FAA/DOD Specification I-856, High Intensity Obstruction Lighting Systems, shall be mounted on the highest point. If the antenna or similar appurtenance is incapable of suporting the omnidirectional light, one or more lights shall be installed on a suitable adjacent support with the light(s) mounted no more than 6.10 meters (20 feet) below the tip of the appurtenance. The light(s) shall be positioned so as to permit unobstructed viewing of at least one light from aircraft at any normal angle of approach. The light unit(s) shall emit a beam peak intensity around its periphery of approximately 20,000 candelas during daytime and twilight operation, and approximately 4,000 candelas at night.
- (d) All lights shall be synchronized to flash simultaneously at 40 pulses per minute. The light system shall be equipped with a light sensitive control device which shall face the north sky and cause the intensity steps to change automatically when the north sky illumination on a vertical surface is as follows:
- (1) Day to Twilight: This shall not occur before the illumination drops to 645.84 lux (60 fc), but shall occur before it drops below 322.92 lux (30 fc).
- (2) Twilight to Night: This shall not occur before the illumination drops to 53.82 lux (5 fc), but shall occur before it drops below 21.53 lux (2 fc).
- (3) Night to Day: The intensity changes listed in (1) and (2) of this paragraph shall be reversed in transitioning from the night to day modes.

Failure of the intensity step changing circuits shall cause all lights to operate in the high intensity mode or the next brighter intensity step above that required for the period of operation.

§ 17.42 Specifications for the high intensity lighting of antenna structures having a skeletal tower over 304.80 meters (1,000 feet) in height.

Antenna structures having a skeletal tower or other main support structure over 304.80 meters (1,000 feet) in height shall be obstruction lighted as follows:

(a) There shall be installed at the top of the skeletal tower or other main support structure three or more high intensity light units which conform to FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems. The complement of units shall emit a white high intensity light and produce an effective intensity of not less than 200,000 candelas (daytime) uniformally about the antenna structure in the horizontal plane. The effective intensity shall be reduced to approximately 20,000 candelas at twilight, and to approximately 4,000 candelas at night. The light units shall be mounted in a manner to insure unobstructed viewing from aircraft at any normal

angle of approach and so that the effective intensity of the full beam is not impaired by any structural members of the skeletal framework. The units will normally be adjusted so that the center of the beam is in the horizontal plane.

- (b) In addition, there shall be installed at approximate equi-distant levels along the vertical axis of the skeletal tower three or more sets of high intensity obstruction lights as in paragraph (a) of this section. Three intermediate levels are required for skeletal towers over 304.80 meters (1,000 feet) up to and including 426.72 meters (1,400 feet). For each additional 21,92 meters (400 feet) or fraction one additional level of lighting shall be installed. The normal angular adjustment of the beam centers at the bottom level shall be 3 degrees above the horizontal and for the second progressive level shall be 2 degrees above the horizontal. For other progressive levels, see Table below.
- (c) Where a rod or similar appurtenance extends more than 6.10 meters (20 feet) above the skeletal tower or other main support structure, a white capacitor discharge omnidirectional light which conforms to FAA/ DOD Specification L-856, High Intensity Obstruction Lighting Systems, shall be mounted on the highest point. If the antenna or similar appurtenance is incapable of supporting the omnidirectional light, one or more lights shall be installed on a suitable adjacent support with the light(s) mounted no more than 6.10 meters (20 feet) below the tip of the appurtenance. The light(s) shall be positioned so as to permit unobstructed viewing of at least one light from aircraft at any normal angle of approach. The light unit(s) shall emit a beam peak intensity around its periphery of approximately 20,000 candelas during daytime and twilight operation, and approximately 4,000 candelas at
- (d) All lights shall be synchronized to flash simultaneously at 40 pulses per minute. The light system shall be equipped with a light sensitive control device which shall face the north sky and cause the intensity steps to change automatically when the north sky illumination on a vertical surface is as follows:
- (1.) Day to Twilight: This shall not occur before the illumination drops to 645.84 lux (60 fc), but shall occur before it drops below 322.92 lux (30 fc).
- (2.) Twilight to Night: This shall not occur before the illumination drops to 53.82 lux (5 fc), but shall occur before it drops below 21.53 iux (2 fc).
- (3.) Night to Day: The intensity changes listed in subparagraph (1) and (2) of this paragraph shall be reversed in transitioning from the night to day modes.

Failure of the intensity step changing circuits shall cause all lights to operate in high intensity mode or the next brighter intensity step above that required for the period of operation.

Degrees elevation above horizontal

|             | Numb | Number of light levels on struc |   |   |   |   |  |
|-------------|------|---------------------------------|---|---|---|---|--|
| Light level |      | 2                               | 3 | 4 | 5 | в |  |
| Тор         | 0    | 0                               | 0 | 0 | 0 |   |  |
| 5           |      |                                 |   |   |   |   |  |
| 4           |      |                                 |   |   | 0 |   |  |
| 3           |      |                                 |   | 1 | 1 |   |  |
| 2           |      |                                 | 1 | 2 | 2 |   |  |
| Bottom      |      | 2                               | 2 | 3 | 3 |   |  |

[In metric conversion §§ 17.10, 17.25—17.42 were amended off. 10–17–77; I(77)-I]

# § 17.43 Painting and lighting of new and existing structures.

- (a) The provisions of this part of the rules with respect to antenna structures required to be painted and/or lighted, shall be effective November 1, 1970, for any new antenna structure and for any change in the height or location of an existing antenna structure.
- (b) All existing antenna structures required to be painted shall be painted in the manner set forth in § 17.23 at the time when the antenna structure is repainted (see § 17.50) or in no event later than November 1, 1977.
- (c) All existing antenna structures required to be illuminated shall be brought into conformity herewith



within 6 months after September 5, 1970, at any station for which the authorization is renewable on or prior to that date, and within 3 months following the renewal of an authorization renewable after September 5, 1970.

(d) Nothing in the notification criteria concerning antenna structures or locations, as set forth in Subpart B of this part, shall apply to painting and lighting those structures authorized prior to September 5, 1967, except where lighting and painting requirements are reduced, in which case the lesser requirements may apply upon approval of an application to the Commission for such reduction.

[§ 17.45 amended cff. 10-17-77; I (77)-1]

### § 17.45 Temporary warning lights.

During construction of an antenna structure, for which red obstruction lighting is required, at least two 116- or 125-watt lamps (A21/TS) enclosed in aviation red obstruction light globes, shall be installed at the uppermost point of the structure. The intensity of each lamp shall not be less than 32.5 candelas. In addition, as the height of the structure exceeds each level at which permanent obstruction lights will be required, two similar lights shall be installed at each such level. These temporary warning lights shall be displayed nightly from sunset to sunrise until the permanent obstruction lights have been installed and placed in operation, and shall be positioned so as to insure unobstructed visibility of at least one of the lights at any normal angle of approach. If practical, the permanent obstruction lights may be installed and operated at each required level as construction progresses.

### § 17.47 Inspection of tower lights and associated control equipment.

The licensee of any radio station which has an antenna structure requiring illumination pursuant to the provisions of section 303 (q) of the Communications Act of 1934, as amended, as outlined elsewhere in this part:

- (a) (1) Shall make an observation of the tower lights at least once each 24 hours either visually or by observing an automatic properly maintained indicator designed to register any failure of such lights, to insure that all such lights are functioning properly as required; or alternatively,
- (2) Shall provide and properly maintain an automatic alarm system designed to detect any failure of such lights and to provide indication of such failure to the licensee.
- (b) Shall inspect at intervals not to exceed 3 months all automatic or mechanical control devices, indicators, and alarm systems associated with the tower lighting to insure that such apparatus is functioning properly.

### § 17.48 Notification of extinguishment or improper functioning of lights.

The licensee of any radio station which has an antenna structure requiring illumination pursuant to the provisions of section 303(q) of the Communications Act of 1934, as amended, as outlined elsewhere in this

- (a) Shall report immediately by telephone or telegraph to the nearest Flight Service Station or office of the Federal Aviation Administration any observed or otherwise known extinguishment or improper functioning of any top steady burning light or any flashing obstruction light, regardless of its position on the antenna structure, not corrected within 30 minutes. Such reports shall set forth the condition of the light or lights, the circumstances which caused the failure, and the probable date for restoration of service. Further notification by telephone or telegraph shall be given immediately upon resumption of normal operation of the light or lights.
- (b) An extinguishment or improper functioning of a steady burning side intermediate light or lights, shall be corrected as soon as possible, but notification to the FAA of such extinguishment or improper functioning is not required.

### § 17.49 Recording of tower light inspections in the station record.

The licensee of any radio station which has an antenna structure requiring illumination shall make the following entries in the station record of the inspections required by § 17.47.

- (a) The time the tower lights are turned on and off each day if manually controlled.
- (b) The time the daily check of proper operation of the tower lights was made, if automatic alarm system is not provided.
- (c) In the event of any observed or otherwise known extinguishment or improper functioning of a tower light:
- (1) Nature of such extinguishment or improper functioning.
- (2) Date and time the extinguishment or improper functioning was observed, or otherwise noted.
- (3) Date, time, and nature of the adjustments, repairs, or replacements made.
- (4) Identification of Flight Service Station (Federal Aviation Administration) notified of the extinguishment of improper functioning of any code or rotating beacon light or top light not corrected within 30 minutes, and the date and time such notice was
- (5) Date and time notice was given to the Flight Service Station (Federal Aviation Administration) that the required illumination was resumed.
- (d) Upon completion of the periodic inspection required at least once each 3 months :
- (1) The date of the inspection and the condition of all tower lights and associated tower lighting control devices, indicators and alarm systems.
- (2) Any adjustments, replacements, or repairs made to insure compliance with the lighting requirements and the date such adjustments, replacements or repairs were made

### § 17.50 Cleaning and repainting.

All towers shall be cleaned or repainted as often as necessary to maintain good visibility.

### § 17.51 Time when lights should be exhibited.

- (a) All red obstruction lighting shall be exhibited from sunset to sunrise unless otherwise specified.
- (b) All high intensity obstruction lighting shall be exhibited continuously unless otherwise specified.

### § 17.53 Lighting equipment and paint.

The lighting equipment, color of filters, and shade of paint referred to in the specifications are further defined in the following government and/or Army-Navy Aeronautical Specifications, Bulletins, and Drawings: (Lamps are referred to by standard numbers).

| Outside white                                              | TT-P-102 1 (Color No. 17875,<br>FS-595). |
|------------------------------------------------------------|------------------------------------------|
| Aviation surface orange                                    | TT-P-59 (Color No. 12197,<br>FS-595).    |
| Aviation surface orange,<br>enamelAviation red obstruction | TT-E-489 1 (Color No 12197,<br>FS-595).  |
| light-color                                                | M1L-C-25050 *                            |
| Flashing beacons                                           | CAA-446 * Code Beacons, 300<br>mm.       |
| Do                                                         | MIL-6273 *.                              |
| Double and single obstruc-                                 | L-810° (FAA AC No. 150/                  |
| tion light                                                 | 5345-24).                                |
| Do                                                         | MIL-L-7830 *.                            |
| High intensity white ob-                                   | FAA/DOD L-856 (FAA AC                    |
| struction light                                            | No. 150/5345-43B4).                      |
| 116-Watt lamp                                              | No. 116 A21/TS (6,000 h),                |
| 125-Watt lamp                                              | No. 125 A21/TS (6,000 h).                |
| 320-Watt lamp                                              | No. 620 PS-40 (3,000 h).                 |
| 700-Watt lamp                                              | No. 700 PS-40 (6,000 h).                 |

1 Copies of this specification can be obtained from the

Specification Activity, Building 197, Room 301, Naval Weapons Plant, 1st and N Streets, SE., Washington, D.C. 20407.

Copies of Military specifications can be obtained by contacting the Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Ave., Attention: NPPC-105, Philadelphia, Be. 10309. Philadelphia, Pa. 19120.

3 Copies of Federal Ariation Administration specifications may be obtained from the Chief, Configuration Control Branch, AAF-110, Department of Transportation, Federal

Aviation Administration, 800 Independence Avenue SW., Washington, D.C. 20591.

Copies of Federal Aviation Administration advisory circulars may be obtained from the Department of Transportation, Publications Section, TAD-443.1, 400 7th St. SW., Washington, D.C. 20590.

### \$17.54 Rated lamp voltage.

To insure the necessary lumen output by obstruction lights, the rated voltage of incandescent lamps used shall correspond to be within 3 percent higher than the voltage across the lamp socket during the normal hours of operation.

[§ 17.54 amended eff. 10-17-77; I (77)-1]

### § 17.56 Maintenance of lighting equipment.

- (a) Replacing or repairing of lights, automatic indicators or automatic control or alarm systems shall be accomplished as soon as practicable.
- (b) The flash tubes in a high intensity obstruction lighting system shall be replaced whenever the peak effective daytime intensity falls below 200,000 candelas.

### § 17.57 Report of radio transmitting antenna construction, alteration and/or removal.

Any permitee or licensee who, pursuant to any instrument of authorization from the Commission to erect or make changes affecting antenna height or location of an antenna tower for which obstruction marking or lighting is required shall, prior to start of tower construction and upon completion of such construction or changes, fill out and file with the Aeronautical Chart Division of the National Ocean Survey, NOAA Form 76-10 (Report of Radio Transmitting Antenna Construction, Alteration and/or Removal) in order that antenna tower information may be provided promptly for use on aeronautical charts and related publications in the interest of safety in air navigation.

### § 17.58 Facilities to be located on land under the jurisdiction of the U.S. Forest Service or the Bureau of Land Management.

Any application proposing new or modified transmitting facilities to be located on land under the jurisdiction of the U.S. Forest Service or the Bureau of Land Management shall include a statement that the facilities will be so located, and the applicant shall comply with the requirements of § 1.70 of this chapter.

# **TELEPHONE DIRECTORY**

NOTE: This directory has been compiled to make it easier to locate the name, address and telephone number of those who manufacture, consult, distribute, install and service the equipment used in the broadcast communications industry along with the companies who produce the programs and materials used in same. If your company has not been included, please send your particulars on your letterhead to the publisher: Bill Daniels Co. Inc., P.O. Box 2056, Shawnee Mission, KS 66201, (913) 831-0098.

### Α

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| 1960-505 Burrard St., Vancouver, Canada V/X 1M6 (604) 522-2711                                                                                | AUDIO VIDEO ENTERPRISES, DBA THE VIDEO CENTER<br>8621 Wilshire Blvd., Beverly Hills, CA 90210                          |                                |
| 25-20 Brooklyn Queens Expwy. West., Woodside, NY 11377 (212) 932-3403                                                                         | AUDIO/VIDEO PRODUCTS<br>6253 Hollywood Blvd., Suite 202, Hollywood, CA 90028                                           |                                |
| ARROW FASTENER CO., INC. 271 Mayhill St. 272 Mayhill St. 273 Mayhill St. 274 Mayhill St.                                                      | AUDIO VIDEO SYSTEMS, INC.<br>3390 Peoria St., #306, Aurora, CO 80010                                                   |                                |
| 271 Mayhill St. Saddle Brook, NJ 07662                                                                                                        | AUDIO VISION COMPANY (Div. of High Fidelity House) 3912 Concord Pike, Wilmington, DE 19803                             |                                |
| ARTHUR MOKIN PRODUCTIONS, INC. 17 W. 60th Street, New York, NY 10023(212) 757-4848                                                            | THE AUDIO VISUAL COMPANY (Div. of Electronic Systems, Inc.) 875 Waimanu St., Suite 500, Honolulu, HI 96813             |                                |
| ARTISTS' ENGINEERING P.O. Box 11457, San Francisco, CA 94107                                                                                  | AUDIO VISUAL CONTRACTORS 6875 East Evans, Denver, CO 80222                                                             |                                |
| ARVIN/ECHO SCIENCE CORP.<br>485 East Middlefield Road, Mountain View, CA 94043(415) 961-7145                                                  | AND A MONTH CONTRACTOR COMPANY INC                                                                                     |                                |
| ARVIN SYSTEMS, INC. 4490 Old Columbus Rd. N.W., Carroll, OH 43112 (614) 756-9211/756-9222                                                     | AUDIO-VISUAL EQUIPMENT CUMPANY, INC. 4511 Dixie Highway, Louisville, KY 40216                                          |                                |
| ASACA CORP. OF AMERICA                                                                                                                        | P.O. Box 11087, 2114 8th Ave. N., Birmingham, AL 35203                                                                 |                                |
| 1289 Rand Road<br>Des Plaines, IL 60016                                                                                                       | P.O. Box 955, Southhampton, PA 18966                                                                                   |                                |
| EMIL ASCHER, INC., 666 Fifth Ave., New York, NY 10019 (212) 581-4504                                                                          | 500 Hillside Ave., Atlantic Highlands, NJ 07716                                                                        |                                |
| 140 Glendale Dr., Endicott, NY 13760                                                                                                          | P.O. Box 480, Milwaukee, WI 53201                                                                                      | 414) 671-4600                  |
| 1500 Broadway, New York, NY 10036                                                                                                             | AUDIO VISUAL RENTALS, INC.<br>6500 Stapleton Dr. S., Suite H, Denver, CO 80216                                         | 303) 388-0939                  |
| ASSOCIATED ELECTRONICS, INC. 7618 Boeing Dr., Suite J, El Paso, TX 79925                                                                      | AUDIO VISUAL REQUIREMENTS, INC. 469 E. Ohio St., Chicago, IL 60611                                                     | 312) 828-0660                  |
| ASSOCIATED PRESS, 50 Rockefeller Plaza, New York, NY 10020(212) 262-4000 ASSOCIATED PRESS BROADCASTERS, INC.                                  | AUDIO VISUAL SERVICES, INC.<br>223 E. Broad Ave., Albany, GA 31705                                                     | 912) 883-2110                  |
| 50 Rockefeller Plaza, New York, NY 10020                                                                                                      | AUDIO-VISUAL SPECIALISTS 3753 Northrop St., Fort Wayne, IN 46805                                                       | 219) 483-0528                  |
| STANDARDS, INC.<br>1730 M Street N.W., Suite 700, Washington, DC 20036 (202) 331-0606                                                         | AUDIO-VUE, INC., 1741 W. Medill Ave., Chicago, IL 60614 ( AUDITRONICS, INC., 3750 Old Getwell Rd., Memphis, TN 38118 ( | 312) 935-6630<br>901) 362-1350 |
| ASSOCIATION of INDEPENDENT TELEVISION STATIONS, INC.<br>19 W. 44th St., New York, NY 10036(212) 575-0577                                      | AURATONE CORP., Box 698, Coronado, CA 92118                                                                            | 714) 297-2820                  |
| ASSOCIATION of MOTION PICTURE & TELEVISION PRODUCERS, 8480 Beverly Blvd., Hollywood, CA 90048 (213) 653-2200                                  | AURICON DIV. BACH AURICON CORP.<br>6950 Romaine St., Hollywood, CA 90038                                               | 213) 462-0932                  |
| ASSOC. OF NATIONAL ADVERTISERS<br>155 E. 44th St., New York, NY 10017(212) 697-5950                                                           | AUROSCOPE, 50 Morningside Dr., New York, NY 10025                                                                      | 305) 855-6868                  |
| ASTRAFILMS, INC.<br>4453 Sedgwick St., N.W., Washington, DC 20026 (202) 362-7857                                                              | AUTOGRAM CORP. P.O. Box 456, 631 J Place, Plano, TX 75074                                                              | 214) 424-8585                  |
| ATHANS COMMUNICATIONS, Box 358, Granbury, TX 76048 (817) 573-2404                                                                             | AUTOMATED BROADCAST CONTROLS 1110 Taft St., Rockville, MD 20852                                                        | (301) 762-0558                 |
| ATLANTA INTERFAITH BROADCASTERS P.O. Box 77005, Atlanta, GA 30309                                                                             | AUTOMATED CUSTOM SYSTEMS, (Div. of DNA) P.O. Box 88342, Seattle, WA 98188                                              |                                |
| ATLANTIS ADVERTISING (Div of JMP Productions)<br>5321 Southwyck, Toledo, OH 43614(419) 866-8480                                               | AUTOMATED PROCESSES, INC.<br>790 Park Ave., Huntington, NY 11743                                                       |                                |
| ATLAS SOUND                                                                                                                                   | AUTOMATIC DEVICES CO.<br>2121 South 12th Street, Allentown, PA 18103                                                   |                                |
| 10 Pomeroy Road<br>Parsippany, NJ 07054                                                                                                       | AUTOMATION ELECTRONICS, INC. 1001 South St., Lafayette, IN 47905                                                       |                                |
| ATLANTIC RESEARCH CORP. 5390 Cherokee Ave., Alexandria, VA 22314(703) 354-3400                                                                | 1001 South St., Larayette, IN 47905  AUTOMATION TECHNIQUES INC.  1846 N. 106th E. Ave., Tulsa, OK 74116                |                                |
| AUBURN INSTRUMENTS<br>1127 Olympic Way West, Seattle, WA 98119 (206) 285-7448                                                                 | AVANTEK, INC., 3175 Bowers Ave., Santa Clara, CA 95051                                                                 | (408) 249-0700                 |
| AUDIO DISTRIBUTOR, INC.<br>2342 S. Division Ave., Grand Rapids, MI 49507 (616) 452-1596                                                       | AVCOM SYSTEMS, INC.                                                                                                    |                                |
| AUDIO INTERFACE, INC.<br>9025 Eton Ave., Ste. A. Canoga Park, CA 91304 (213) 998-1082                                                         | 1648 Locust Ave., P.O. Box 486<br>Bohemia, NY 11716                                                                    | (516) 567-5205                 |
| AUDICO, LTD., 219 Crossen Ave, Elk Grove Village, IL 60007 (312) 640-1030                                                                     | A-VIDD ELECTRONICS COMPANY 2210 Bellflower Blvd., Long Beach, CA 90815                                                 | (213) 598-0444                 |
| AUDI-CORD CORP., 1845 West Hovey Ave.<br>P.O. Box 611, Normal, IL 61761                                                                       | AVERNHEIMER LABS. & CO.<br>4561 E. Florence Ave., Fresno, CA 93725                                                     | (209) 442-1048                 |
| AUDIO ACCESSORIES, INC., 163 Water St., Keene, NH 03431 (603) 352-2320 AUDIO DESIGNS AND MFG., INC.                                           | AVID CORP., 10 Tripps Lane, East Providence, RI 02914                                                                  | (401) 438-5400                 |
| 16005 Sturgeon, Roseville, MI 48066                                                                                                           |                                                                                                                        |                                |
| 60 E 42nd St., Room 449, New York, NY 10017                                                                                                   | В                                                                                                                      |                                |
| 810 N. Waterman Ave., San Bernadino, CA 92402 (714) 888-1395<br>AUDIOIMAGE, 40 E. 49th Street, New York, NY 10017 (212) 753-8980              | BB PRODUCTIONS, INC.                                                                                                   |                                |
| AUDIOIMAGE, 40 E. 49th Street, New York, NY 1007/<br>AUDIO INTERFACE, INC.<br>9025 Eton Ave., Canoga Park, CA 91304                           | 92 Stuyvesant Ave., Newark, NJ 07106                                                                                   |                                |
| 9025 Eton Ave., Canoga Park, CA 91304                                                                                                         | 360 N. Michigan Ave., Chicago, IL 60601                                                                                |                                |
| ALIDIONICS INC                                                                                                                                | BCS-KAMAN SCIENCES CORP.<br>1500 Garden of the Gods Rd., Colorado Springs, CO 80907                                    | (303) 599-1601                 |
| Suite 160, 10950 Southwest 5th Ave., Beaverton, OR 97005 (503) 641-5225 AUDIOSEARS CORP., Two South Street, Stamford, NY 12167 (607) 652-7305 | BFA EDUCATIONAL MEDIA (Div. of CBS, Inc.) 2211 Michigan Ave., Santa Monica, CA 90404                                   | . (213) 829-2901               |
|                                                                                                                                               |                                                                                                                        |                                |

| BGW SYSTEMS, INC.                                                                                   | CHARLES BESELER CO.                                                                                                                        |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| 13130 S. Yukon Ave., Hawthorne, CA 90250 (213) 973-8090 B & I ELECTRONICS, INC.                     | 8 Fernwood Rd., Florham Park, NJ 07932                                                                                                     |
| Bldg. 128 Donaldson Center, Greenville, SC 29605 (803) 277-5985                                     | BESTON ELECTRONICS, INC.<br>P.O. Box 106A, 15315 S. Highway 169                                                                            |
| BJA SYSTEMS, INC. 666 Davisville Road                                                               | Olathe, KS 66061                                                                                                                           |
| Willow Grove, PA 19090                                                                              | 5540 W. Glendale Ave., Suite C-106, Glendale, AZ 85301                                                                                     |
| 511 West 164th St., Cleveland, OH 44142 (216) 267-4800                                              | BETA TECHNOLOGY, INC., 94 Verdi St., Farmingdale, NY 11735(516) 293-4313 BETZER PRODUCTIONS, INC.                                          |
| B & K PRECISION, (Dynascan Corp.)<br>6460 W. Courtland, Chicago, IL 60635(312) 889-8870             | 450 E. Ohio St., Chicago, IL 60611                                                                                                         |
| BNA COMMUNICATIONS, INC.<br>9401 Decoverly Hall Rd., Rockville, MD 20850 (301) 948-0540             | 3000 Directors Row — Suite 508, Memphis, TN 38131 (901) 345-3544                                                                           |
| BTX CORP., 438 Boston Post Rd., Weston, MA 02193(617) 891-1239                                      | BIBAS-REDFORD, INC.<br>111 Bowman Ave., Port Chester, NY 10573(914) 937-4320                                                               |
| BSC INC., 2932 River Rd., River Grove, IL 60171 (312) 452-5551  BACKGROUND ENGINEERS, INC.          | JAMES G. BIDDLE CO. Township Line & Jolly Rd., Plymouth Meeting, PA 19462 (215) 646-9200                                                   |
| 729 N. Seward, Hollywood, CA 90038                                                                  | BIRD ELECTRONIC CORP.                                                                                                                      |
| 45 W. 45th St., New York, NY 10036(212) 354-8760                                                    | 30303 Aurora Rd., Cleveland, OH 44139                                                                                                      |
| WILLIAM BAL CORP.<br>947 Newark Ave., Box 588, Elizabeth, NJ 07208                                  | 1026 N. Highland Ave., Los Angeles, CA 90038 (213) 466-8211 BLACK HAWK FILMS, INC.                                                         |
| BALD MOUNTAIN LAB, 230 Belleview Rd., Tray, NY 12180 (518) 279-9753  BALL ELECTRONIC DISPLAY DIV.   | 1235 W. 5th St., Davenport, IA 54302                                                                                                       |
| 345 High St., Muncie, IN 47302                                                                      | BLACKBOURN, INC., 1821 University Ave., St. Paul, MN 55104 (612) 646-2781 BLAKE FILMS, 104 W. Concord St., Boston, MA 02118 (617) 267-7713 |
| BALLANTINE LABORATORIES, INC.<br>P.O. Box 97, Boonton, NJ 07005                                     | BLOCK SYSTEMS, INC., VIDEO CENTRAL<br>4405 France Ave. S., Minneapolis, MN 55410 (612) 922-6535/546-9361                                   |
| RON BANASZ AUDIO PRODUCTION<br>1448 W. Polk, Chicago, IL 60602                                      | BLONDER-TONGUE LABS                                                                                                                        |
| BARBIZON ELECTRIC, 426 W. 55th St., New York, NY 10019 (212) 586-1620                               | One Jake Brown Rd., Old Bridge, NJ 08857                                                                                                   |
| BARDWELL and McALISTER, INC.                                                                        | 52 South Main St., Spring Valley, NY 10977(914) 425-4466                                                                                   |
| 7269 Santa Monica Blvd.<br>Hollywood, CA 90046                                                      | BLUE SKY PRODUCTIONS<br>P.O. Box 548, Santa Fe, NM 87501                                                                                   |
| BARON WIRE & CABLE CORP.<br>6019 W. Howard St., Niles, IL 60648                                     | BLUMBERG PHOTO SOUND COMPANY 525 N. Washington Ave., Minneapolis, MN 55401 (612) 335-1271                                                  |
| BARTON PRODUCTIONS, 3094 W. Market St., Akron, OH 44313(216) 867-1670                               | BOEING COMPUTER SERVICES CO.<br>Box 24346, Seattle, WA 98124                                                                               |
| BARWICK/KRANZ INC., P.O. Box 5099, Westport, CT 06880 (203) 226-9420 BARKER AND WILLIAMSON, INC.    | BOGEN DIVISION/LEAR SIEGLER, INC.                                                                                                          |
| 10 Canal St., Bristol, PA 19007                                                                     | Box 500                                                                                                                                    |
| 31 Peachtree Pl. N.E., Atlanta, GA 30309                                                            | Paramus, NJ 07652                                                                                                                          |
| BAUER AUDIO VIDEO, INC.<br>4 Lemmon Park E., Dallas, TX 75204                                       | 401 Railroad Ave., Westbury, NY 11590                                                                                                      |
| E.J. BAUGHMAN & CO.<br>1914 N. Cogswell Rd., So., El Monte, CA 91733                                | BONDURANT BROTHERS COMPANY<br>906 Sevier Ave., P.O. Box 2069, Knoxville, TN 37901 (615) 573-9151                                           |
| BAYLY ENGINEERING, LTD.,                                                                            | BONNEVILLE PRODUCTIONS 130 Social Hall Ave., Salt Lake City, UT 84111 (801) 237-2619                                                       |
| 167 Hunt St., Ajax, Ont., Canada L1S 1P6                                                            | BOONTON ELECTRONICS                                                                                                                        |
| 1614 Mercantile Bank Bldg., Dallas, TX 75201 (214) 741-3228                                         | Rt. 287, Smith Road, Parsippany, NJ 07054 (201) 887-5110 BORDEN PRODUCTIONS, INC.                                                          |
| BEACON-CAMERA-VISUAL CO., INC.<br>360 Furman St., Brooklyn, NY 11201(212) 625-3570                  | Great Meadows Rd., Concord, MA 01742                                                                                                       |
| BEAVERONICS, INC.                                                                                   | 65 Bay Street, Boston, MA 02125(617) 265-2102                                                                                              |
| 8 Haven Avenue Port Washington, NY 11050                                                            | BOSTON SOUND & POWER SYSTEMS 3 Fredith Rd., Weymouth, MA 02189                                                                             |
| THE BEDSIDE NETWORK OF THE VETERANS HOSPITAL RADIO & TELEVISION GUILD                               | BOSUSTOW PRODUCTIONS<br>1649 11th St., Santa Monica, CA 90404                                                                              |
| 1841 Broadway, New York, NY 10023 (212) 757-8659                                                    | ROBERT J. BRADY COMPANY( Div. of Prentice-Hall, Inc.)                                                                                      |
| BECKERMAN/MANSFIELD, INC.<br>8 E. 48th St., New York, NY 10017(212) 832-1056                        | Brady Bldg., Bowie, MD 20715(301) 262-6300 BRAND NAMES FOUNDATION INC.                                                                     |
| BEEHIVE VIDEO, 865 E. 4th St. S., Salt Lake City, UT 84147 (801) 531-1476                           | 477 Madison Ave., New York, NY 10022. (212) 753-4131<br>BRAND-REX CO., P.O. Box 498, Willimantic, CT 06226 (203) 423-7771                  |
| GEORGE BEKER ASSOC., 90 Hilltop Dr., Trumbull, CT 06611 (203) 377-2180 BELAR ELECTRONICS LAB., INC. | RON BRAUNSTEIN VIDEO SYSTEMS                                                                                                               |
| Lancaster Ave. at Dorset, Devon, PA 19333                                                           | 8600 La Sabre Dr., Maineville, OH 45039(513) 683-6508                                                                                      |
| BELDEN COMMUNICATIONS, INC.<br>25 West 45th Street                                                  | BRETFORD MFG. CO. 9715 Soreng Avenue                                                                                                       |
| New York, NY 10036                                                                                  | Schiller Park, IL 60176                                                                                                                    |
| Box 1327                                                                                            | WALTER S. BREWER CO., INC.<br>5424 South Zunis Place                                                                                       |
| Richmond, IN 47374                                                                                  | Tulsa, OK 74105                                                                                                                            |
| 994 Freeway Dr. N., Columbus, OH 43229                                                              | BREWSTER CORP., 50 River St., Old Saybrook, CT 06475 (203) 388-3097 THE BRICKYARD LTD.                                                     |
| 7100 McCormick Rd.                                                                                  | P.O. Box 1752, Salt Lake City, UT 84110(801) 363-3757                                                                                      |
| Chicago, IL 60645                                                                                   | BRIGHAM YOUNG UNIVERSITY MEDIA MARKETING W-Stad                                                                                            |
| Evanston, IL 60602                                                                                  | Provo, UT 84602ext. 4071 (801) 374-1211 BROADBAND ENGINEERING, INC.                                                                        |
| 145 Scarborough Road, Briarcliff Manor, NY 10510 (914) 762-3838                                     | 1525 Cypress Drive, Jupiter, FL 33458                                                                                                      |
| BENJAMIN ELECTRONIC SOUND 790 Park Ave., Huntington, NY 11743                                       | BROADCAST AIDS, INC. 20 Red Rose Dr., Levittown, PA 19056                                                                                  |
| BENNER NAWMAN, INC. P.O. Box 23378, Pleasant Hill, CA 94523                                         | BROADCAST AUTOMATION ASSOC. Box 277, Ft. Pierce, FL 33450                                                                                  |
| BERKEY COLORTRAN                                                                                    | BROADCAST CARTRIDGE SERVICE                                                                                                                |
| 1015 Chestnut Street<br>Burbank, CA 91502(213) 843-1200                                             | P.O. Box 1790<br>North Hollywood, CA 91604                                                                                                 |
|                                                                                                     |                                                                                                                                            |

World Radio History B-287

| BROADCAST COMMUNICATIONS DEVICES, INC. 5526 E. La Palma Ave., Anaheim, CA 92807                                              | CPAC INC., 2364 Leicester Rd., Leicester, NY 14481                                                      |
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| BROADCAST COMPONENTS DIST. Tilghman at Jefferson Sts., Allentown, PA 18102                                                   | CRV SYSTEMS, INC. 1901 Madison Avenue (2004) F25 2622                                                   |
| Box 590 Leesburg, VA 22075(804) ///-8660                                                                                     | Huntington, WV 25704                                                                                    |
| BROADCAST EDUCATION ASSOCIATION<br>1771 N St. NW, Washington, DC 20036                                                       | 0000 O O O O O O O O O O O O O O O O O                                                                  |
| DDCADCACT FLECTBONICS INC                                                                                                    | 3800 S. Congress Avenue<br>Boynten Beach, FL 33435 (305) 737-5626                                       |
| 4111 North 24th St., Quincy, IL 62301                                                                                        | C.S.P. INC., 203 Airport Rd., Doylestown, PA 18901                                                      |
|                                                                                                                              | CTL VIDEO CENTER, 918 Sligo Ave., Silver Spring, MD 20910 (301) 585-6311                                |
| BOX 3141, Bristol, TN 37620                                                                                                  |                                                                                                         |
| BROADCAST PIONEERS, 40 W. 57th St., New York, NY 10019 (212) 586-2000 BROADCAST PIONEERS LIBRARY                             | CABLE FILMS                                                                                             |
| 1771 N St. NW, Washington, DC 20036(202) 223-0088                                                                            | Country Club Station, Box 7171<br>Kansas City, MO 64113                                                 |
| PROADCAST RATING COUNCIL INC                                                                                                 | CARLE LOCK CONNECTORS LTD                                                                               |
| Room 2347, 420 Lexington Ave., New York, NY 10017                                                                            | 137 Milvan Dr., Weston, Ontario M9L 1ZB, Canada                                                         |
| 3518 Cahuenga Blvd. West, Suite 307, Hollywood, CA 90068 (213) 851-5515                                                      | 1429 W. Southern Ave., Williamsport, PA 17701 (717) 323-8518                                            |
| BROADCAST VIDEO SYSTEMS LTD.  1050 McNicoll Ave.                                                                             | CABLE SPINNING EQUIPMENT CO. 3080 Topeka Ave., Topeka, KS 66611 (913) 267-0234                          |
| Agincourt, Ont., Canada M1W 2L8                                                                                              | CABLE TELEVISION INFORMATION CENTER Urban Institute, 2100 M St. NW, Washington, DC 20037 (202) 872-8888 |
| BROADCASTERS FOUNDATION (212) F96 2000                                                                                       | CABLE TV SUPPLY CO., P.O. Box 2663, Culver City, CA 90230 (213) 390-8002                                |
| 40 W. 57th St., New York, NY 10019                                                                                           | CARLEDATA 3200 Arden Way, Sacramento, CA 92825 (916) 485-2911                                           |
| BROADCASTERS PROMOTION ASSOC., INC.<br>Box 5102, Lancaster, PA 17601                                                         | CABLEFACTS, 2444 Palumbo Dr., Lexington, KY 40509 (606) 269-2323                                        |
| PROADWAY MAINTENANCE CORP                                                                                                    | CARLEVICION CONCEDICTION CORP                                                                           |
| 205 Bethpage - Sweet Hollow Rd., Old Bethpage, NY 11804 (516) 694-2300                                                       | 76 Cooper St., P.O. Box 3760, Houston, TX 77088                                                         |
| BROMLEY ELECTRONICS<br>883 Cambridge St., Cambridge, MA 02141                                                                | CABLEWAVE SYSTEMS, INC.<br>60 Dodge Ave., North Haven, CT 06473 (203) 239-3311                          |
| PRODUCINAL COLLECT TV CENTER                                                                                                 |                                                                                                         |
| 018 Whitehead Hall, Brooklyn, NY 11210(212) 780-5555                                                                         | CADCO 2706 National Circle                                                                              |
| BROOKS CAMERAS, INC.<br>239 Utah Ave., South San Francisco, CA 94080 (415) 952-5400                                          | Garland, TX 75041                                                                                       |
|                                                                                                                              | CAL DUNN 3 LODIOS, 141 44, Olilo St., Chicago, 12 occio 111111111111111111111111111111111               |
| 1233 Somerset Dr., San Jose, CA 95132                                                                                        | CALIFORNIA INSTRUMENTS<br>5150 Convoy St., San Diego, CA 92111                                          |
| BROWN ELECTRONICS, Artemus Rd., Barbourville, KY 40906 (606) 546-523                                                         | CALIFORNIA CIAITCH and SIGNAL                                                                           |
| JOHN BRUMAGE PRODUCTIONS<br>514 W. 57th St., New York, NY 10019. (212) 245-611                                               |                                                                                                         |
| BRYCE AUDIO, 115 W. 40th St., New York, NY 10018                                                                             | CALIFORNIA VIDEO SERVICE                                                                                |
| BLIOKEVE TELEBUONE & CUBBLY CO                                                                                               | Off Golden Gate Ave., Gall Francisco, Green Gall                                                        |
| 1250 Kinnear Rd., Columbus, OH 43221                                                                                         |                                                                                                         |
| BUD INDUSTRIES, INC.<br>4605 E. 355th St., Willoughby, OH 44094 (216) 946-3200/(800) 321-176                                 | CAL-MED ELECTRONICS COMPANY 2328 Hercules Dr., Los Angeles, CA 90046                                    |
| BUHL OPTICAL, 1009 Beech Ave., Pittsburgh, PA 15233 (412) 321-0070                                                           | CALUMET COLLEGE COMMUNICATIONS CENTER                                                                   |
| BURNE AUDIO VISUAL SERVICE                                                                                                   | CALUMET COLLEGE COMMONICATION AND ACCURATION                                                            |
| 2716 St. Charles Rd., Bellwood, IL 60104                                                                                     | (Div. of Calumet College) 2400 New York Ave.  Whiting, IN 46394                                         |
| 44 Burlews Court, Hackensack, NJ 07601 (201) 489-130                                                                         | CALVERT ELECTRONICS INC.                                                                                |
| BURNS ELECTRONICS, 735 Route 5, South Windsor, CT 06074 (203) 528-218                                                        | 6 220 E. 23rd Street<br>New York, NY 10010                                                              |
| BURNUP AND SIMS, INC.<br>4047 Okeechobee Blvd., West Palm Beach, FL 33409 (305) 683-831                                      | CAMPBIDGE BOOK CO                                                                                       |
|                                                                                                                              | 406 Wadison Ave., New York, W.                                                                          |
| BUSINESS COMMUNICATIONS, INC.                                                                                                | CAMBRIDGE PRODUCTS 244 Woodland Ave., Bloomfield, CT 06002(203) 243-1761                                |
| 20 W. Ninth St., Room 104<br>Kansas City, MO 64105                                                                           | CAMPRINGE PRODUCTS CORP                                                                                 |
| BUCINEGO EVOLANCE INC                                                                                                        | 101 Folia: St. Samonillo MA 02145 (617) 666-3343                                                        |
| 4716 Vineland, North Hollywood, CA 91602                                                                                     | CAMERA CORNER, INC.<br>P.O. Box 218, 525 S. Military Ave., Green Bay, WI 54305 (414) 494-1151           |
| BUSINESS SERVICES COMPANY of UTICA, INC.<br>133 N. Genesee St., Utica, NY 13501                                              | THE CAMEDA MADTING                                                                                      |
| DUCINECC TV CEDVICES INC                                                                                                     | 456 W. 55th St., New York, NY 10019(212) /5/-69//                                                       |
| 405 Lexington Ave., New York, NY 10017                                                                                       | CAMEX CORP., 6362 Hollywood Blvd., Hollywood, CA 90028 (213) 464-0174                                   |
| BYRON MOTION PICTURES<br>65 K St., N.E., Washington, DC 20002                                                                | CAMPUS FILMS, 2 Overhill Rd., Scarsdale, NY 10583(914) 472-9590                                         |
| do it ott, m.e., washington, a a acceptance                                                                                  | CANADIAN ADMIRAL CORP. LTD. 501 Lakeshore Rd., Mississauga, Ontario L5G 4M5                             |
|                                                                                                                              | CANADIAN CENEDAL ELECTRIC CO. LTD.                                                                      |
| C                                                                                                                            | 396 Attwell Drive, Rexdale, Ontario, M9W 5C3, Canada (416) 675-7500                                     |
| _                                                                                                                            | CANON U.S.A., INC.                                                                                      |
| CA COMPTON, INC CO 00003 (303) 494-513                                                                                       |                                                                                                         |
| CA COMPTON, INC. 1658 Bear Mountain Drive, Boulder, CO 80303                                                                 | ALEXANDER CANTWELL ASSOCIATES                                                                           |
| CCA ELECTRONICS CORP. Box 5500, Broadcast Plaza (200) 257.8171/(609) 424-15                                                  |                                                                                                         |
| Charry Hill N I 09034                                                                                                        | New York, NY 10022                                                                                      |
| CCB PRODUCTIONS, LTD., (Div. of Network Broadcasting Systems, Inc.) 500 Old Country Rd., Garden City, NY 11530 (516) 746-10. |                                                                                                         |
| COC HATELE DIMINE AND CARLS                                                                                                  | CAPRON LIGHTING AND SOUND (Div. of Capron Lighting                                                      |
| P.O. Box 14710, Phoenix, AZ 85063(602) 272-68                                                                                | Co., Inc.) 278 West Street, Needham Heights, MA 02194 (617) 444-8850                                    |
| COOR COMMUNICATIONS INC                                                                                                      | CARA RACIEIC SALES CO                                                                                   |
| CECO COMMONICA HONS, INC. 2115 Avenue X, Brooklyn, NY 11235(212) 646-6300/(800) 221-08                                       |                                                                                                         |
| C.E.I., dba VID-DISCO<br>60 A Elton Ave., Watertown, MA 02172 (617) 926-09                                                   | CARINGELLA FLECTRONICS, INC.                                                                            |
| 60 A Elton Ave., Watertown, MA 021/2                                                                                         | CARINGELLA ELECTRONICS, INC.<br>9 P.O. Box 727, Upland, CA 91786                                        |
| are support for this of Consolidated Film Industries)                                                                        | 69 P.O. Box 727, Upland, CA 91786                                                                       |
| CFI VIDEOTAPE (Div. of Consolidated Film Industries) 959 Seward St., Hollywood, CA 90038                                     | P.O. Box 727, Upland, CA 91786                                                                          |
| CFI VIDEOTAPE (Div. of Consolidated Film Industries) 959 Seward St., Hollywood, CA 90038                                     | P.O. Box 727, Upland, CA 91786                                                                          |
| CFI VIDEOTAPE (Div. of Consolidated Film Industries) 959 Seward St., Hollywood, CA 90038 (213) 462-31                        | P.O. Box 727, Upland, CA 91786                                                                          |

| CAROLINA AUDIO VISUAL 2517 Devine St., Columbia, SC 29205                                                                                                                                | CHYRON CORP.  223 Newtown Road, Plainview, NY 11803                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Box 9228, Wichita, KS 67277                                                                                                                                                              | CINE 60, INC. 630 Ninth Avenue                                                                                                                                                                                     |
| 1745 W. 134 St., Gardena, CA 90249                                                                                                                                                       | New York, NY 10036                                                                                                                                                                                                 |
| CATERPILLAR TRACTOR CO., 100 N.E. Adams, Peoria, IL 61629(309) 578-6071 CATHOLIC TV NETWORK OF CHICAGO (Div. of Archdiocese of Chicago) 1 N. Wacker Dr., Chicago, IL 60606(312) 332-3860 | CINE SONIC SOUND INC., P.O. Box 996, New York, NY 10001 (212) 563-0540 CINEMA CONCEPTS, INC., 91 Main St., Chester, CT 06412 (203) 526-9513 CINEMAGRAPHICS, 101 Trowbridge St., Cambridge, MA 02138 (617) 491-0866 |
| CAVOX STEREO PRODUCTIONS 502 S. Isis, Inglewood, CA 90301                                                                                                                                | CINEMA PRODUCTS CORP. 2037 Granville Ave., Los Angeles, CA 90025                                                                                                                                                   |
| C-COR ELECTRONICS INC. 60 Decibel Rd., State College, PA 16801                                                                                                                           | 1635 S. Division, Grand Rapids, MI 49507                                                                                                                                                                           |
| 1650 Webster St., Denver, CO 80215                                                                                                                                                       | 377 Broadway, New York, NY 10013                                                                                                                                                                                   |
| CENTER CITY VIDEO, INC., (Div. of Alcare Communications, Inc.) 1600 Walnut St., 3rd floor, Philadelphia, PA 19103 (215) 546-4634 CENTER FOR NON-BROADCAST TELEVISION, INC.               | 1914 Sunderland Place NW, Washington, DC 20036                                                                                                                                                                     |
| Automation House, 49 E. 68th St., New York, NY 10021 (212) 628-1010                                                                                                                      | CITY FILM PRODUCTIONS (Div. of City Film Center, Inc.) 64-12 65th Pl., Middle Village, NY 11379 (212) 456-5050                                                                                                     |
| 5800 W. Fullerton, Chicago, IL 60639                                                                                                                                                     | DAVID CLARK CO., INC., 360 Franklin St., Worcester, MA 01604 (617) 756-6216  CLARKE VIDEO & FILM PRODUCTION 472 Greenwich St., New York, NY 10013                                                                  |
| 331 W. Northwest Highway<br>Palatine, IL 60067                                                                                                                                           | CLAUS GELOTTE, INC. 185 Alewife Brook Pkwy., Cambridge, MA 02138                                                                                                                                                   |
| CENTRAL DYNAMICS, LTD.  147 Hymus Boulevard  Montreal, Quebec, Canada H9R 1G1                                                                                                            | 1766 K St. NW, Washington, DC 20006                                                                                                                                                                                |
| CENTRAL SCHOOL SUPPLY COMPANY 217 W. Capitol, Jackson, MS 39205 (601) 969-6700                                                                                                           | 759 Harrison Street San Francisco, CA 94107(415) 989-1130                                                                                                                                                          |
| CENTRAL VIDEO, INC. 3806 Woodland Park Ave. N., Seattle, WA 98103                                                                                                                        | CLEAVELAND/PRICE, INC.<br>12340 Linshan Drive, North Huntingdon, PA 15642                                                                                                                                          |
| 1103 El Centro Ave., Hollywood, CA 90038                                                                                                                                                 | 72 Huntley Dr., Bethel, VT 05032                                                                                                                                                                                   |
| 210 S.W. Sixth St., Topeka, KS 66603       (913) 232-7701         CENTREX PRODUCTIONS, INC.       (212) 986-8270         240 E. 45th St., New York, NY 10017       (212) 986-8270        | COAXIAL DYNAMICS INC. 13110 Enterprise Ave., Cleveland, OH 44135                                                                                                                                                   |
| CENTRON FILMS (Div. of Centron Corp.) 1621 W. Ninth, Lawrence, KS 66044(913) 843-0400                                                                                                    | P.O. Box 623, San Diego, CA 92112                                                                                                                                                                                  |
| CENTURY FILM, 2606 Wade Ave., Raleigh, NC 27607                                                                                                                                          | Supply Co., Denver, CO) 202 DeMers Ave. Grand Forks, ND 58201                                                                                                                                                      |
| CENTURY PROJECTOR CORP.<br>32-02 Queens Blvd., Long Island City, NY 11101 (212) 786-3715                                                                                                 | Mail Station 406-240, Dallas, TX 75207                                                                                                                                                                             |
| CERRO COMMUNICATION PRODUCTS, Freehold, NJ 07728 (201) 462-8700 CETEC AUDIO, P.O. Box 3941 13035 Saticoy Street, North Hollywood, CA 91605 (213) 875-1900                                | COLORADO MAGNETICS  4620 Milkweed Lane, Colorado Springs, CO 80917                                                                                                                                                 |
| CETEC BROADCAST GROUP 75 Castillion Drive, Goleta, CA 93017                                                                                                                              | COLORADO STATE UNIVERSITY ENGINEERING RENEWAL & GROWTH, Fort Collins, CO 80523                                                                                                                                     |
| CETEC JAMPRO, 6939 Power Inn Road, Sacramento, CA 95828 (916) 383-1177  CEZAR INTERNATIONAL LTD.                                                                                         | COLORADO VIDEO, INC. P.O. Box 928 Boulder, CO 80302                                                                                                                                                                |
| 1211 McIntosh Ave., Sunnyvale, CA 94087                                                                                                                                                  | COLOR STOCK LIBRARY, INC./LEM BAILEY PRODUCTIONS 910 North Citrus Ave., Hollywood, CA 90038(213) 466-1344                                                                                                          |
| A.B. CHANCE CO., 210 N. Allen St., Centralia, MO 65240 (314) 682-5521 CHANNELL COMMERCIAL CORP.                                                                                          | COLORTONE CAMERA, INC. 76 S. Central Ave., Elmsford, NY 10523                                                                                                                                                      |
| 620 W. Foothill Blvd., Glendora, CA 91740                                                                                                                                                | 2803 Mission Village Dr., San Diego, CA 92123       (714) 232-1033         COLOUR IMAGES UNLIMITED, INC.       8645 Kirk Drive, Colorado Springs, CO 80908       (303) 495-4751                                    |
| CHELSEA HOUSE PUBLISHERS<br>70 W. 40 St., New York, NY 10018                                                                                                                             | COLUMBIA PICTURES 1501 Landmier Rd., Elk Grove Village, IL 60007 (312) 640 2350                                                                                                                                    |
| CHISM SCHOOL SUPPLIES, P.O. Box 6417<br>638 W. Fifth St., Reno, NV 89503                                                                                                                 | COLUMBIA SPECIAL PRODUCTS Room 861, 51 West 52nd Street                                                                                                                                                            |
| DON CHRIST VIDEO CENTER 267 Haddon Ave., Collingswood, NJ 08108                                                                                                                          | New York, NY 10019                                                                                                                                                                                                 |
| CHRISTIE ELECTRIC CORP.  3410 W. 67th St., Los Angeles, CA 90043                                                                                                                         | 1805 St. Johns Avenue Highland Park, IL 60035                                                                                                                                                                      |
| 2 West Park Road, Havertown, PA 19083                                                                                                                                                    | 355 W. Sunrise Hwy., Freeport, NY 11520                                                                                                                                                                            |



### CENTRAL DYNAMICS LTD

New York Tel: (914) 592-5440

Dallas Tel: (214) 741-3332 Los Angeles Tel: (213) 789-0574

**Denver** Tel: (303) 623-7603

Atlanta Tel: (404) 491-9037

CANADA-Montreal Tel: (514) 697-0810

| DLUMBINE SYSTEMS, INC. P.O. Box 740, 1301 Arapahoe, Golden, CO 80401                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | CONSOLIDATED VIDEO SYSTEMS, INC. 1255 E. Arques Ave., Sunnyvale, CA 94086                                                       |
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| DMAD COMMUNICATIONS LTD.<br>91 Kelfield St., Unit 5, Rexdale, Ontario, Canada M9W 5A3(416) 245-1734                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>CONTEL MFG.</b> 1620 W. 32nd Place, Hialeah, FL 33012                                                                        |
| DMARK INDUSTRIES, INC.       (413) 568-1870         P.O. Box 196, Westfield, MA 01085       (203) 323-1749         DMET SALES, Box 4755, Springdale, CT 06907       (203) 323-1749         DMET SALES, Box 4755, Springdale, CT 06907       (203) 323-1749                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | CONTINENTAL ELECTRONICS MFG. CO. P.O. Box 270879, Dallas, TX 75227                                                              |
| JME1 SALES, Box 4756, Springdare, C 1 0:000<br>MEX SYSTEMS, INC., Executive Dr., Hudson, NH 03051 (603) 889-8564<br>DMMAND PRODUCTS CO., P.O. Box 1577, Evanston, IL 60204 (312) 944-6600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CONTINENTAL VIDEO CENTER (Div. of Continental Telecommunications Corp.) 10440 Metcalf Ave. Overland Park, KS 66212(913) 341-212 |
| OMMERCIAL ELECTRONICS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CONTROL TECHNOLOGY, INC.<br>620 Easy Street, Garland, TX 75042                                                                  |
| 880 Maude Avenue<br>Mountain View, CA 94043                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | COVENANT PRESS (Div. of Evangelical Covenant Church of America) 3200 W. Foster Ave., Chicago, IL 60625                          |
| OMMERCIAL RADIO MONITORING CO., INC.<br>103 S. Market, Lee's Summit, MO 64063 (816) 524-3777                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | CONVERGENCE CORP                                                                                                                |
| 103 S. Market, Lee's Summit, Mo-Section 103 S. | 17935 Sky Park Circle, Irvine, CA 92714                                                                                         |
| DMMONWEAL PRODUCTIONS, INC. 21 Ellery St., Cambridge, MA 02138                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 18 W. 45th St., R-619, New York, NY 10036                                                                                       |
| OMM/SCOPE CO., Rt. 1, Box 199A, Catawba, NC 28609 (704) 241-3142                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | MVR Hall, Cornell University, Ithaca, NY 14853                                                                                  |
| DMMUNICATION COMMISSION NAT'L COUNCIL OF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3900 Electronics Dr., Raleigh, NC 27604(919) 876-110                                                                            |
| New York, NY 10562(212) 870-2574                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1111 16th St. NW, Washington DC 20036(202) 293-610                                                                              |
| 1205 San Luis Obispo Ave., Hayward, CA 94545                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | JOHN A COSTELOW CO., INC.<br>125 Kansas Ave., Topeka, KS 66603 (913) 233-650                                                    |
| OMMUNICATIONS DISTRIBUTION CORP.<br>P.O. Box 567, 120 Collins Industrial Blvd., Athens, GA 30603 (404) 353-1159                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | COUNCIL FOR UHF BROADCASTING (CUB) Box 23640, L'Enfant Plaza Station, Washington, DC 20024 (202) 488-52                         |
| OMMUNICATIONS GROUP WEST 6606 Sunset Blvd., Hollywood, CA 90028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | COUNCIL OF BETTER BUSINESS BUREAUS INC.<br>1150 17th St. NW, Washington, DC 20036 (202) 467-52                                  |
| OMMUNICATIONS, LTD. 1601 N. Bristol St., Santa Ana, CA 92706                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | COLINGII ON CLUI DRENI MEDIA & MERCHANDISING                                                                                    |
| OMMUNICATIONS SYSTEMS<br>3500 Depauw Blvd., Suite 3000, Indianapolis, IN 46268 (317) 299-7100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1346 Connecticut Ave. NW, Washington, DC 20036. (202) 466-25 COUNCIL OF MOTION PICTURE ORGANIZATIONS, INC.                      |
| ONANALIALICATIONS WORKERS OF AMERICA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (COMPO) 1500 Broadway, New York, NY 10036                                                                                       |
| Mercury Bldg., 1925 K Street NW, Washington, DC 20006 (202) 785-6700  OMMUNITRONICS CORPORATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 146 Montgomery Ave., Bala Cynwyd, PA 19004 (215) 667-95                                                                         |
| 1907 S. King's Hwy., St. Louis, MO 63110                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Suite 100/Prado North, 5600 Roswell Rd., Atlanta, GA 30342 (404) 356-52                                                         |
| 4209 NW 23rd, Suite 106, Oklahoma City, OK 73107                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CRAMER ELECTRONICS, INC. 120 Hampton Ave.                                                                                       |
| 733 Summit Ave. E., Seattle, WA 98102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Needham, MA 02194 (617) 449-21 CREATIVE MEDIA (Div of Batten, Batten, Hudson & Swab, Inc.)                                      |
| DMPACT VIDEO SYSTEMS, INC.<br>2813 W. Alameda Ave., Burbank, CA 91505(213) 843-3232                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 820 Keo Way, Des Moines, IA 50309                                                                                               |
| OMPASS PRODUCTIONS<br>44 E. Superior St., Chicago, IL 60611 (312) 664-6353                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | CREATIVE PRODUCTIONS, INC.<br>221 N. LaSalle St., Chicago, IL 60601                                                             |
| COMPCO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CREATIVE PRODUCTIONS, INC.<br>200 Main St., Orange, NJ 07050                                                                    |
| 6820 Romaine<br>Hollywood, CA 90038                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CREATIVE VIDEO PRODUCTIONS, INC. 601 Deming Pl., Chicago, IL 60614                                                              |
| COMPCO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CRIMSON CAMERA TECHNICAL SALES, INC.<br>60 Landsdowne St., Cambridge, MA 02139                                                  |
| 364 West Erie<br>Chicago, IL 60610                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CROMAR'S PHOTO & SOUND (203) 571-1                                                                                              |
| COMPONENTS CORP., 6 Kinsey Place, Denville, NJ 07834 (201) 627-0290                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CROSSPOINT LATCH                                                                                                                |
| COMPOSERS & LYRICISTS GUILD OF AMERICA INC.<br>6525 Sunset Blvd., Hollywood, CA 90028(213) 462) 6068                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 316 Broad Street Summit, NJ 07901                                                                                               |
| COMPREHENSIVE AUDIO VISUALS INC.  Box 881, Times Square Station, New York, NY 10036(212) 586-6161                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | CROUSE HINDS CO., Box 4999, Syracuse, NY 13221                                                                                  |
| COMPREHENSIVE VIDEO SUPPLY 148 Veterans Dr., Northvale, NJ 07647                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CROWN INTERNATIONAL, INC.<br>178 West Mishawaka Rd., Elkhart, IN 46514 (219) 294-5                                              |
| COMPUCON, INC. 13749 Neutron Rd., Dallas, TX 75240(214) 233-4380                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CRYSTAL PICTURES INC.<br>1560 Broadway, New York, NY 10036 (212) 757-5                                                          |
| COMPUTER IMAGE, 2475 W. 2nd Ave., Denver, CO 80223 (303) 934-5801<br>COMPUTER LABS, 505 Edwardia Dr., Greensboro, NC 27409 (919) 292-6427                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CUSHCRAFT, P.O. Box 4680, Manchester, NH 03108 (603) 627-7                                                                      |
| COMPUTER MAGNETICS CORP.<br>125 W. Providencia Ave., Burbank, CA 91502                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CUSTOM AUDIO ELECTRONICS                                                                                                        |
| COMQUIP, INC., 366 S. Maple Ave., Glen Rock, NJ 07452 (201) 444-3800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2805 S. Teion St., Englewood, CO 80110                                                                                          |
| COMREX CORP., 60 Union Ave., Sudbury, MA 01776                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CUSTOM FILMS, INC., 11 Cob Drive, Westport, CT 06880 (203) 226-0                                                                |
| CONCEPTS PRODUCTIONS P.O. Box 41406, Sacramento, CA 95841                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 17521 15th Ave., N.E., Seattle, WA 98155(206) 365-5                                                                             |
| 1.T.S.—CONCOR<br>2223 S. 48th St., Tempe, AZ 85282                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CZART HODGE HORO, 20 Zotto Harry                                                                                                |
| CONCORD COMMUNICATIONS (Div. of Auvitel Systems Corp.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                 |
| P.O. Box 875, 176 Main St., Norwalk, CT 06852                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                 |
| JERRY CONN ASSOCIATES P.O. Box 444, Chambersburg, PA 17201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | BX INC., 71 Chapel St., Newton, MA 02195                                                                                        |
| CONRAC CORP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | DVH, INC., P.O. Box 520, Mineral Wells, TX 76067                                                                                |
| 3 Landmark Square<br>Stamford, CT 06901                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | D & S CORLEY LTD.  80 Galaxy Rivd - Rexdale Ont, Canada M9W 4Y8                                                                 |
| CONPAC DIV CONRAC CORP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | D'SAN CORP., 25-30 163rd St., Flushing, NY 11358                                                                                |
| CONRAC DIV., CONRAC CORP.         (213) 966-351           600 North Rimsdale Ave., Covina, CA 91722         (213) 966-351           CONSOLIDATED ELECTRONIC IND.         (301) 948-932           9721 Singleton Dr., Bethesda, MD 20034         (301) 948-932                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                 |

| DWJ ASSOCIATES, 295 Madison Ave., New York, NY 10017 (212) 949-7676                                                                       | DIX HILLS ELECTRONICS INC. 25 No. Mall, Plainview, NY 11803                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| DAK INDUSTRIES, INC.<br>10845 Vanowen Street                                                                                              | DO IT NOW FOUNDATION/INSTITUTE FOR CHEMICAL<br>SURVIVAL, P.O. Box 5115, Phoenix, AZ 85010                        |
| North Hollywood, CA 91605                                                                                                                 | DOLBY LABORATORIES, INC. 731 Sansome Street, San Francisco, CA 94111 (415) 392-0300                              |
| 3100 State Road 15 North<br>Warsaw, IN 46580                                                                                              | DOLBY LABORATORIES, INC.  346 Clapham Rd., London SW9 9AP England                                                |
| BILL DANIELS COMPANY, INC.                                                                                                                | O1-720-1111  DOLPHIN PRODUCTIONS, INC.  140 E. 80th St., New York, NY 10021 (212) 628-5930                       |
| P.O. Box 2056<br>Shawnee Mission, KS 66201(913) 831-0098                                                                                  | DON CHRIST VIDEO CENTER                                                                                          |
| DATA COMMUNICATIONS CORP. 3000 Directors Row, Memphis, TN 38131                                                                           | 267 Haddon Ave., Collingswood, NJ 06108                                                                          |
| DATALOGIC RUST CO., P.O. Box 273, Everett, MA 02149(617) 389-3380                                                                         | 830 N. Shelton Rd., Colorado Springs, CO 80909                                                                   |
| DATA PRECISION CORP., Audubon Rd., Wakefield, MA 01880 (617) 246-1600                                                                     | 41 W. 87th St., New York, NY 10024 (212) 877-4308                                                                |
| DATAMETRICS                                                                                                                               | DORATE, INC., 1000 N. 4th St., Sayre, OK 73662                                                                   |
| 340 Fordham Road<br>Wilmington, MA 01887                                                                                                  | P.O. Box 400, Binghampton, NY 13902(607) 772-1610                                                                |
| DATATEK CORP., 1166 W. Chestnut St., Union, NJ 07083 (201) 964-3656<br>DATATRON INC., 1562 Reynolds Ave., Irvine, CA 92714 (714) 540-9330 | DORIS FAYE PRODUCTIONS, INC. 325 W. 45th St., New York, NY 10036                                                 |
| DAVCO ELECTRONICS CORP                                                                                                                    | DOWNSTREAM-KEYER INC                                                                                             |
| P.O. Box 2456, Batesville, AR 72501                                                                                                       | 6350 De Longpre Avenue, Hollywood, CA 90028                                                                      |
| 165 Tunstead Ave., San Anselmo, CA 94960                                                                                                  | 2385 South Clinton Ave., South Plainfield, NJ 07080 (201) 755-7080 DUAL-IMAGE, INC.                              |
| DAVIS AUDIO-VISUAL, INC.<br>1801-07 Federal Blvd., Denver, CO 80204                                                                       | 4004 W. Strathmore Ave., Baltimore, MD 21215(301) 358-8707                                                       |
| WALT DAVIS ENTERPRISES                                                                                                                    | THE LEE DU BOIS CORP., Box G, Hyannis, MA 02601                                                                  |
| 3439 Cahuenga W., Hollywood, CA 90068                                                                                                     | 11465 West 48th Avenue, Wheat Ridge, CO 80033 (303) 423-1300                                                     |
| 84 Belknap Beach Rd., P.O. Box 115, Prospect, KY 40059 (502) 228-4898                                                                     | DUFFEX, INC., 30 E. 40th St., New York, NY 10016                                                                 |
| DAVIS AND SANFORD CO., INC.<br>24 Pleasant Street                                                                                         | DUKANE CORP (Audio Visual Div.) 2900 Dukane Drive                                                                |
| New Rochelle, NY 10802                                                                                                                    | 2900 Dukane Drive St. Charles, IL 60174                                                                          |
| DAYSTAR AUDIO-VISUAL, INC.<br>2960 South Fox Street, Englewood, CO 80110                                                                  | 2865 Fairview Rd., Costa Mesa, CA 92626(714) 545-8261                                                            |
| DAYTON COMMUNICATIONS CORP.<br>2971 Bluefield Ave., Dayton, OH 45414                                                                      | VICTOR DUNCAN, INC.<br>2659 Fondron Dr., Dallas, TX 75206                                                        |
| DEARBORN WIRE & CABLE CO                                                                                                                  | E.I. DUPONT DE NEMOURS & CO. (TV Egpt. Div., Magnetic                                                            |
| 9299 Evenhouse Ave., Rosemont, IL 60018 (312) 696-1000<br>DECCA AUSTIN INSULATORS                                                         | Products) Old Dupont Airport Site, Bldg. 1<br>Wilmington, DE 19898                                               |
| 71 Selby Rd., Brampton Ont. Canada L6W 1K5 (416) 457-8720                                                                                 | DURACELL PRODUCTS CO. Berkshire Industrial Park, Bethel, CT 06801 (203) 792-2222                                 |
| DECIBEL PRODUCTS INC.<br>3184 Quebec St., Dallas, TX 75247                                                                                | DYMA ENGINEERING INC., Box 1697, Taos, NM 87571                                                                  |
| DEFOREST PIONEERS INC.                                                                                                                    | DYNAIR ELECTRONICS, INC. 5275 Market St., San Diego, CA 92114                                                    |
| 254 Vincent Ave., Lynbrook, NY 11563                                                                                                      | DYNASCIENCES                                                                                                     |
| DELTA ELECTRONICS, INC.                                                                                                                   | Township Line Road                                                                                               |
| 5534 Port Royal Rd., Springfield, VA 22151                                                                                                | Blue Bell, PA 19422 (215) 643-0250<br>DYNATECH DATA SYSTEMS                                                      |
| 145 Fayette St., Winston-Salem, NC 27101                                                                                                  | 900 Slaters Lane, Alexandria, VA 22314(703) 548-3889                                                             |
| DENSON ELECTRONICS CORPORATION                                                                                                            | DYTEK INDUSTRIES, INC. 2475 W. 2nd Ave., Denver, CO 80223                                                        |
| Longview St., Rockville, CT 06066       (203) 875-5198         DESIGN-FORM, 2398 4th St., Berkeley, CA 94710       (415) 848-7198         |                                                                                                                  |
| DEVINE'S MACHINE & DESIGN INC.                                                                                                            |                                                                                                                  |
| So. Faith Rd., Grantville, PA 17028                                                                                                       | E                                                                                                                |
| 150 W. 55th St., New York, NY 10019                                                                                                       | <b>L</b>                                                                                                         |
| DE WOLFE MUSIC LIBRARY 25 West 45th Street                                                                                                | E & C MEDIA, 1831 S. Halsted, Chicago, IL 60608 (312) 666-0541                                                   |
| New York, NY 10036                                                                                                                        | ECI VIDEO (Div. of Wholesale Electronic Supply)<br>2515 Ross Ave., Dallas, TX 75201                              |
| DIAMOND ELECTRONICS (Div. of Arvin Systems, Inc.) P.O. Box 200, Lancaster, OH 43130                                                       | EECO (Electronic Engineering Co. of Calif.)                                                                      |
| DIDACTIC SYSTEMS, INC. P.O. Box 457, Cranford, NJ 07016                                                                                   | 1441 E. Chestnut Ave., Santa Ana, CA 92701                                                                       |
| DIELECTRIC COMMUNICATIONS                                                                                                                 | 82 Rome Street, Farmingdale, NY 11735                                                                            |
| Route 121, Raymond, ME 04071                                                                                                              | EEV, INC., 7 Westchester Ave., Elmsford, NY 10523                                                                |
| 310 14th Ave. So., St. Petersburg, FL 33701 (813) 895-4201                                                                                | EM COM, INC.                                                                                                     |
| DIGITAL CONCEPTS CORP. 249 Route 46, Saddle Brook, NJ 07662                                                                               | 4000 W. 76th St., Minnespolis, MN 55435 (612) 835-4001 EME, 112 Buena Vista, High Point, NC 27260 (919) 869-3335 |
| DIGITAL VIDEO SYSTEMS 519 McNicoll Avenue, Willowdale, Ontario, Canada M2H 2C9 (416) 499-4826                                             | EMC CORPORATION                                                                                                  |
| THE DIRECT VIDEO CORP.                                                                                                                    | 2979 Ualena St., Honolulu, HI 96819                                                                              |
| Time & Life Bldg., Rockefeller Center, New York, NY 10020 (212) 541-5954 DIRECTORS GUILD OF AMERICA                                       | 1009 C Shary Circle, Concord, CA 94520                                                                           |
| 7950 Sunset Blvd., Hollywood, CA 90046 (213) 656-1220                                                                                     | ESC ELECTRONICS CORP. 534 Bergen Blvd., Palisades, NJ 07650                                                      |
| DISPLAY MEDIA, INC., 120 Laura Dr., Addison, IL 60101                                                                                     | E.S.E.                                                                                                           |
| DI-TECH, INC.<br>311 Wyandanch Avenue                                                                                                     | 505 ½ Centinela Avenue<br>Inglewood, CA 90302                                                                    |
| North Babylon, NY 11704                                                                                                                   | E-Z WAY PRODUCTS, INC.                                                                                           |
| P.O. Box 66, Perry, OK 73077(415) 336-4404                                                                                                | Pay 22945 Tampa CL 22622                                                                                         |
|                                                                                                                                           | Box 22845, Tampa, CL 33622                                                                                       |
| DIVERSIFIED ELECTRONIC COMMUNICATION CORP., dba DELCOM CORP., 6019 S. 66th East Ave., Tulsa, OK 74145                                     | Box 22845, Tampa, CL 33622                                                                                       |

| EASTERN AIR LINES, INC.                                                                                                                                                                | ELECTRONIC MERCHANDISING                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bldg. 30, Room 105, Miami Int'l. Airport, Miami, FL 33148(305) 873-7091                                                                                                                | 3525 W. Peterson Ave., Chicago, IL 60659 (312) 583-8535                                                                                                                                                                           |
| EASTERN MICROWAVE INC.<br>3 Northern Concourse, N. Syracuse, NY 13212 (315) 455-5955                                                                                                   | ELECTRONIC NEWS, 7 E. 12th St., New York, NY 10003 (212) 741-4230 ELECTRONIC TECHNICIAN/DEALER                                                                                                                                    |
|                                                                                                                                                                                        | 1 East First St., Duluth, MN 55802(218) 727-8511                                                                                                                                                                                  |
| EASTMAN KODAK COMPANY 343 State Street                                                                                                                                                 | ELECTRONIC UNIVERSITY, Box 361, Mill Valley, CA 94941 (415) 383-0479                                                                                                                                                              |
| Rochester, NY 14650                                                                                                                                                                    | ELECTRONICS McGraw-Hill Bldg., 1221 Ave. of the Americas                                                                                                                                                                          |
| ECHOLAB, INC.                                                                                                                                                                          | New York, NY 10020                                                                                                                                                                                                                |
| 213 Middlesex Turnpike Burlington, MA 01803                                                                                                                                            | ELECTRONICS DIVERSIFIED, INC.                                                                                                                                                                                                     |
| ECHO SCIENCE CORP                                                                                                                                                                      | 1675 Northwest 216th<br>Hillsboro, OR 97123                                                                                                                                                                                       |
| 485 E. Middlefield Rd., Mountain View, CA 94043                                                                                                                                        | ELECTRONICS, MISSILES AND COMMUNICATIONS, INC.                                                                                                                                                                                    |
| ECONCO BROADCAST SERVICES INC.<br>Rt. 2, Box 188, Woodland, CA 95695(916) 662-4495                                                                                                     | Box 116, Susquehanna St., White Haven, PA 18661(717) 443-9575                                                                                                                                                                     |
| EDGO BRODUCTS INC                                                                                                                                                                      | ELECTROVERT INC.<br>86 Hartford Avenue, Mount Vernon, NY 10553 (914) 664-6090                                                                                                                                                     |
| 680 Bizzell Drive, Lexington, KY 40504                                                                                                                                                 | ELECTRO VOICE INC                                                                                                                                                                                                                 |
| EDCOA PRODUCTIONS, INC.<br>310 Cedar Lane, Teaneck, NJ 076                                                                                                                             | 600 Cecil Street, Buchanan, MI 49107                                                                                                                                                                                              |
|                                                                                                                                                                                        | ELIZABETH IRON WORKS CO.<br>546 Green Lane, Union, NJ 07083                                                                                                                                                                       |
| EDCOR<br>3030 Red Hill Avenue                                                                                                                                                          | FULIOTT AUDIO VISUAL INC. (Div. of Elliott Camera                                                                                                                                                                                 |
| Costa Mesa, CA 92626                                                                                                                                                                   | Shops, Inc.) 3848 N. Division St., Davenport, IA 52806 (319) 391-3256                                                                                                                                                             |
| EDIT/CHICAGO<br>Prudential Plaza, Rm 3010, Chicago, IL 60601 (312) 787-9100                                                                                                            | EMCEE BROADCAST PRODUCTS P.O. Box 116, White Haven, PA 18661                                                                                                                                                                      |
| EDITEL (Dis. of Columbia Bioturas Industrias, Inc.)                                                                                                                                    | EMCOR PRODUCTS/GE BUSINESS FOUIPMENT, INC.                                                                                                                                                                                        |
| 301 E. Erie St., Chicago, IL 60611                                                                                                                                                     | 1600 4th Ave. Northwest, Rochester, MN 55901 (507) 289-3371                                                                                                                                                                       |
| EDITEL COMMUNICATIONS 729 N. Highland, Hollywood, CA 90038                                                                                                                             | ENCLOSURE CORP.<br>4529 Adams Circle, Cornwells Heights, PA 19020 (215) 638-9550                                                                                                                                                  |
| EDNALITE CORPORATION                                                                                                                                                                   | ENCYCLOPAEDIA BRITANNICA EDUCATIONAL CORP.                                                                                                                                                                                        |
| 200 North Water Street, Peekskill, NY 10566                                                                                                                                            | ENCYCLOPAEDIA BRITANNICA EDUCATIONAL CORP. 425 N. Michigan Ave., Chicago, IL 60611                                                                                                                                                |
| EDUCATIONAL COMMUNICATION ASSOCIATION INC.<br>National Press Bldg., Room 822, Washington, DC 20004 (202) 393-6267                                                                      | ENERGY TECHNOLOGY, INC., Box Q, Las Cruces, NM 88001 (505) 526-3358 ENG PRODUCTS CORP., Box 42, Scarborough, NY 10510 (914) 762-4800                                                                                              |
| EDUCATIONAL ELECTRONICS DE CALIEORNIA INC                                                                                                                                              | ENTERPRISE ELECTRONICS CORP                                                                                                                                                                                                       |
| 213 N. Cedar Ave., Inglewood, CA 90301                                                                                                                                                 | Box 1216, Enterprise, AL 36330(205) 347-3478                                                                                                                                                                                      |
| EDUCATIONAL RESEARCH ASSOCIATES<br>10,401 Menaul Blvd. N.E., Albuquerque, NM 87112 (505) 293-7986                                                                                      | ENTERTAINMENT VIDEO RELEASING, INC. 1 E. 57th St., New York, NY 10022                                                                                                                                                             |
| EDUTRON, 25 Oak St., Suite 1, Roswell, GA 30075 (404) 992-1626                                                                                                                         | ENTRON INC., Route 79, Morganville, NJ 07751                                                                                                                                                                                      |
| EDUTRONICS/McGRAW HILL                                                                                                                                                                 | FOLIPTO STORAGE SYSTEMS                                                                                                                                                                                                           |
| 3435 Broadway, Kansas City, MO 64111                                                                                                                                                   | 225 South Highland Avenue, Aurora, IL 60507                                                                                                                                                                                       |
| EIGEN VIDEO, P.O. Box 1027, Grass Valley, CA 95945                                                                                                                                     | ERCONA CORP., 2492 Merrick Road, Bellmore, NY 11710(516) 781-2770 ERSKINE-SHAPIRO THEATRE TECHNOLOGY, INC.                                                                                                                        |
| FIMAC (Div. of Varian)                                                                                                                                                                 | 37 West 20th Street, Room 703, New York, NY 10011(212) 929-5380                                                                                                                                                                   |
| 301 Industrial Way, San Carlos, CA 94070                                                                                                                                               | ESPERA-21 INC                                                                                                                                                                                                                     |
| EITEL ELECTRONICS, 211 E. Sheldon, Prescott, AZ 86301 (602) 445-0691                                                                                                                   | 141 S. Maple Ave., So. San Francisco, CA 94080                                                                                                                                                                                    |
| ELCOM ENGINEERING CO                                                                                                                                                                   | Pictures Industries) 222 E. 44th St., New York, NY 10017 (212) 867-4030                                                                                                                                                           |
| P.O. Box 10432<br>Santa Ana, CA 92711                                                                                                                                                  | EUMIG Lake Success Business Park, 225 Community Drive                                                                                                                                                                             |
| ELECTRO CONTROLS                                                                                                                                                                       | Great Neck, NY 11026                                                                                                                                                                                                              |
| 207E C 200 M/ord                                                                                                                                                                       | ELIANDAM LE TUEATRE CURRI VIINC                                                                                                                                                                                                   |
| 0.11.1.03.117.04145                                                                                                                                                                    | EVANSVILLE THEATRE SUPPLY, INC.                                                                                                                                                                                                   |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115       (801) 487-9861         ELECTRO & OPTICAL SYSTEMS, LTD.       (416) 291-4492         3015 Kennedy Rd., Scarborough, Ontario M1V 1E7       (416) 291-4492 | 2274 E. Division St., Evansville, IN 47714       (812) 476-6410         EVENTIDE CLOCKWORKS, INC.       (212) 581-9290         265 West 54th Street, New York, NY 10019       (212) 581-9290                                      |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714       (812) 476-6410         EVENTIDE CLOCKWORKS, INC.       (265 West 54th Street, New York, NY 10019       (212) 581-9290         EVENVIEW TELEVISION SYSTEMS, (Div. Evenview Corp.) |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714       (812) 476-6410         EVENTIDE CLOCKWORKS, INC.       (212) 581-9290         265 West 54th Street, New York, NY 10019       (212) 581-9290                                      |
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| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
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| Salt Lake City, UT 84115   (801) 487-9861                                                                                                                                              | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
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| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, ÍN 47714                                                                                                                                                                                        |
| Salt Lake City, UT 84115                                                                                                                                                               | ## Page 1274 E. Division St., Evansville, IN 47714                                                                                                                                                                                |
| Salt Lake City, UT 84115                                                                                                                                                               | 2274 E. Division St., Evansville, IN 47714                                                                                                                                                                                        |

| DISTRICT OF COLUMBIA (WASHINGTON, D.C.) 1919 M Street N.W., Room 411, Washington, DC 20554 (202) 632-8834 FLORIDA, MIAMI                                                        | FILMAGIC PRODUCTS, INC.<br>204 Fourteenth St., NW, P.O. Box 93584, Atlanta GA 30318 (404) 874-1842<br>FILM/COM, INC., Outer Winthrop Rd., Hallowell, ME 04347 (207) 623-9466     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 919 Federal Bldg., 52 S.W. First Avenue, Miami, FL 33130 (305) 350-5541 FLORIDA, TAMPA Barnett Office Bldg., Rm 809, 1000 Ashley Drive Tampa, FL 33602                          | FILMFAIR COMMUNICATIONS (Div. of FilmFair Inc.) 10900 Ventura Blvd., Studio City, CA 91604                                                                                       |
| GEORGIA, ATLANTA Room 440, Massell Bidg., 1365 Peachtree St. N.E. Atlanta, GA 30309                                                                                             | FILMS, INC., 1144 Wilmette Avenue, Wilmette, IL 60091 (312) 256-4730 FILM TECHNICIANS, LOCAL 683 6721 Melrose Ave., Hollywood, CA 90038 (213) 935-1123                           |
| GEORGIA, SAVANNAH 238 Federal Office Bldg. and Courthouse, 125 Bull Street P.O. Box 8004, Savannah, GA 31402ext. 320 (912) 232-4321                                             | THE FINNEY CO. 34 W. Interstate Street. Bedford, OH 44146                                                                                                                        |
| HAWAII, HONOLULU 502 Federal Bldg., P.O. Box 1021, 335 Merchant Street Honolulu, HI 96808                                                                                       | IMERO FIORENTINO ASSOC. INC. 10 West 66th St., New York, NY 10023. (212) 787-3050 FISHER BERKELEY CORP.                                                                          |
| 3935 Federal Bidg., 230 S. Dearborn St., Chicago, IL 60604(312) 353-0195<br>LOUISIANA, NEW ORLEANS<br>829 F. Edward Hebert Federal Bidg., 600 South Street                      | 5800 Christie Ave., Emeryville, CA 94608                                                                                                                                         |
| New Orleans, LA 70130                                                                                                                                                           | Phoenix, AZ 85003                                                                                                                                                                |
| Baltimore, MD 21201                                                                                                                                                             | FLASH TECHNOLOGY CORP. of AMERICA 55 Lake Street Nashua, NH 03060                                                                                                                |
| 1045 Federal Bidg., 231 W. Lafayette St., Detroit, MI 48226 (313) 226-6078<br>MINNESOTA, ST. PAUL<br>691 Federal Bidg., 316 N. Robert Street, St. Paul, MN 55101 (612) 725-7810 | FLEEHART & SULLIVAN INC. 10109 Aurora Ave. No., Seattle, WA 98133                                                                                                                |
| MISSOURI, KANSAS CITY 1703 Federal Bldg., 601 East 12th St., Kansas City, MO 64106(816) 374-6155 NEW YORK, BUFFALO                                                              | VIDEO CENTER, Union Bldg. Room 330, Tallahassee, FL 32306 (904) 644-1811 FLORIDA VIDEO SYSTEMS, INC. 14422 N.W. 7th Ave., Miami, FL 33168 (305) 688-6618                         |
| 1307 Federal Bldg., 111 W. Huron St. at Delaware Ave. Buffalo, NY 14202                                                                                                         | JOHN FLUKE MFG. CO., INC. Box 43210, Mountlake Terrace, WA 98043                                                                                                                 |
| OREGON, PORTLAND 1782 Federal Office Bldg., 1220 S.W. 3rd Ave. Portland, OR 97204                                                                                               | FORD FOUNDATION, 320 E. 43rd St., New York, NY 10017 (212) 573-5000 FORGEY-LYSEK-HAMLIN One Professional Plaza, Box 256, Newtown, PA 18940 (215) 968-6338 FORSYTHE AUDIO SYSTEMS |
| PENNSYLVANIA, PHILADELPHIA 11425 James A. Byrne Federal Courthouse, 601 Market St., Philadelphia, PA 19106                                                                      | 28 Action St., Watertown, MA 02172 (617) 926-2574 FORT WORTH TOWER CO., INC. Box 8597, Ft. Worth, TX 76112 (817) 457-3060                                                        |
| PUERTO RICO, SAN JUAN U.S. Post Office and Courthouse, Room 323, P.O. Box 2987 San Juan, PR 00903                                                                               | FOUR STATE RADIO SUPPLY CO., INC. P.O. Box 1446, 402 Wall St., Joplin, MO 64801                                                                                                  |
| Room 323, Federal Bldg., 300 Willow St., Beaumont, TX 77701 (713) 838-0271 TEXAS, DALLAS Earle Cabell Federal Bldg., Room 13E7, 1100 Commerce St.                               | San Antonio, TX) 1351 E. Eldorado, Decatur, IL 62525                                                                                                                             |
| Dallas, TX 75242                                                                                                                                                                | TOM FRASER, DIRECTOR, 79 Charles St., New York, NY 10014(212) 242-8300 FRAZIER, INC., 1930 Valley View Lane, Dallas, TX 75234(214) 241-3441 FREELAND PRODUCTS CO.                |
| VIRGINIA, NORFOLK Military Circle, 870 N. Military Hwy., Norfolk VA 23502                                                                                                       | 3233 Conti St., New Orleans, LA 70119                                                                                                                                            |
| FACTS, FIGURES & FILM  30 E. 42nd St., New York, NY 10017                                                                                                                       | 25 Locust St., Haverhill, MA 01830                                                                                                                                               |
| 75 Mall Drive, Commack, NY 11725                                                                                                                                                | Hawthorne, NJ 07506                                                                                                                                                              |
| 18101 Lorain Ave., Cleveland, OH 44111                                                                                                                                          | FRYAN AUDIO VISUAL EQUIPMENT, INC. 4369 Hamann Parkway Willoughby, OH 44094                                                                                                      |
| 4802 Fifth Ave., Pittsburgh, PA 15213                                                                                                                                           | FUJI PHOTO FILM USA, INC.<br>350 Fifth Avenue, New York, NY 10001                                                                                                                |
| FAX CO., 374 South Fair Oaks Ave., Pasadena, CA 91105                                                                                                                           | FUJINON OPTICAL, INC. 672 White Plains Road Scarsdale, NY 10583                                                                                                                  |
| THE FEDERATED GROUP 716 N. La Brea Ave., Hollywood, CA 90038                                                                                                                    | THE FULL CIRCLE ARCHIVE (Div. of The Living Foundation) P.O. Box 4370, Boulder, CO 80306                                                                                         |
| P.O. Drawer 871, Henderson, TX 75652 (214) 854-2405 FERNO-WASHINGTON, INC. 70 Weil Way, Wilmington, OH 45177 (513) 382-1451                                                     | 4 Cours Des Bastions, CH-1205 Geneva, Switzerland                                                                                                                                |
| FERNSCH GROUP/ROBERT BOSCH CORP. 279 Midland Avenue, Saddlebrook, NJ 07662                                                                                                      | G                                                                                                                                                                                |
| 601 West 26th Street<br>New York, NY 10001                                                                                                                                      | G.B.C. CLOSED CIRCUIT TV CORPORATION 315 Hudson Street New York, NY 10013                                                                                                        |
| FIELD ENGINEERING ENTERPRISES 3047 E. Riverview, Bay City, MI 48706                                                                                                             | GC ELECTRONICS, 400 S. Wyman St., Rockford, IL 61101 (815) 968-9661  G.E. LARGE SCREEN (Video Display Equipment Operation) Electronics Park, Building 6-206                      |
| 1113 S. Pearl St., Denver, CO 80210                                                                                                                                             | Syracuse, NY 13221                                                                                                                                                               |

| G.E. LIGHTING BUSINESS GROUP Nela Park                                                                 |  |
|--------------------------------------------------------------------------------------------------------|--|
| Cleveland, OH 44112(216) 226-2121                                                                      |  |
| G.G. COMMUNICATIONS<br>820 Statler Office Bidg., Boston, MA 02116                                      |  |
| GMS, 2025 Gateway Place, San Jose, CA 95110                                                            |  |
| P.O. Box 456. Shelburne Shopping Pk. Shelburne, VT 05482 (802) 985-2922                                |  |
| GTE LENKURT INC., 1105 County Road, San Carlos, CA 94070 (415) 595-3000                                |  |
| GTE SYLVANIA, INC., CATV Equipment and Installation Operation                                          |  |
| 114 South Oregon Street<br>El Paso, TX 79901                                                           |  |
| GTE SYLVANIA INC.                                                                                      |  |
| Lighting Products Group 100 Endicott Street                                                            |  |
| Danvers, MA 01923                                                                                      |  |
| GYRR 1335 South Claudina                                                                               |  |
| Anaheim, CA 92805                                                                                      |  |
| GABRIEL ELECTRONICS, INC., P.O. Box 626<br>Scarborough Industrial Park, Scarborough, ME 04074          |  |
| GAF CORP., 140 W. 51st St., New York, NY 10020                                                         |  |
| 2920 Engle Rd., Ft. Wayne, IN 46809(219) 747-6780                                                      |  |
| THE GALLAGHER REPORT 230 Park Ave., New York, NY 10017                                                 |  |
| GALLERY WEST FILMS, LTD. 630 Oakwood Ave., West Hartford, CT 06110                                     |  |
| GAMCO INDUSTRIES INC., 291 Cox St., Roselle, NJ 07203 (201) 241-7500                                   |  |
| GARDEN STATE AUDIOVISUAL COMPANY, INC.<br>40 Livingston Ave., New Brunswick, NJ 08901 (201) 249-4409   |  |
| <b>GARNER INDUSTRIES</b> 4200 North 48th Street Lincoln, NE 68504                                      |  |
| GARNER PRODUCTIONS                                                                                     |  |
| P.O. Roy 399                                                                                           |  |
| Angwin, CA 94508                                                                                       |  |
| GAW CO., INC., 53 S. Jefferson Rd., Whippany, NJ 07981 (201) 887-7210                                  |  |
| GELECO ELECTRONICS LTD.<br>2 Thorncliffe Park Dr., Unit 28, Toronto, Ont. Canada M4H1H2 (416) 421-5631 |  |
| GENERAL AUDIO-VISUAL, INC. (GAVI)<br>306 Hempstead Avenue, Malverne, NY 11565                          |  |
| GENERAL CARLE CORP                                                                                     |  |
| 500 West Putnam Ave., Greenwich, CT 06830                                                              |  |
| GENERAL ELECTRIC CO Tubes/MW Devices                                                                   |  |
| 316 E. Ninth Street Owensboro, KY 42301                                                                |  |
| GENERAL ELECTRODYNAMICS CORP                                                                           |  |
| 4430 Forest Lane, Garland, TX 75040(214) 276-1161                                                      |  |
| GENERAL ELECTRONIC SYSTEMS, INC.<br>1440 San Pablo Ave., Berkeley, CA 94702                            |  |
| GENERAL MACHINE PRODUCTS CO., INC.<br>3111 Old Lincoln Hwy, Trevose, PA 19047 (215) 357-5500           |  |
| GENERAL SEMICONDUCTOR INDUSTRIES<br>2001 W. 10th Place, Box 3078, Tempe, AZ 85281 (602) 968-3101       |  |
| GENERAL TELEPHONE & ELECTRONICS CORP. One Stamford Forum, Stamford, CT 06904                           |  |
| GENERAL TELEVISION NETWORK (Div. of Meilink Industries)                                                |  |
| 13225 Capital Ave., Oak Park, MI 48237                                                                 |  |
| GETTERNE THE GETTIGE, SON 1957, 11509, 12509                                                           |  |
|                                                                                                        |  |

### General Electric 315-456-2562

LARGE SCREEN TV PROJECTORS

Electronics Park, Building 6-206 Syracuse, NY 13221 315-456-2533 or 315-456-2179

| GENERAL TV NETWORK, (Div. of Meilink Industries, Toledo, OH) 13225 Capital, Oak Park, MI 48237                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | (313) 548-2500                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CENERVE RYSTEMS INC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                         |
| 1180 East Meadow Drive, Palo Alto, CA 94303                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                         |
| GENESEE VIDEO SYSTEMS, INC. 4034 E. Bristol Rd., Flint, MI 48507                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (313) 743-0110                                                                                                                                                                                                                                                                                                                                                                          |
| OCCUPANT COLICATIONAL TV NETWORK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                         |
| 666 Fifth Ave., New York, NY 10019                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                         |
| 1425 E. Bowman St., Wooster, OH 44691                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | (216) 262-2015                                                                                                                                                                                                                                                                                                                                                                          |
| GILBERT ENGINEERING CO. 3700 N. 36th Ave., Phoenix, AZ 85019                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | (800) 528-5567                                                                                                                                                                                                                                                                                                                                                                          |
| ROBERT GILMORE ASSOCIATES, INC. 990 Washington St., Dedham, MA 02026                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                         |
| CLENTRONIX LTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                         |
| 160 Duncan Mill Rd., Don Mills Ont., Canada M3B 1Z5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (617) 375-0392                                                                                                                                                                                                                                                                                                                                                                          |
| GLOBAL VILLAGE, 454 Broome St., New York, NY 10013                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (212) 966-7526                                                                                                                                                                                                                                                                                                                                                                          |
| GOLDBERG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                         |
| 364 West Erie Chicago, IL 60610                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (312) 787-0622                                                                                                                                                                                                                                                                                                                                                                          |
| GOLDBERG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                         |
| 6820 Romaine Hollywood, CA 90038                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (213) 467-3107                                                                                                                                                                                                                                                                                                                                                                          |
| IEEE COLD PRODUCTIONS INC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                         |
| 300 E. 51st St., New York, NY 10022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (212) 759-8785                                                                                                                                                                                                                                                                                                                                                                          |
| GOLDEN WEST VIDEOTAPE DIVISION (Div. of Golden West<br>Broadcasters) 5800 Sunset Blvd., Hollywood, CA 90028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (213) 469-3181                                                                                                                                                                                                                                                                                                                                                                          |
| GOLLEHON INDUSTRIES, INC.<br>209 Front St. N.W., Grand Rapids, MI 49504                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                         |
| ALAN GORDON ENTERPRISES, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                         |
| 1430 North Cahuenga Blvd.<br>Hollywood, CA 90028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (213) 466-3561                                                                                                                                                                                                                                                                                                                                                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                         |
| GORMAN REDLICH MFG. CO, 6 Curtis St., Athens, OH 45701 GOTHAM AUDIO CORP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                         |
| 741 Washington Street, New York, NY 10014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | . (212) 741-7411                                                                                                                                                                                                                                                                                                                                                                        |
| 3631 Perkins Ave., Cleveland, OH 44114                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | . (216) 361-3315                                                                                                                                                                                                                                                                                                                                                                        |
| GRACE AUDIO VIDEO SYSTEMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                         |
| (D) (MALD Correct Co. New York NV)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                         |
| (Div. of W.R. Grace & Co., New York, NY)<br>2910 Kraft Drive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                         |
| 2910 Kraft Drive<br>Nashville, TN 37204                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | . (615) 244-5566                                                                                                                                                                                                                                                                                                                                                                        |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | . (615) 244-5566                                                                                                                                                                                                                                                                                                                                                                        |
| 2910 Kraft Drive Nashville, TN 37204                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                         |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS (Div. of W.R. Grace & Co., New York, NY) 11 Dunwoodie Rd., Suite 128 Atlanta, GA 30341                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | . (404) 393-1885                                                                                                                                                                                                                                                                                                                                                                        |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS (Div. of W.R. Grace & Co., New York, NY) 11 Dunwoodie Rd., Suite 128 Atlanta, GA 30341  GRALEX INDUSTRIES, 155 Marine St., Farmingdale. NY 11735  GRANADA TV INTERNATIONAL LTD. (Div. of Granada TV Ltd./                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | .(404) 393-1885                                                                                                                                                                                                                                                                                                                                                                         |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS (Div. of W. R. Grace & Co., New York, NY) 11 Dunwoodie Rd., Suite 128 Atlanta, GA 30341  GRALEX INDUSTRIES, 155 Marine St., Farmingdale. NY 11735 GRANADA TV INTERNATIONAL LTD. (Div. of Granada TV Ltd./England) 1221 Ave. of the Americas, New York NY 10020                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | .(404) 393-1885<br>.(516) 694-3607<br>.(212) 869-8480                                                                                                                                                                                                                                                                                                                                   |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS (Div. of W.R. Grace & Co., New York, NY) 11 Dunwoodie Rd., Suite 128 Atlanta, GA 30341  GRALEX INDUSTRIES, 155 Marine St., Farmingdale. NY 11735 GRANADA TV INTERNATIONAL LTD. (Div. of Granada TV Ltd./ England) 1221 Ave. of the Americas, New York NY 10020 GRAND IRON WORKS INC. 525 Tiffany St., New York, NY 10474                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | .(404) 393-1885<br>.(516) 694-3607<br>.(212) 869-8480<br>.(212) 328-2600                                                                                                                                                                                                                                                                                                                |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS (Div. of W.R. Grace & Co., New York, NY) 11 Dunwoodie Rd., Suite 128 Atlanta, GA 30341  GRALEX INDUSTRIES, 155 Marine St., Farmingdale. NY 11735  GRANADA TV INTERNATIONAL LTD. (Div. of Granada TV Ltd./England) 1221 Ave. of the Americas, New York NY 10020  GRAND IRON WORKS INC. 525 Tiffany St., New York, NY 10474  GRANDY, INC., 1275 Bloomfield Ave., Fairfield, NJ 07006                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | . (404) 393-1885<br>. (516) 694-3607<br>. (212) 869-8480<br>. (212) 328-2600<br>. (201) 575-1433                                                                                                                                                                                                                                                                                        |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS (Div. of W.R. Grace & Co., New York, NY) 11 Dunwoodie Rd., Suite 128 Atlanta, GA 30341  GRALEX INDUSTRIES, 155 Marine St., Farmingdale. NY 11735 GRANADA TV INTERNATIONAL LTD. (Div. of Granada TV Ltd./ England) 1221 Ave. of the Americas, New York NY 10020 GRAND IRON WORKS INC. 525 Tiffany St., New York, NY 10474 GRANDY, INC., 1275 Bloomfield Ave., Fairfield, NJ 07006 GRAPHIC ARTS ADVERTISING 311 9th St. S.E., Suite A, Roanoke, VA 24013 (703) 342                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | . (404) 393-1885<br>. (516) 694-3607<br>. (212) 869-8480<br>. (212) 328-2600<br>. (201) 575-1433                                                                                                                                                                                                                                                                                        |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS (Div. of W.R. Grace & Co., New York, NY) 11 Dunwoodie Rd., Suite 128 Atlanta, GA 30341  GRALEX INDUSTRIES, 155 Marine St., Farmingdale. NY 11735 GRANADA TV INTERNATIONAL LTD. (Div. of Granada TV Ltd./ England) 1221 Ave. of the Americas, New York NY 10020 GRAND IRON WORKS INC. 525 Tiffany St., New York, NY 10474 GRANDY, INC., 1275 Bloomfield Ave., Fairfield, NJ 07006 GRAPHIC ARTS ADVERTISING 311 9th St. S.E., Suite A, Roanoke, VA 24013                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | .(404) 393-1885<br>.(516) 694-3607<br>.(212) 869-8480<br>.(212) 328-2600<br>.(201) 575-1433<br>2-1104/344-1238<br>.(216) 881-2100                                                                                                                                                                                                                                                       |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS (Div. of W.R. Grace & Co., New York, NY) 11 Dunwoodie Rd., Suite 128 Atlanta, GA 30341  GRALEX INDUSTRIES, 155 Marine St., Farmingdale. NY 11735 GRANADA TV INTERNATIONAL LTD. (Div. of Granada TV Ltd./England) 1221 Ave. of the Americas, New York NY 10020 GRAND IRON WORKS INC. 525 Tiffany St., New York, NY 10474 GRANDY, INC., 1275 Bloomfield Ave., Fairfield, NJ 07006 GRAPHIC ARTS ADVERTISING 311 9th St. S.E., Suite A, Roanoke, VA 24013 GRAPHIC LAMINATING, INC. 5122 St. Clair Ave., Cleveland, OH 44103 GRASIS CORP., 5601 Gardner Ave., Kansas City, MO 64120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | . (404) 393-1885<br>. (516) 694-3607<br>. (212) 869-8480<br>. (212) 328-2600<br>. (201) 575-1433<br>2-1104/344-1238<br>. (216) 881-2100<br>. (816) 483-1100                                                                                                                                                                                                                             |
| 2910 Kraft Drive Nashville, TN 37204  GRACE EDUCATIONAL PRODUCTS (Div. of W.R. Grace & Co., New York, NY) 11 Dunwoodie Rd., Suite 128 Atlanta, GA 30341  GRALEX INDUSTRIES, 155 Marine St., Farmingdale. NY 11735 GRANADA TV INTERNATIONAL LTD. (Div. of Granada TV Ltd./ England) 1221 Ave. of the Americas, New York NY 10020 GRAND IRON WORKS INC. 525 Tiffany St., New York, NY 10474 GRANDY, INC., 1275 Bloomfield Ave., Fairfield, NJ 07006 GRAPHIC ARTS ADVERTISING 311 9th St. S.E., Suite A, Roanoke, VA 24013(703) 342 GRAPHIC LAMINATING, INC. 5122 St. Clair Ave., Cleveland, OH 44103 GRASIS CORP., 5601 Gardner Ave., Kansas City, MO 64120 GRASS-ROOTS TELEVISION P.O. Box 2006, Aspen, CO 81611                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | . (404) 393-1885<br>. (516) 694-3607<br>. (212) 869-8480<br>. (212) 328-2600<br>. (201) 575-1433<br>2-1104/344-1238<br>. (216) 881-2100<br>. (816) 483-1100                                                                                                                                                                                                                             |
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| 598 Deming Rd., Berlin, CT 06037       (203) 828-6361         LIGHTING ELECTRIC OF PENNSYLVANIA         1746 E. Chocolate Avenue       (717) 534-2757         Hershey, PA 17033       (717) 534-2757                                                                                                                                                                                                                                                                                                                                                                                                                                               |

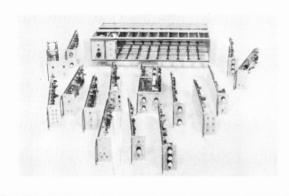


### LENCO ELECTRONICS

A DIVISION OF LENCO, INC.

PHONE (314) 243-3147

319 W. MAIN ST., JACKSON, MISSOURI 63755



| LIGHTNING ELIMINATION ASSOC., INC.                                                              | MC PRODUCTIONS (Ed Marzola & Associates)                                                            |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 12412 Benedict Avenue, Downey, ČA 90242 (213) 923-1268                                          | 8831 Sunset Blvd., Suite 408<br>Hollywood, CA 90069                                                 |
| LINDBERG PRODUCTIONS, INC.<br>49 W. 46th St., New York, NY 10036(212) 582-9060                  | M.M.S. INC., 3665 W. 240th St., Los Angeles, CA 90505 (213) 378-8403                                |
| LINDSAY SPECIALTY PRODUCTS 50 Mary St. West, Lindsay, Ontario, Canada (705) 324-2196            | MPB TECHNOLOGIES, INC., P.O. Box 160 Ste. Anne de Bellevue, Quebec, Canada HQX 3L5(514) 457-2035    |
| LINES AUDIO VIDEO SYSTEMS                                                                       | MPC EDUCATIONAL SYSTEMS, INC.<br>35 Fulton Street, New Haven, CT 06512                              |
| Jefferson at McDaniel                                                                           | MPCS VIDEO INDUSTRIES INC                                                                           |
| Springfield, MO 64806                                                                           | 514 W. 57th St., New York, NY 10019                                                                 |
| J.B. LIPPINCOTT COMPANY                                                                         | M.P. VIDEO INC. 45 Kenneth Street                                                                   |
| E. Washington Square, Philadelphia, PA 19105                                                    | Newton, MA 02161                                                                                    |
| LIPSNER-SMITH CORP., 4700 Chase St., Lincolnwood, IL 60646 (312) 675-8473                       | M.R. COMMUNICATION & CONSULTANTS, INC. (Div. of M.R. Communication & Consultants, Toronto, Ontario) |
| LISTEC TELEVISION EQUIPMENT CORP.                                                               | 60 E. 42nd St., New York, NY 10017(212) 682-1708                                                    |
| 39 Cain Drive Plainview, NY 11803(516) 694-8963                                                 | M/R PRODUCTIONS, INC.<br>117 W. 46th St., New York, NY 10036 (212) 265-6724                         |
| LITA BROADCASTING DISTRIBUTORS  Box 440752, Miami, FL 33144                                     | MSI TELEVISION<br>4788 S. State Street, Salt Lake City, UT 84107(801) 262-8475                      |
| LITTLE BEAVER INC., Box 840, Livingston, TX 77351(713) 327-3121                                 | THE MACHLETT LABORATORIES INC.                                                                      |
| LOCATOR ELECTRONICS CO.<br>South County Industrial Park, St. Louis, MO 63129(314) 894-8000      | 1063 Hope Street, Stamford, CT 06907                                                                |
| LOGAN ELECTRIC SPECIALTY MEG. CO.                                                               | 5507 N. Peck Road, Arcadia, CA 91006                                                                |
| 1431 West Hubbard St., Chicago, IL 60622                                                        | JAMES MADISON UNIVERSITY TELEVISION PRODUCTION CENTER (Div. of Commonwealth of Virginia)            |
| Box 25304, Houston, TX 77005(713) 523-7878                                                      | 201 Harrison Hall, Harrisonburg, VA 22801                                                           |
| THE LONDON COMPANY<br>811 Sharon Drive, Cleveland, OH 44145 (216) 871-8900                      | MAGNACRAFT ELECTRIC CO. 5575 N. Lynch Ave., Chicago, IL 60630                                       |
| LONG ENGINEERING COMPANY<br>961 Burke St., Winston-Salem, NC 27101(919) 725-2306                | MAGNASYNC/MOVIOLA CORP.                                                                             |
| LOUISVILLE PRODUCTIONS (Div. of WHAS, Inc.)                                                     | 5539 Riverton Ave., North Hollywood, CA 91601(213) 763-8441 MAGNA-TECH ELECTRONICS CO., INC.        |
| P.O. Box 1084, Louisville, KY 40201                                                             | 630 Ninth Ave., New York, NY 10036                                                                  |
| LOWEL-LIGHT MFG., INC.<br>421 West 54th Street                                                  | 133 West Seneca Street, Manlius, NY 13104 (315) 682-9105                                            |
| New York, NY 10019                                                                              | MAGNAVOX CONSUMER ELECTRONICS 1700 Magnavox Way, Ft. Wayne, IN 46804                                |
| LOWELL MFG. CO. 3030 Leclede Station Road, St. Louis, MO 63143(314) 781-9058                    | MAGNESONICS MFG. AND SALES CO.<br>P.O. Box 758, Ventura, CA 93001                                   |
| LOWENTHAL MFG., 2076 N. Elston, Chicago, IL 60614(312) 235-4414 THE LOWE-SHELDREW COMPANY, INC. | MAGNETIC AUDIO-VIDEO PRODUCTS (Div. of 3M Co.)                                                      |
| 10 East 106th St., Indianapolis, IN 46280(317) 846-7777                                         | 3M Center, St. Paul, MN 55101                                                                       |
| LUCASEY MFG. CO., INC.                                                                          | 121 La Veta N.E., Albuquerque, NM 87108 (800) 545-6580                                              |
| 2639 East Ninth Street Oakland, CA 94601(415) 534-1435                                          | MAGNETIC MEDIA, 1314 North Lee, Austin, TX 79761 (915) 332-4341 MAGNETIC VIDEO CORPORATION          |
| LUMITROL LTD.<br>400 Don Park Rd., (Unit 23), Markham Ont., Canada L3R 1C6(416) 495-1762        | 23434 Industrial Park Ct., Farmington Hills, MI 48024 (313) 477-6066                                |
| LUTHERAN GENERAL HOSPITAL (Media Services)                                                      | MAIER HANCOCK INDUSTRIES 13212 Raymer Street, North Hollywood, CA 91605 (213) 875-2008              |
| 1775 Dempster, Park Ridge, IL 60068                                                             | MAINE VIDEO SYSTEMS, INC.<br>468 Forest Ave., Portland, ME 04101                                    |
| LUXOR CORP.<br>2245 Delany Road                                                                 | MAIN ST. VIDEO, 246 Main Street, Derby, CT 06418 (203) 735-6203                                     |
| 2245 Delany Road Waukegan, IL 60085                                                             | MAJOR REPRODUCTIONS (Div. of Major Media) 2751 Lake Cook Rd., Deerfield, IL 60015                   |
| 5745 Jefferson Hwy., New Orleans, LA 70123 (504) 733-3400                                       | MALCO ELECTRONICS, 5 Wolcott Av., Lawrence, MA 01843 (617) 685-4383                                 |
| LYON METAL PRODUCTS, INC. P.O. Box 671, Aurora, IL 60507(312) 892-8941                          | CHARLES MALCOLM VIDEO SERVICES<br>515 Superior Ave., Newport Beach, CA 92663 (714) 631-1144         |
|                                                                                                 | P.R. MALLORY & CO., INC., Box 1284, Indianapolis, IN 46201 (317) 636-5353                           |
|                                                                                                 | BRUCE ELLIOTT MALT ASSOCIATES P.O. Box 248986, Coral Gables, FL 33124                               |
| Mc                                                                                              | JOSEPH MAMMEN, INC., 35 E. 10th St., New York, NY 10003 (212) 777-5457                              |
|                                                                                                 | MARATHON STEEL CO.<br>P.O. Box 6598, S. 19th Ave., Phoenix, AZ 85005(602) 252-5971                  |
| McKUNE AUDIO/VISUAL (Div. of Harry McCune Sound Service Inc., San Francisco, CA)                | MARBAUGH ENGINEERING SUPPLY CO., INC.<br>121 W. North St., Indianapolis, IN 46204                   |
| 1773 West Lincoln Ave., Anaheim, CA 92801                                                       | MARCONI COMMUNICATION SYSTEM Marconi House, Chelmsford, Essex, CM1 1PL, England                     |
| 951 Howard St., San Francisco, CA 94103                                                         | MARCONI INSTRUMENTS                                                                                 |
| McCURDY RADIO INDUSTRIES, INC.<br>1711 Carmen Drive, Elk Grove Village, IL 60007 (312) 640-7077 | 100 Stonehurst Ct., Northvale, NJ 07647                                                             |
| McGRAW-HILL FILMS 1221 Ave. of the Americas, New York, NY 10020(212) 997-4409                   | D.L. MARKEY & ASSOCIATES, INC. (Consulting Engineers)                                               |
| McINTIRE CO. (Subsidiary of William Steinen Mfg. Co.)                                           | 3101B W. Harmon Hwy., Peoria, IL 61604                                                              |
| 29 East Halsey Rd., Parsippany, NJ 07054                                                        | 7 Minola Rd., Lexington, MA 02173                                                                   |
| Box 5000, Claremont, CA 91711 (800) 472-1783/(800) 854-7769                                     | MARSHALL ELECTRONICS                                                                                |
| McMARTIN INDUSTRIES, INC.<br>4500 South 76th St., Omaha, NE 68127                               | P.O. Box 2027<br>Culver City, CA 90230(213) 836-4288                                                |
| McQ TELEPRODUCTION SERVICES P.O. Box 1676, San Mateo, CA 94401                                  | MART MAGAZINE, Berkshire Common, Pittsfield, MA 01201 (413) 499-2550                                |
| 1.5. Son 1070, Call Iniator, Ch. Smoth                                                          | MARTEL ELECTRONICS<br>970-A East Orangethorpe Ave., Anaheim, Ca 92801 (714) 871-7102                |
|                                                                                                 | MARTHA STUART COMMUNICATIONS INC                                                                    |
| M                                                                                               | 66 Bank St., New York, NY 10014                                                                     |
|                                                                                                 | MARTI ELECTRONICS, INC.<br>P.O. Box 661, 1501 North Main                                            |
| MCI, INC.                                                                                       | P.O. Box 661, 1501 North Main<br>Cleburne, TX 76031                                                 |
| 4007 Northeast Sixth Ave., Ft. Lauderdale, FL 33334 (305) 566-2853                              | HIGH THE MODIO VIDEO, 320 FF. 30th 5th, 140H 1 0H, 141 100131212/ 041-3000                          |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| MARYLAND CENTER FOR PUBLIC BROADCASTING Owings Mills, MD 21117                                                                                                  | MICRO COMMUNICATIONS, INC. Grenier Field, RFD 3, Manchester, NH 03103(603) 624-4351 MICRO CONSULTANTS, INC.                                         |
| Center for Advanced Engineering Study Room 9-234, Cambridge, MA 02139(617) 253-7444                                                                             | 2483 E. Bayshore Rd., Suite 209, Palo Alto, CA 94303 (415) 321-0832 MICRO CONTROL ASSOCIATES. INC.                                                  |
| MASS COMMUNICATIONS HISTORY CENTER State Historical Society of Wisconsin 816 State St., Madison, WI 53706                                                       | Box 13250, Arlington, TX 76013                                                                                                                      |
| MAST DEVELOPMENT CO.                                                                                                                                            | P.O. Box 1527, 627 Lofstrand Lane, Rockville, MD 20850(301) 762-8500 MICROFLECH CO., INC. 3575 25th Street Southeast, Salem, OR 97302(503) 363-9267 |
| 2212 E. 12th Street Devenport, IA 52803                                                                                                                         | MICROTIME, INC.                                                                                                                                     |
| 7536 Spring Lake Drive, Bethesda, MD 20034                                                                                                                      | 1280 Blue Hills Avenue Bloomfield, CT 06002                                                                                                         |
| TED MATHER PRODUCTIONS 20 Treetop Rd., Ellington, CT 06029                                                                                                      | MICROTAN CO., INC. 141 East Mineola Ave., P.O. Box 236                                                                                              |
| CURTIS MATHES MFG. CO., P.O. Box 151, Athens, TX 75751 (214) 675-2294  MATRIX VIDEO SERVICES 727 11th Ave., New York, NY 10019                                  | Valley Stream, NY 11582                                                                                                                             |
| MAURY MICROWAVE CORP<br>8610 Helms Avenue, Cucamonga, CA 91730                                                                                                  | 3600 Conshohocken Ave., Philadelphia, PA 19131 (215) 879-0900 MICRO VISION SYSTEMS                                                                  |
| MAXELL CORP. OF AMERICA 60 Oxford Drive                                                                                                                         | P.O. Box 1676, San Mateo, CA 94401                                                                                                                  |
| Moonachie, NJ 07074                                                                                                                                             | MICROWAVE FILTER CO., INC.<br>6743 Kinne Street, East Syracuse, NY 13057(315) 437-3953                                                              |
| 225 E. 57th Street, New York, NY 10022 (212) 496-1544 CHARLES MAYER STUDIOS, INC. 168 E. Market Street, Akron, OH 44308 (216) 535-6121                          | MICROWAVE POWER DEVICES, INC. Adams Court, Plainview, NY 11803                                                                                      |
| MEADE ELECTRONICS (Div. of Meade Electric Co., Inc., Chicago, IL)                                                                                               | MID STATE COMMUNICATIONS  174 South First Ave., Beech Grove, IN 46107                                                                               |
| 3100 S. 25th Avenue Broadview, IL 60153                                                                                                                         | MIDWEST TELECOMMUNICATIONS                                                                                                                          |
| MEDIA ACCESS PROJECT 1609 Connecticut Ave. NW, Washington, DC 20006                                                                                             | Virginia Beach, VA 23455 (804) 464-6256                                                                                                             |
| MEDIA ARTS PRODUCTIONS 6501 Winchester Ave., Ventnor, NJ 08406                                                                                                  | MIDWEST TELECOMMUNICATIONS           5200 Mitchelldale, Ste F28           Houston, TX 77092         (713) 686-9278                                  |
| 616 National Ave., Mountain View, CA 94043                                                                                                                      | MIDWEST TELECOMMUNICATIONS                                                                                                                          |
| 559 49th Street S., St. Petersburg, FL 33707                                                                                                                    | 15046 Beltway Drive Dallas, TX 75240                                                                                                                |
| MEDIA DEPARTMENT OF MENTAL RETARDATION INSTITUTE, NEW YORK MEDICAL COLLEGE Valhalla, NY 10595                                                                   | 1804 Cargo Court Louisville, KY 40299                                                                                                               |
| MEDIA FABRICATORS 5071 W. Washington Blvd., Los Angeles, CA 90016 (213) 937-3344                                                                                | MIDWEST TELECOMMUNICATIONS 3331 N.W. 82nd Avenue                                                                                                    |
| MEDIA GROUP TELEVISION (Div. of Moline Gospel Temple)       (309) 764-6411         2305 7th Avenue, Moline, IL 61265                                            | 3331 N.W. 82nd Avenue Miami, FL 33122                                                                                                               |
| MEDIA, INC., 153 WOSTER AVE., New Naveri, CT 00511                                                                                                              | 300 First Avenue, P.O. Box 385<br>Nitro, WV 25143                                                                                                   |
| MEDIA MEANS PRODUCERS The Exchange, Farmington, CT 06032                                                                                                        | MIDWEST TELECOMMUNICATIONS 4937 Harford Avenue                                                                                                      |
| THE MEDIA WORKS, INC. 300 West Washington Ave., Suite #408, Chicago, IL 60606 (312) 332-4441                                                                    | Beltsville, MD 10705                                                                                                                                |
| MEAD TECHNOLOGY LABS 3481 Dayton-Xenia Rd., Dayton, OH 45432                                                                                                    | 1150C West 8th Street Cincinnati, OH 45203                                                                                                          |
| P.O. Box 8463, Rochester, NY 14618(716) 244-2016 MELCO SALES CO.                                                                                                | MIDWEST VISUAL EQUIPMENT CO., INC. 6500 N. Hamlin, Chicago, IL 60645                                                                                |
| 3030 E. Victoria St., Compton, CA 90221 (213) 537-7132/(800) 421-1132<br>MEMOREX CORP.<br>P.O. Box 1000, 1200 Memorex Dr., Santa Clara, CA 95052 (408) 987-1000 | MILADY PUBLISHING CORPORATION 3839 White Plains Rd., Bronx, NY 10467                                                                                |
| MERCHANDISING, One Astor Plaza, New York, NY 10036                                                                                                              | 6000 E. Evans Ave., Bldg. 3, Suite G10, Denver, CO 80222 (303) 759-5841 MILES ASSOCIATES                                                            |
| MERLIN ENGINEERING WORKS, INC. 1880 Embarcadero Rd., Palo Alto, CA 94303                                                                                        | 240 Birmingham St., Toronto, Ont., Canada, M8V 2C8 (416) 251-1705 MILLARD METAL SERVICE CENTER, INC.                                                |
| MERRILL CABLE EQUIPMENT CO. 2949 W. Osborn Rd., Phoenix, AZ 85002                                                                                               | Box O, Braintree, MA 02184                                                                                                                          |
| CHARLES MERRILL PUBLISHING COMPANY (Div. of Bell & Howell) 1300 Alum Creek Dr., Columbus, OH 43216                                                              | BARNEY MILLERS, INC. (213) 466-5105                                                                                                                 |
| METCALFE FILM & VIDEO 3709 Locksley Dr., Birmingham, AL 35223                                                                                                   | 232 E. Main St., Lexington, KY 40507                                                                                                                |
| METRO DATA CORP.<br>2150 North 107th, Suite 120, Seattle, WA 98*33 (206) 367-2100                                                                               | George Washington Hwy., Danbury, CT 06810                                                                                                           |
| METROPOLITAN ELECTRIC MFG. CO. 25 Knickerbocker Ave., Brooklyn, NY 11237                                                                                        | MINICOM DIVISION, 3M COMPANY<br>3M Center Bldg., 223-5E, St. Paul, MN 55101 (612) 736-0389                                                          |
| 670 National Ave., Mountain View, CA 94043                                                                                                                      | MINNEAPOLIS MAGNETICS, INC.                                                                                                                         |
| 1220 E. Imperial Ave., El Segundo, CA 90245                                                                                                                     | Minneapolis, MN 55416                                                                                                                               |
| 2995 Ladybird Lane, Dallas, TX 75220                                                                                                                            | 6660-1 Shingle Creek Pkwy., Braoklyn Center, MN 55430 (612) 560-3410                                                                                |

| MINOLTA CORP., 101 Williams Drive, Ramsey, NJ 07446.  MINORITY MEDIA ACTION GROUP (Div. of Diocesan Communica tions Center) 74 Kalidena Rd., Morristown, NJ 07960.  MISSISSIPPI SCHOOL SUPPLY CO., INC. 4155 Industrial Drive, Jackson, MS 39205.  MITCHELL CAMERA CORP. 11630 Tuxford St., Sun Valley, CA 91352.  MOBILE TELEVISION ASSOCIATES, LTD. Rte. 45 & Knowles Rd., Lake Villa, IL 60046.  MOBILE-VIDEO PRODUCTIONS, INC. 7315 Wisconsin Ave., Suite 1018E, Washington, DC 20014.  MODERN TALKING PICTURE SERVICE, INC. 2323 New Hyde Park Rd., New Hyde Park, NY 11040.  MODULAR AUDIO PRODUCTS, (A Unit of Modular Devices, Inc.) 50 Orville Drive, Airport International Plaza Bohemia, NY 11716.  MOEN MEDIA 2135 Enterprise La Crosse, WI 54601.  MOHAWK WIRE & CABLE CORP. 9 Mohawk Drive, Leominster, MA 01453.  MOLE-RICHARDSON CO. 937 N. Sycamore Ave., Hollywood, CA 90038. | (201) 540-8452<br>(601) 948-8600<br>(213) 768-6400<br>(312) 223-2706<br>(301) 656-2525<br>(516) 437-6300<br>(516) 567-9620<br>(608) 784-7180<br>(617) 537-9961 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| THE MONEY MACHINE P.O. Box 23355, Nashville, TN 37202                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (800) 251-2058                                                                                                                                                 |
| MONITOR c/o SEM MEDIA SERVICE CORP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                |
| 6 E. 43rd Street, New York, NY 10003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (212) 082-0700                                                                                                                                                 |
| MONROE ELECTRONICS, INC. 100 Housel Avenue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                |
| Lyndonville, NY 14098                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (716) 765-2254                                                                                                                                                 |
| MONTANA STATE UNIVERSITY TV CENTER Bozeman, MT 59717                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (406) 994-3437                                                                                                                                                 |
| MONUMENTAL FILMS AND RECORDINGS INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                |
| 2160 Rockrose Avenue., Baltimore, MD 21211                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                |
| 234 S.E. 12th Ave., Portland, OR 97214                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | . (503) 233-5621                                                                                                                                               |
| MOORE VIDEO (Div. of Moore on Main)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                |
| 1607 W. Main Street Richmond, Va 23220                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (804) 353-7400                                                                                                                                                 |
| MOSELEY ASSOC., INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                |
| 111 Castilian Drive, Goleta, CA 93017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | . (805) 968-9621                                                                                                                                               |
| MOTION PICTURE EDITORS GUILD<br>Room 100, 7715 W. Sunset Blvd., Hollywood, CA 90046                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | . (213) 876-4770                                                                                                                                               |
| MOTION PICTURE EXPORT ASSOC. OF AMERICA 522 Fifth Ave., New York, NY 10036                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | . (212) 867-1200                                                                                                                                               |
| MOTION PICTURE SCREEN CARTOONISTS 12441 Ventura Blvd., Studio City, CA 91604                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | . (213) 766-7151                                                                                                                                               |
| MOTION PICTURE SCREEN CARTOONISTS 25 W. 43rd Street, New York, NY 10036                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (212) 354-6410                                                                                                                                                 |
| MOTION PICTURE STUDIO ELECTRICAL TECHNICIANS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |
| 3400 Barham Blvd., Hollywood, CA 90068                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                |
| 6640 Sunset Blvd., Ste 110, Hollywood, CA 90028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                |
| 12754 Ventura Blvd., No. Hollywood, CA 91604                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | . (213) 984-3000                                                                                                                                               |
| MOTOROLA COMMUNICATIONS & ELECTRONICS, INC. 1301 E. Algonquin Rd., Schaumburg, IL 60196                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | . (312) 576-7000                                                                                                                                               |
| MOTOROLA SPI, Box 20912, Phoenix, AZ 85036                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | . (602) 949-3033                                                                                                                                               |
| 4825 N. Scott Street, Suite 23<br>Schiller Park, IL 60176                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | //312) 671-1565                                                                                                                                                |
| MORTRONICS LINE CONTROL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                |
| 2567 38th Avenue, Oakland, CA 84601                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | . (415) 533-3340                                                                                                                                               |
| MULTICAST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                |
| 100 Merrick Rd., Rockville Centre, NY 11570                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | . (516) 764-5516                                                                                                                                               |
| MULTIMEDIA FORUM PRODUCTIONS IN CROWN CENTER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |
| 2450 Grand Avenue, Suite 400<br>Kansas City, MO 64108                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | . (816) 274-8321                                                                                                                                               |
| MULTIPLEX DISPLAY FIXTURE CO.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,                                                                                                                        |
| 1555 Larkin Williams Rd., Fenton, MO 63026                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | . (314) 343-5700                                                                                                                                               |
| MULTIPLIER INDUSTRIES CORP. 464 So. 10th Avenue, Mount Vernon, NY 10550                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | . (914) 699-0990                                                                                                                                               |
| MULTIVISION P.O. Box 16236, Roland Park Sta., Baltimore, MD 21210                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | . (301) 476-5792                                                                                                                                               |
| MULTIVISION, 31 Old Randolph St., Canton, MA 02021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | . (617) 828-8866                                                                                                                                               |
| MULTRONICS, INC.<br>9005 Red Branch Rd., Columbia, MD 21045                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | . (301) 730-1122                                                                                                                                               |
| MUNDAY & COLLINS, INC.<br>P.O. Box 5669, 270 Willow St., San Jose, CA 95150                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                |
| F.O. DOX 0003, 270 WILLIAM St., Sall JUSE, CA 33150                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                |
| MUTUAL AIDS, 1953 1/2 Hillhurst Ave., Los Angeles, CA 90027                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | . (213) 661-4503                                                                                                                                               |

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| NAB HIGHLIGHTS, 1771 N St. NW, Washington, DC 20036(202) 293-3500 NAEB LETTER                                        |
| 1346 Connecticut Ave. NW, Washington, DC 20036(202) 785-1100                                                         |
| 1346 Connecticut Ave. NW, Washington, DC 20036 (202) 785-1100                                                        |
| 2 N. Riverside Plaza, Suite 222, Chicago, IL 60606                                                                   |
| Suite 1150, 1730 Pennsylvania Ave. NW<br>Washington DC 20006                                                         |
| NATESA SCOPE, 5908 S. Troy St., Chicago, IL 60629 (312) 476-6363                                                     |
| <b>NEC AMERICA, INC.</b> 160 Martin Lane, Elk Grove Village, IL 60007(312) 640-3750                                  |
| NEC TELEPHONES, INC., 65 Seacliff Ave., Glen Cove, NY 11542 (516) 671-7400 N.T.I. AMERICA, INC.                      |
| 1680 N. Vine St., Hollywood, CA 90028                                                                                |
| NVS SYSTEMS, INC. 4609 Business Park Blvd., Anchorage, AK 99503(907) 279-5571                                        |
| NABET, ASSOC. OF FILM CRAFTSMEN 1800 N. Argyle, Suite 501, Hollywood, CA 90028. (213) 462-7484                       |
| NAGRA MAGNETIC RECORDERS, INC.                                                                                       |
| 19 W. 44th St., Rm 715, New York, NY 10036                                                                           |
| P.O. Box 289, McLean, VA 22101                                                                                       |
| NANOTEC 414 Hilman Place Solana Beach, CA 92075                                                                      |
| THE NARDA MICROWAVE CORP. 75 Commercial St., Plainview, NY 11803. (516) 433-9000                                     |
| NARDO'S VIDEO WORLD                                                                                                  |
| 891 Bucknell St., Philadelphia, PA 19130                                                                             |
| 291 South La Cienega Blvd., Beverly Hills, CA 90211                                                                  |
| DuPont Circle Bldg., 1346 Connecticut Ave. NW<br>Washington, DC 20036                                                |
| NATIONAL ASSOCIATION OF MANUFACTURERS (NAM) 1776 F St. NW, Washington, DC 20006(202) 331-3700                        |
| NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS (NARUC)                                                     |
| 1102 I.C.C. Bldg., P.O. Box 684, Washington, DC 20044 (202) 628-7324 NATIONAL ASSOCIATION OF TELEVISION & ELECTRONIC |
| SERVICE ASSOCIATIONS (NATESA) 5908 S. Troy St., Chicago, IL 60629                                                    |
| NATIONAL ASSOCIATION OF TELEVISION PROGRAM EXECU-<br>TIVES INC. (NATPE)                                              |
| Box 5272, Lancaster, PA 17601                                                                                        |
| 1500 Broadway, New York, NY 10036                                                                                    |

### FRED A. NUDD CORPORATION

Route 104 Ontario, New York 14519 (315) 524-2531



**MONO-POLES** 

| NATIONAL AUDIO VISUAL ASSOCIATION INC. (MAYA)                                                                      | RUDERT ME IN A                                                                                                            |
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| NATIONAL AUDIO-VISUAL ASSOCIATION INC. (NAVA)<br>3150 Spring St., Fairfax, VA 22030                                | RUPERT NEVE, INC., Berkshire Industrial Park, Bethel, CT 06801                                                            |
| NATIONAL AUDIOVISUAL CENTER (Div. of National Archives                                                             | NEWARK ELECTRONICS, 500 N. Pulaski Rd., Chicago, IL 60624(312) 638-4411                                                   |
| and Record Service) Washington, DC 20409                                                                           | NEW ENGLAND TOWER, Brandon, VT 05733(802) 247-5725                                                                        |
| 2027 Massachusetts NW, Washington, DC 20036 (202) 797-7473                                                         | NEWCOMB AUDIO PRODUCTS CO.<br>12881 Bradley Avenue, Sylmar, CA 93065 (213) 367-1921                                       |
| NATIONAL BROADCASTERS CLUB<br>1737 DeSales St. NW, Washington, DC 20036(202) 638-3535                              | NEW ENGLAND WHOLESALE SUPPLY INC                                                                                          |
| NATIONAL CABLE TELEVISION INSTITUTE                                                                                | 57 Harvey Rd., Londonberry, NH 03053                                                                                      |
| P.O. Box 27277, Denver, CO 80227                                                                                   | NEWMAN VISUAL EDUCATION, INC.<br>400 32nd Street S.E., Grand Rapids, MI 49508(616) 243-3300                               |
| NATIONAL CAMERA EXCHANGE<br>9010 Olson Memorial Hwy., Minneapolis, MN 55427(612) 546-6831                          | NEWMAN VISUAL EDUCATION, INC.                                                                                             |
| NATIONAL CINE EQUIPMENT, INC.                                                                                      | 134 Manchester Ave., Highland Park, MI 48203 (313) 868-4120 NEWSPAPER ADVERTISING BUREAU INC.                             |
| 4140 Austin Blvd., P.O. Box 326, Island Park, NY 11558                                                             | 485 Lexington Ave., New York, NY 10017 (212) 557-1800                                                                     |
| 1028 Connecticut Ave. NW, Washington, DC 20036(202) 466-8407                                                       | THE NEWSPAPER GUILD<br>1125 15th St. NW, Washington, DC 20005                                                             |
| NATIONAL COUNCIL OF CHURCHES, COMMUNICATIONS                                                                       | NEW TRIER TELEVISION                                                                                                      |
| (BFC FILMS) 475 Riverside Dr., Room 860<br>New York, NY 10027                                                      | 385 Winnetka Ave., Winnetka, IL 60093(312) 446-9440                                                                       |
| NATIONAL EDUCATION ASSOCIATION                                                                                     | NEW WORLDS VIDEO 1660 Woodley Rd., Washington, DC 20008 (202) 966-0109                                                    |
| 1201 16th St. NW, Washington, DC 20036                                                                             | NEW YORK INSTITUTE OF TECHNOLOGY                                                                                          |
| 15760 Ventura Blvd., Encino, CA 91436                                                                              | Old Westbury, NY 11568                                                                                                    |
| NATIONAL ELECTRICAL MANUFACTURERS ASSOC. (NEMA) 2101 L St. NW, Washington, DC 20037(202) 457-8400                  | 1321 Connecticut Ave. NW, Washington, DC 20036(202) 296-0009                                                              |
| NATIONAL ELECTROLAB LTD                                                                                            | NICHOLSON-MUIR PRODUCTIONS, INC.<br>138 Chatsworth Ave., Larchmont, NY 10538 (914) 834-3005                               |
| 1536 Columbia St., North Vancouver, BC Canada V7J 1A4 (604) 985-0511                                               | NICHOLSON PRODUCTS CO.                                                                                                    |
| NATIONAL ELECTRONIC DISTRIBUTORS ASSOC. (NEDA)<br>3525 W. Peterson Ave., Chicago, IL 60659                         | 3403 Cahuenga Blvd., Los Angeles, CA 90068                                                                                |
| NATIONAL FILM BOARD OF CANADA                                                                                      | NIGHTINGALE-CONANT CORP.<br>3730 West Devon Avenue, Chicago, IL 60659                                                     |
| 1251 Ave. of the Americas, New York, NY 10020. (212) 586-2400 NATIONAL FIRE PROTECTION ASSOCIATION                 | FRED A NILES COMMUNICATIONS CENTERS, INC.                                                                                 |
| 470 Atlantic Ave., Boston, MA 02210                                                                                | 240 W. 60th Street, New York, NY 10023                                                                                    |
| NATIONAL GEOGRAPHIC EDUCATIONAL SERVICES (National Geographic Society) Dept. 78 Washington DC 20036 (202) 857-7000 | NORTH AMERICAN PHILIPS CORP. 100 E. 42nd Street                                                                           |
| NATIONAL HONORARY BROADCASTING SOCIETY                                                                             | New York, NY 10017(212) 697-3600                                                                                          |
| ALPHA EPSILON RHO — College of Journalism University of South Carolina, Columbia, SC 29208                         | NORTH AMERICAN RADIO CORP.                                                                                                |
| NATIONAL INDUSTRY ADVISORY COMMITTEE (NIAC)                                                                        | 1300 E. Arapaho Rd. 203, Richardson, TX 75081 (214) 690-1615<br>NORTH AMERICAN VIDEO                                      |
| FCC, 1919 M St. NW, Washington, DC 20554 (202) 632-7007                                                            | 423 E. 90th Street, New York, NY 10028 (212) 369-2552                                                                     |
| NATIONAL MEDICAL AUDIOVISUAL CENTER Statin K, Atlanta, GA 30324(404) 881-3021                                      | NORTH-EAST VIDEO AND SOUND, INC./IMAGE PRODUC-<br>TION, INC., 287 Kenyon St., Stratford, CT 06497 (203) 377-1444          |
| NATIONAL MUNICIPAL LEAGUE                                                                                          | NORTH HILLS ELECTRONICS INC                                                                                               |
| 47 E. 68th St., New York, NY 10021                                                                                 | Alexander Place, Glen Cove, NY 11542                                                                                      |
| National Press Bldg., 529 14th St. NW, Washington, DC 20045 (202) 737-2500                                         | NORTH LAKE ENGINEERING, IN€.<br>999 Anita Ave., Antioch, IL 60002                                                         |
| NATIONAL RADIO BROADCASTERS ASSOCIATION (NRBA)                                                                     | NORTHWEST ELECTRONICS, INC.                                                                                               |
| 1705 DeSales St. NW, Washington, DC 20036(202) 466-2030 NATIONAL RETAIL MERCHANTS ASSOCIATION                      | P.O. Box 3047 E., 730 First Ave., Spokane, WA 99220 (509) 535-7652<br>NORTH-WEST INDUSTRIES, INC.                         |
| 100 W. 31st St., New York, NY 10001                                                                                | 5518 Empire Way S. Seattle, WA 98118 (206) 725-1400                                                                       |
| NATIONAŁ SAFETY COUNCIL<br>425 N. Michigan Ave., Chicago, IL 60611                                                 | NORTHWEST MATERIALS, INC., Box 30, Bryan, OH 43506 (419) 737-2358                                                         |
| NATIONAL SCHOOL FURNITURE CORP                                                                                     | NORTHWEST MONITORING SERVICE P.O. Box 1042, Pendleton, OR 97801                                                           |
| Box 1569, Hollywood, FL 33020                                                                                      | NORTHWEST TELEPRODUCTIONS                                                                                                 |
| 12636 Beatrice St., Los Angeles, CA 90066                                                                          | 4455 W. 77th St., Minneapolis, MN 55435                                                                                   |
| THE NATIONAL TELEPHONE SUPPLY COMPANY                                                                              | NORTON ASSOCIATES, INC.                                                                                                   |
| 5100 Superior Ave., Cleveland, OH 44113                                                                            | 10 Ditomas Court, Copaique, NY 11726                                                                                      |
| 330 Washington St., Marina del Rey, CA 90291 (213) 821-1020                                                        | NORTRONICS CO., INC.                                                                                                      |
| NATIONAL TRANSLATOR ASSOCIATION P.O. Box 11306, Salt Lake City, UT 84147(801) 524-2623                             | 8101 Tenth Avenue North Minneapolis, MN 55427                                                                             |
| NATIONAL VIDEO INDUSTRIES                                                                                          | NOTES FROM THE CENTER (Cable Television Information Center)                                                               |
| 15 W. 17th St., New York, NY 10011                                                                                 | 2100 M St. N.W., Washington, DC 20037(202) 872-8888<br>NOVA COMMUNICATIONS, INC.                                          |
| NATIONAL VIDEO LISTING SERVICE<br>P.O. Box 290, Rt. 1, Elgin, IL 60120                                             | 104 E. 37th St., New York, NY 10016(212) 683-7444                                                                         |
| NATIONAL VIDEO MARKETING, INC.<br>1 E. 57th Street, New York, NY 10022                                             | NOVA CORP., Box 2121, Canoga Park, CA 91306(213) 888-5122                                                                 |
| NATIONAL VIDEO SERVICES                                                                                            | FRED A. NUDD CORP.                                                                                                        |
| 3 Pembroke Rd., Danbury, CT 06810                                                                                  | Box 1743, Rt. 104<br>Ontario, NY 14519                                                                                    |
| NATIONWIDE ELECTRONIC SYSTEMS, INC.<br>1536 Brandy Parkway, Streamwood, IL 60103 (312) 289-8820                    | NURAD, INC., 2165 Druid Park Drive, Baltimore, MD 21211 (301) 462-1700                                                    |
| NATIVE AMERICAN PUBLIC BROADCASTING                                                                                |                                                                                                                           |
| Box 83111, Lincoln, NE 68501                                                                                       | 0                                                                                                                         |
| Box 83111, Lincoln, NE 68501(402) 472-3611                                                                         | 0                                                                                                                         |
| NEFF COMMUNICATIONS INC.                                                                                           | OAK INDUSTRIES ING (O. L. CATHARIA                                                                                        |
| 9721 Singleton Dr., Bethesda, MD 20034                                                                             | OAK INDUSTRIES, INC. (Oak CATV Div.)  Crystal Lake, IL 60014                                                              |
| 3200 Eisenhower Pkwy., Ann Arbor, MI 48104 (313) 971-0031                                                          | O'CONNOR ENGINEERING LABORATORIES, INC.                                                                                   |
| THE NETWORK FOR CONTINUING MEDICAL EDUCATION 15 Columbus Circle, New York, NY 10023(212) 541-8086                  | 100 Kalmus Drive, Irvine Industrial Complex                                                                               |
| NEUMADE PRODUCTS CORP.                                                                                             | Costa Mesa, CA 92626                                                                                                      |
| P.O. Box 568, 720 White Plains Rd., Scarsdale, NY 10583 (914) 725-4900                                             | 1516 W. Magnolia Blvd., Burbank, CA 91506(213) 846-2819                                                                   |
| P.K. NEUSES INC.<br>1401 Rohlwing Rd., Rolling Meadows, IL 60008(312) 253-6555                                     | OFFICE OF TELECOMMUNICATIONS POLICY, EXECUTIVE OF-                                                                        |
| NEUTRON ELECTRONICS, 309 Washington, Glencoe, IL 60022 (312) 835-1920                                              | FICE OF THE PRESIDENT, 1800 G St., Washington, DC 20504 (202) 395-5800 OHIO STATE UNIVERSITY, MEDICAL AUDIO VISUAL AND TV |
| NEVADA AUDIO VISUAL SERVICES, INC.<br>3062 Sheridan St., Las Vegas, NV 89102                                       | CENTER, School of Allied Medical Professions Bldg.                                                                        |
|                                                                                                                    | 1583 Perry St., Rm. 243, Columbus, OH 43210                                                                               |

| COMPANY TO THE PROPERTY OF THE |
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| OHIO UNIV. TELECOMMUNICATIONS CENTER Radio-TV Communications Bldg., Athens, OH 45701                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| OKTEL CORP., 490 Division St., Campbell, CA 95008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| OLESEN, 1535 Ivar Ave., Hollywood, CA 90028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| GUNNAR A. OLSEN CORP.<br>120 Bayside, Port Washington, NY 11050                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| OLSON ANDERSON COMPANY<br>106 S. McLellan St., Bay City, MI 48706                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| OLSON ELECTRONICS (Div. of Teledyne, Inc., Los Angeles, CA) 4101 N. Milwaukee Ave., Chicago, IL 60641 (312) 545-8487                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| OMNILCOM ASSOCIATES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 300 Tremont St., Newton, MA 02158(617) 969-3751                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| ONAN COPP (Open Div.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 1400 73rd Avenue N.E., Minneapolis, MN 55432 (612) 574-5000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| ONE PASS VIDEO, INC., 900 3rd St., San Francisco, CA 94107 (415) 777-5777                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| ONTARIO EDUC. COMMUNICATIONS AUTHORITY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2180 Yonge St., Toronto, Ont. M4S 2C1, Canada                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| OPAMP LABS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 1022 North Sycamore Avenue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Los Angeles, CA 90038(213) 934-3566                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| OPTEY INC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 5526 E. La Palma Ave., Anaheim, CA 92807                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| OPTICAL COATING LABORATORY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| P.O. Box 1599, Santa Rosa, CA 95402(707) 545-6440                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| OPTICAL RADIATION CORP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 6352 North Irwindale Ave., Azusa, CA 91702                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| OPTIMEDIA SYSTEMS, INC.<br>1080 Rte. 46, Clifton, NJ 07013                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| ORA VISUAL CO., INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| P.O. Box 11150, St. Petersburg, FL 33733                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| ORANGE COUNTY ELECTRONICS CORP., LTD.<br>1125 Empress St., Winnipeg, Manitoba R3E 3HI Canada (204) 775-8151                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| ORANGEBURG PLASTICS CO.<br>2101 E. Washington Blvd., Los Angeles, CA 90021 (213) 749-1473                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| ORBAN ASSOC. INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 645 Bryant Street, San Francisco, CA 94107                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| OREGON AV SYSTEMS COMPANY, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 7056 N.E. Glisan St., Portland, OR 97213                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| OREGON MAGNETICS, Box 13374, Portland, OR 97213 (503) 233-8295                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| OREGON SOUND & LIGHTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 1856 E. 13th Ave., Eugene, OR 97403(503) 344-2333                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

### Opamp Labs Inc. 213-934-3566

1033 North Sycamore Avenue

Los Angeles, CA 90038

| ORIOLO FILM STUDIOS, INC.<br>50 E. 42nd St., New York, NY 10017                        | 12) 986-5682  |
|----------------------------------------------------------------------------------------|---------------|
| ORION ENTERPRISES<br>8625 Langhelm Rd., El Cajon, CA 92021(7                           | 14) 443-7593  |
| ORROX CORP.<br>3303 Scott Blvd., Santa Clara, CA 95050                                 | 08) 988-2000  |
| OSAWA AND CO. USA, INC.<br>521 Fifth Ave., New York, NY 10017 (212) 687-55             | 35/687-5539   |
| OTARI CORP.  981 Industrial Road San Carlos, CA 94070                                  | 115) 593-1648 |
| San Carlos, CA 94070  OVERSEAS WRITERS  National Press Bldg., Washington, DC 20045  (2 |               |
| OXBERRY, 180 Broad St., Carlstadt, NJ 07072                                            |               |

| P                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P/H ELECTRONICS<br>117 E. Helena St., Dayton, OH 45405                                                                                                                                                                                                                                                                                                                 |
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| PACIFIC RECORDERS & ENG. CORP.  11100 Roselle Street San Diego, CA 92121                                                                                                                                                                                                                                                                                               |
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50 Meadowlands Parkway, Secaucus, NJ 07094, (201) 348-7627 New York:

425 E. Algonquin Rd., Arlington Heights, IL 60005, (312) 364-7936 Chicago:

Newcraft/Panasonic, 8383 Wilshire Blvd., Beverly Hills, CA 70211, (213) 655-1111 Los Angeles:

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| Panasonic Video Systems 50 Meadowlands Parkway, Secaucus, NJ 07094 (201) 348-7627           | 5615 Howard Avenue, Chicago, IL 60648                                                         |
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| Panasonic Video Systems                                                                     |                                                                                               |
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| WESTERN SALES OFFICE Newcraft, Inc.                                                         | Arlington, VA 22201                                                                           |
| 8383 Wilshire Blvd., Beverly Hills, CA 70211 (213) 655-1111                                 | PERSPECTIVE FILMS                                                                             |
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| PANOS PRODUCTIONS                                                                           | THE PETERSEN COMPANY                                                                          |
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| PARAMOUNT COMMUNICATIONS                                                                    | 91 McKee Drive                                                                                |
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| PARAMOUNT OXFORD FILMS                                                                      | PHILIPS BROADCAST EQUIPMENT                                                                   |
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| P.O. Box 748, Winter Haven, FL 33880 (813) 324-3696                                         | PHILIPS ELECTRONICS LTD. 601 Milner Ave., Scarborough, Ontario, M1B 1M8, Canada(416) 292-5161 |
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| 82 Pawnee Rd., New Britain, PA 18901                                                        | PHOTOGRAPHIC SPECIALTIES                                                                      |
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| netics, Inc., Mamaroneck, NY) 730 Third Ave., 24th Floor, New York, NY 10017       | . (212) 682-0995 |
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| <b>RADIO SUPPLY COMPANY, INC.</b> (Div. of VTR Center) 131 Laura Wichita, KS 67211                                                                                                                                                                                                                                                                                                                                             |
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| 955 Venture Ct., Sacramento, CA 95825                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                        |
| 124 East 124th Street, New York, NY 10035                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                        |
| 1415 Boston-Providence Turnpike, Norwood, MA 02060                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (800) 225-9874                                                                                                                                                                                                                                                                                         |
| R-COLUMBIA PRODUCTS CO., INC. 2008 St. Johns Avenue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (212) 422 7015                                                                                                                                                                                                                                                                                         |
| Highland Park, IL 60035                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                        |
| 200 Park Ave., New York, NY 10017  JIMMY REA ELECTRONICS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                        |
| 540 W. Broad St., Columbus, OH 43215                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (614) 221-1625                                                                                                                                                                                                                                                                                         |
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| RECORDING SUPPLY CO. (Div. of Polyline Corp.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                        |
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| REEL IMAGES, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (1007/00 00=1                                                                                                                                                                                                                                                                                          |
| 456 Monroe Turnpike<br>Monroe, CT 06468                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | (203) 261-5022                                                                                                                                                                                                                                                                                         |
| REEVES AUDIO VISUAL SYSTEMS, INC. (Div. of Reeves Teletape Corp.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                        |
| 708 Third Ave., New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                        |
| 708 3rd Avenue, New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                        |
| 1185 Virginia Ave., N.E., Atlanta, GA 30306                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (404) 874-8436                                                                                                                                                                                                                                                                                         |
| RELIANCE ALIDIO VISUAL CORPORATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                        |
| 550 W. 43rd St., New York, NY 10036                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                        |
| 108-18 Queens Boulevard, Forest Hills, NY 11375                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (212) 544-9800                                                                                                                                                                                                                                                                                         |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (213) 445-5955                                                                                                                                                                                                                                                                                         |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (213) 445-5955                                                                                                                                                                                                                                                                                         |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (213) 445-5955                                                                                                                                                                                                                                                                                         |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (213) 445-5955                                                                                                                                                                                                                                                                                         |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (213) 445-5955(312) 677-3000(813) 961-4290                                                                                                                                                                                                                                                             |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624  RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030  REY BLEOSTAT CO. INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | (213) 445-5955<br>(312) 677-3000<br>(813) 961-4290<br>(404) 373-7743                                                                                                                                                                                                                                   |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624  RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030  REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (213) 445-5955<br>(312) 677-3000<br>(813) 961-4290<br>(404) 373-7743<br>(516) 379-1030                                                                                                                                                                                                                 |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (213) 445-5955<br>(312) 677-3000<br>(813) 961-4290<br>(404) 373-7743<br>(516) 379-1030<br>(213) 982-2630                                                                                                                                                                                               |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624  RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030  REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575  REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (213) 445-5955<br>(312) 677-3000<br>(813) 961-4290<br>(404) 373-7743<br>(516) 379-1030<br>(213) 982-2630<br>(615) 824-1735                                                                                                                                                                             |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605 RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (213) 445-5955<br>(312) 677-3000<br>(813) 961-4290<br>(404) 373-7743<br>(516) 379-1030<br>(213) 982-2630<br>(615) 824-1735<br>(213) 786-2441                                                                                                                                                           |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624  RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Mediock Road, Decatur, GA 30030  REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575  REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605  RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075  RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | (213) 445-5955<br>(312) 677-3000<br>(813) 961-4290<br>(404) 373-7743<br>(516) 379-1030<br>(213) 982-2630<br>(615) 824-1735<br>(213) 786-2441<br>(404) 832-7001                                                                                                                                         |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624  RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030  REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575  REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605.  RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075  RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404  RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117  RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953                                                                                                                                                           |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030.  REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605. RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117 RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2 RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207                                                                                                                                             |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624  RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030  REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575  REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605.  RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075  RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404  RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117  RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2 RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895                                                                                                                               |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turrpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605. RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117 RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2. RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017 RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272 THE RIPLEY CO. INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070                                                                                                                 |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605. RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117. RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2. RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017 RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272 THE RIPLEY CO., INC. 46 Nooks Hill Rd., Cromwell, CT 06416                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070(203) 635-2200                                                                                                   |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605. RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117 RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2. RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017 RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272 THE RIPLEY CO., INC. 46 Nooks Hill Rd., Cromwell, CT 06416                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070(203) 635-2200(812) 423-5436                                                                                     |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turrpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605. RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117 RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2. RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017 RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272 THE RIPLEY CO., INC. 46 Nooks Hill Rd., Cromwell, CT 06416 RISLEY ELECTRONICS, INC. 2233 W. Franklin St., Evansville, IN 47712 RIVERS ASSOCIATES INC., Box 58, Leominster, MA 01453                                                                                                                                                                                                                                                                                                                                                                                                           | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070(203) 635-2200(812) 423-5436(617) 537-4821                                                                       |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605. RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117 RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2. RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017 RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272 THE RIPLEY CO., INC. 46 Nooks Hill Rd., Cromwell, CT 06416 RISLEY ELECTRONICS, INC. 2233 W. Franklin St., Evansville, IN 47712 RIVERS ASSOCIATES INC., Box 58, Leominster, MA 01453 ROAD RUNNER CAMERA CRANE CARS 1029 Fisher Bldg., Detroit, MI 48202                                                                                                                                                                                                                                                                                                                                        | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070(203) 635-2200(812) 423-5436(617) 537-4821(313) 875-5724                                                         |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605 RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117 RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2 RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017 RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272 THE RIPLEY CO., INC. 46 Nooks Hill Rd., Cromwell, CT 06416 RISLEY ELECTRONICS, INC. 2233 W. Franklin St., Evansville, IN 47712 RIVERS ASSOCIATES INC., Box 58, Leominster, MA 01453 ROAD RUNNER CAMERA CRANE CARS 1029 Fisher Bldg., Detroit, MI 48202 JOHN ROBERT PRODUCTIONS (Div. of John Robert Associa                                                                                                                                                                                                                                                                                     | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070(203) 635-2200(812) 423-5436(617) 537-4821(313) 875-5724 attes)(415) 392-8408                                    |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605. RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117. RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2. RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017 RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272 THE RIPLEY CO., INC. 46 Nooks Hill Rd., Cromwell, CT 06416 RISLEY ELECTRONICS, INC. 2233 W. Franklin St., Evansville, IN 47712 RIVERS ASSOCIATES INC., Box 58, Leominster, MA 01453 ROAD RUNNER CAMERA CRANE CARS 1029 Fisher Bldg., Detroit, MI 48202 JOHN ROBERT PRODUCTIONS (Div. of John Robert Associal 186 Francisco St., San Francisco, CA 94133 ROBINS BROADCAST & SOUND EQUIP. CORP. 75 Austin Blvd., Commack, NY 11725                                                                                                                                                             | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070(203) 635-2200(812) 423-5436(617) 537-4821(313) 875-5724(415) 392-8408(516) 543-5200                             |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624  RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030  REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575  REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605.  RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075  RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404  RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117  RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2. RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada  RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017  RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272  THE RIPLEY CO., INC. 46 Nooks Hill Rd., Cromwell, CT 06416  RISLEY ELECTRONICS, INC. 2233 W. Franklin St., Evansville, IN 47712  RIVERS ASSOCIATES INC., Box 58, Leominster, MA 01453  ROAD RUNNER CAMERA CRANE CARS 1029 Fisher Bldg., Detroit, MI 48202  JOHN ROBERT PRODUCTIONS (Div. of John Robert Associa 186 Francisco St., San Francisco, CA 94133  ROBINS BROADCAST & SOUND EQUIP. CORP. 75 Austin Blvd., Commack, NY 11725  ROBOT RESEARCH INC. 7591 Convoy Ct., San Diego, CA 92111  ROCHESTER INSTITUTE OF TECHNOLOGY                                                   | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070(203) 635-2200(812) 423-5436(617) 537-4821(313) 875-5724(415) 392-8408(516) 543-5200                             |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605. RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117 RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2. RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017 RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272 THE RIPLEY CO., INC. 46 Nooks Hill Rd., Cromwell, CT 06416 RISLEY ELECTRONICS, INC. 2233 W. Franklin St., Evansville, IN 47712 RIVERS ASSOCIATES INC., Box 58, Leominster, MA 01453 ROAD RUNNER CAMERA CRANE CARS 1029 Fisher Bldg., Detroit, MI 48202 JOHN ROBERT PRODUCTIONS (Div. of John Robert Associa 186 Francisco St., San Francisco, CA 94133 ROBINS BROADCAST & SOUND EQUIP. CORP. 75 Austin Blvd., Commack, NY 11725 ROBOT RESEARCH INC. 7591 Convoy Ct., San Diego, CA 92111 ROCHESTER INSTITUTE OF TECHNOLOGY Media Production Center 1 Lomb Memorial Drive, Rochester, NY 14623 | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070(203) 635-2200(812) 423-5436(617) 537-4821(313) 875-5724 stes)(415) 392-8408(516) 543-5200(714) 279-9430         |
| RESDEL ENGINEERING CORP., Arcadia, CA 91105.  RESEARCH TECHNOLOGY, INC. 4700 Chase Avenue Lincolnwood, IL 60646.  RESOURCE, INC. 13902 N. Dale Mabry, Tampa, FL 33624 RESOURCES FOR EDUCATION AND MANAGEMENT, INC. 544 Medlock Road, Decatur, GA 30030 REX RHEOSTAT CO., INC. 149 Babylon Turnpike, Roosevelt, NY 11575 REYNOLDS/LETERON 13425 Wyandotte St., North Hollywood, CA 91605. RHOADES NATIONAL CORP. Box 817, Hendersonville, TN 37075 RICHARD MFG. CO., P.O. Box 2910, Van Nuys, CA 91404 RICHARDS & ASSOCIATES INC. P.O. Box 400, Carrollton, GA 30117 RICHMOND HILL LABS 1080 Bellamy Rd., Scarborough, Ontario M1H 1H2. RICHMOND SOUND DESIGN, LTD. 1234 W. 6th Ave., Vancouver, B.C. V6H 1A5 Canada RIDDLE VIDEO-FILM PRODUCTIONS, INC. 507 Fifth Ave., New York, NY 10017 RILUMA COMPANY OF AMERICA P.O. Box 366, Pacific Palisades, CA 90272 THE RIPLEY CO., INC. 46 Nooks Hill Rd., Cromwell, CT 06416 RISLEY ELECTRONICS, INC. 2233 W. Franklin St., Evansville, IN 47712 RIVERS ASSOCIATES INC., Box 58, Leominster, MA 01453 ROAD RUNNER CAMERA CRANE CARS 1029 Fisher Bldg., Detroit, MI 48202  JOHN ROBERT PRODUCTIONS (Div. of John Robert Associa 186 Francisco St., San Francisco, CA 94133 ROBINS BROADCAST & SOUND EQUIP. CORP. 75 Austin Blvd., Commack, NY 11725 ROBOT RESEARCH INC. 7591 Convoy Ct., San Diego, CA 92111 ROCHESTER INSTITUTE OF TECHNOLOGY Media Production Center                                           | (213) 445-5955(312) 677-3000(813) 961-4290(404) 373-7743(516) 379-1030(213) 982-2630(615) 824-1735(213) 786-2441(404) 832-7001(416) 431-2953(604) 736-7207(212) 697-5895(213) 454-4070(203) 635-2200(812) 423-5436(617) 537-4821(313) 875-5724(415) 392-8408(516) 543-5200(714) 279-9430(716) 475-2411 |

| ROCKWELL INTERNATIONAL-COLLINS BROADCAST PRODUC<br>P.O. Box 10462, Dallas, TX 75207                                                                                                                                                                                                                                                                                                                                                                                                                                     | TS                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| RODELCO ELECTRONICS CORP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | . (214) 996-5424                                                                                                                             |
| 356A Comac Road, Deer Park, NY 11729                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | . (212) 643-5110                                                                                                                             |
| ROGERS ELECTRONICS 7079 West Laredo Ave., Las Vegas, NV 89107                                                                                                                                                                                                                                                                                                                                                                                                                                                           | . (702) 876-4111                                                                                                                             |
| ROH CORPORATION 107 Technology Park, Norcross, GA 30092                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | . (404) 449-0873                                                                                                                             |
| ROHDE & SCHWARZ SALES CO., INC.<br>14 Gloria Lane, Fairfield, NJ 07006                                                                                                                                                                                                                                                                                                                                                                                                                                                  | . (201) 575-0750                                                                                                                             |
| ROH'S, INC., 4553 E. Broadway, Tucson, AZ 85711                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | . (602) 795-8573                                                                                                                             |
| ROLL-A-REEL, 7881 Reading Rd., Cincinnati, OH 45237                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | . (513) 761-8500                                                                                                                             |
| ROMBEX PRODUCTIONS CORPORATION (Div. of DuArt Film Labs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                              |
| 245 W. 55th St., New York, NY 10019                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | . (212) 757-3681                                                                                                                             |
| ROSCOR CORP., 6160 Oakton, Morton Grove, IL 60053                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | . (312) 966-3010                                                                                                                             |
| DOSS CAPENEY INC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                              |
| 21 W. 46th St., New York, NY 10036                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | . (212) 582-3744                                                                                                                             |
| ROSS VIDEO LTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                              |
| P.O. Box 220, 9 Plaza Dr., Iroquois, Ontario K0E 1K0, Canada                                                                                                                                                                                                                                                                                                                                                                                                                                                            | . (613) 652-4889                                                                                                                             |
| THE ROTARY CO., INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                              |
| 1746 Dale Road                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                              |
| Buffalo, NY 14225                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                              |
| Dullulo, III ITEEO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | . (716) 894-4425                                                                                                                             |
| LEE BOTHBERG PRODUCTIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                              |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                              |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (212) 759-0822                                                                                                                               |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017 ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211                                                                                                                                                                                                                                                                                                                                                                                         | (212) 759-0822                                                                                                                               |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017  ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211                                                                                                                                                                                                                                                                                                                                                                                        | (212) 759-0822                                                                                                                               |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017  ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211.  JACK ROURKE PRODUCTIONS P.O. Box 1705, Burbank, CA 91507                                                                                                                                                                                                                                                                                                                             | (212) 759-0822                                                                                                                               |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017.  ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211.  JACK ROURKE PRODUCTIONS P.O. Box 1705, Burbank, CA 91507.  DANNY ROUZER STUDIO 7022 Melrose Ave., Hollywood, CA 90038.                                                                                                                                                                                                                                                              | (212) 759-0822(213) 657-1402(213) 843-4839                                                                                                   |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017.  ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211.  JACK ROURKE PRODUCTIONS P.O. Box 1705, Burbank, CA 91507.  DANNY ROUZER STUDIO 7022 Melrose Ave., Hollywood, CA 90038.  RUBERT NEVE INC.                                                                                                                                                                                                                                            | (212) 759-0822<br>(213) 657-1402<br>(213) 843-4839<br>(213) 936-2494                                                                         |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017 ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211  JACK ROURKE PRODUCTIONS P.O. Box 1705, Burbank, CA 91507  DANNY ROUZER STUDIO 7022 Melrose Ave., Hollywood, CA 90038  RUBERT NEVE, INC. Berkshire Industrial Park, Bethel, CT 06801                                                                                                                                                                                                    | (212) 759-0822<br>(213) 657-1402<br>(213) 843-4839<br>(213) 936-2494<br>(203) 744-6230                                                       |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017.  ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211.  JACK ROURKE PRODUCTIONS P.O. Box 1705, Burbank, CA 91507.  DANNY ROUZER STUDIO 7022 Melrose Ave., Hollywood, CA 90038.  RUBERT NEVE, INC. Berkshire Industrial Park, Bethel, CT 06801.  RUSSCO ELECTRONICS MFG. INC. 1070 Brookhaven Dr., Clovis, CA 93612.                                                                                                                         | (212) 759-0822<br>(213) 657-1402<br>(213) 843-4839<br>(213) 936-2494<br>(203) 744-6230<br>(209) 299-2167                                     |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017.  ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211.  JACK ROURKE PRODUCTIONS P.O. Box 1705, Burbank, CA 91507.  DANNY ROUZER STUDIO 7022 Melrose Ave., Hollywood, CA 90038.  RUBERT NEVE, INC. Berkshire Industrial Park, Bethel, CT 06801.  RUSSCO ELECTRONICS MFG. INC. 1070 Brookhaven Dr., Clovis, CA 93612.  RUST CORPORATION, P.O. Box 273, Everett, MA 02149.                                                                     | (212) 759-0822<br>(213) 657-1402<br>(213) 843-4839<br>(213) 936-2494<br>(203) 744-6230<br>(209) 299-2167<br>(617) 389-3380                   |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017.  ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211.  JACK ROURKE PRODUCTIONS P.O. Box 1705, Burbank, CA 91507.  DANNY ROUZER STUDIO 7022 Melrose Ave., Hollywood, CA 90038.  RUBERT NEVE, INC. Berkshire Industrial Park, Bethel, CT 06801.  RUSSCO ELECTRONICS MFG. INC. 1070 Brookhaven Dr., Clovis, CA 93612.  RUST CORPORATION, P.O. Box 273, Everett, MA 02149.                                                                     | (212) 759-0822<br>(213) 657-1402<br>(213) 843-4839<br>(213) 936-2494<br>(203) 744-6230<br>(209) 299-2167<br>(617) 389-3380                   |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017.  ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211.  JACK ROURKE PRODUCTIONS P.O. Box 1705, Burbank, CA 91507.  DANNY ROUZER STUDIO 7022 Melrose Ave., Hollywood, CA 90038.  RUBERT NEVE, INC. Berkshire Industrial Park, Bethel, CT 06801.  RUSSCO ELECTRONICS MFG. INC. 1070 Brookhaven Dr., Clovis, CA 93612.  RUST CORPORATION, P.O. Box 273, Everett, MA 02149. F.B. RYAN MANUFACTURING CO., INC. P.O. Box 451, Chariton, IA 50049. | (212) 759-0822<br>(213) 657-1402<br>(213) 843-4839<br>(213) 936-2494<br>(203) 744-6230<br>(209) 299-2167<br>(617) 389-3380<br>(515) 774-5981 |
| LEE ROTHBERG PRODUCTIONS 311 E. 47th St., New York, NY 10017.  ROUNDTABLE FILMS, INC. 113 N. San Vicente, Beverly Hills, CA 90211.  JACK ROURKE PRODUCTIONS P.O. Box 1705, Burbank, CA 91507.  DANNY ROUZER STUDIO 7022 Melrose Ave., Hollywood, CA 90038.  RUBERT NEVE, INC. Berkshire Industrial Park, Bethel, CT 06801.  RUSSCO ELECTRONICS MFG. INC. 1070 Brookhaven Dr., Clovis, CA 93612.  RUST CORPORATION, P.O. Box 273, Everett, MA 02149.                                                                     | (212) 759-0822<br>(213) 657-1402<br>(213) 843-4839<br>(213) 936-2494<br>(203) 744-6230<br>(209) 299-2167<br>(617) 389-3380<br>(515) 774-5981 |

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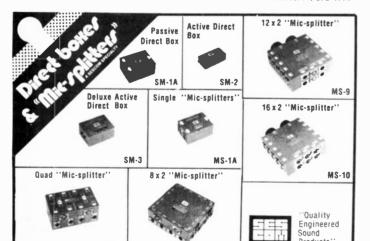
| SC ELECTRONICS, INC.<br>530 Fifth Ave., N.W., St. Paul, MN 55112      |
|-----------------------------------------------------------------------|
| S-L FILM PRODUCTIONS                                                  |
| Box 41108, Los Angeles, CA 90041                                      |
| SMPTE JOURNAL, 862 Scarsdale Ave., Scarsdale, NY 10583 (914) 472-6606 |
| S.O.S. PHOTO-CINE OPTICS INC.                                         |
| 315 W. 43rd St., New York, NY 10036(212) 586-1420                     |



| SSAC INC., Box 395, Liverpool, NY 13088                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 622-1000                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| (Div. of Sony Corp. and Video Corp. of America)<br>500 William Tree Rd., Leonia, NJ 07607 (201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ) 947-6450                                                                                                           |
| SADELCO, INC., 299 Park Avenue, Weehawken, NJ 07087 (201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ) 866-0912                                                                                                           |
| SAKI MAGNETICS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                      |
| 1649 12th Street Santa Monica, CA 90404                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ) 450-1551                                                                                                           |
| SALENGER EDUCATIONAL MEDIA<br>1635 12th Street, Santa Monica, CA 90404                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 393-0311                                                                                                             |
| SALES & MARKETING EXECUTIVES INTERNATIONAL 380 Lexington Ave., New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                      |
| SALESCASTER DISPLAYS CORPORATION 1010 E. Elizabeth Ave., Linden, NJ 07036 (201                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                      |
| SALZBURG ENTERPRISES, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                      |
| Atrium Bldg., 98 Cutter Mill Rd., Great Neck, NY 11021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 487-4515                                                                                                             |
| 4300 West 62nd St., Indianapolis, IN 46268                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 298-5400                                                                                                             |
| SAMIGON DIVISION/ARGRAPH CORPORATION 111 Asia Place, Carlstadt, NJ 07072                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 939-7722                                                                                                             |
| ROBERT SANDE, INC.<br>18152 Sunburst St., Northridge, CA 91325                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 349-7050                                                                                                             |
| SANDLER INSTITUTIONAL INTERNATIONAL FILMS 7449 Melrose Ave., Los Angeles, CA 90046                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                      |
| SANSUI ELECTRONICS CORPORATION 55-11 Queens Boulevard, Woodside, NY 11377 (212)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                      |
| 55-11 Queens Boulevard, Woodside, NY 11377 (212)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 779-5300                                                                                                             |
| SANYO ELECTRIC, INC. (Communications Products/Flectronics Division)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                      |
| SANYO ELECTRIC, INC. (Communications Products/Electronics Division) 1200 West Artesia Boulevard Compton, CA 90220                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 537-5830                                                                                                             |
| SANYO ELECTRIC, INC. (Communications Products/Electronics Division) 1200 West Artesia Boulevard Compton, CA 90220                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 537-5830                                                                                                             |
| SANYO ELECTRIC, INC.           (Communications Products/ Electronics Division)           1200 West Artesia Boulevard         (213)           Compton, CA 90220         (213)           SATCHIDANANDA ASHRAM YOGAVILLE, INC.         P.O. Box 108, Pomfret Center, CT 06259         (203)           SATIN BY OSAWA, 521 Fifth Ave., New York, NY 10017         (212)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 974-1006                                                                                                             |
| SANYO ELECTRIC, INC. (Communications Products/Electronics Division) 1200 West Artesia Boulevard Compton, CA 90220. (213) SATCHIDANANDA ASHRAM YOGAVILLE, INC. P.O. Box 108, Pomfret Center, CT 06259 (203) SATIN BY OSAWA, 521 Fifth Ave., New York, NY 10017 (212) SAWYER INDUSTRIES INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 974-1006<br>687-5535                                                                                                 |
| SANYO ELECTRIC, INC.           (Communications Products/ Electronics Division)           1200 West Artesia Boulevard         (213)           Compton, CA 90220         (213)           SATCHIDANANDA ASHRAM YOGAVILLE, INC.         (203)           P.O. Box 108, Pomfret Center, CT 06259         (203)           SATIN BY OSAWA, 521 Fifth Ave., New York, NY 10017         (212)           SAWYER INDUSTRIES, INC.         (254)           5649 Peck Road, Arcadia, CA 91006         (213)           SAXTON PRODUCTS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 974-1006<br>687-5535<br>442-5981                                                                                     |
| SANYO ELECTRIC, INC.         (Communications Products/ Electronics Division)           1200 West Artesia Boulevard         (213)           Compton, CA 90220         (213)           SATCHIDANANDA ASHRAM YOGAVILLE, INC.         (203)           P.O. Box 108, Pomfret Center, CT 06259         (203)           SATIN BY OSAWA, 521 Fifth Ave., New York, NY 10017         (212)           SAWYER INDUSTRIES, INC.         (249)           5649 Peck Road, Arcadia, CA 91006         (213)           SAXTON PRODUCTS, INC.         (215)           215 North Route 303, Congers, NY 10920         (914)           SCALA RADIO CORP. ELECTRONIC MANUFACTURERS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 974-1006<br>687-5535<br>442-5981<br>268-6846                                                                         |
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| HACK SWAIN PRODUCTIONS, INC.<br>P.O. Box 10235, 1185 Cattlemen Rd., Sarasota, FL 33578 (813) 371-236                                             |          |
| SWENSON PRODUCTIONS 40 Winsor Pl., Glen Ridge, NJ 07028                                                                                          |          |
| SWIDERSKI FLECTRONICS INC                                                                                                                        |          |
| 1200 Greenleaf Ave., Elk Grove Village, IL 60007                                                                                                 |          |
| 5555 North Elston Avenue, Chicago, IL 60630                                                                                                      | 0        |
| 1087 Plainfield Ave., Plainfield, NJ 07060 (201) 561-6876/561-6888<br>SYNSOR CORPORATION                                                         | 8        |
| 2927 112th St. S.W., Everett, WA 98204                                                                                                           | 7        |
| SYNTHA/VISION (Div. of Mathematical Applications Group, Inc.)<br>3 Westchester Plaza, Elmsford, NY 10523                                         | 3        |
| SYSTEM ASSOCIATES 6117 Reseda Blvd., Ste 205, Reseda, CA 91335                                                                                   |          |
| SYSTEM CONCEPTS INC. 395 Ironwood Dr., Salt Lake City, UT 84115                                                                                  |          |
| SYSTRON-DONNER, 10 Systron Dr., Concord, CA 94518 (415) 682-6161                                                                                 | }        |
| 11250-7 Roger Bacon Drive, Reston, VA 22090                                                                                                      |          |
| New York.         (212) 246-0176           Washington DC         (703) 471-7887                                                                  | j        |
| T                                                                                                                                                |          |
| TDK ELECTRONICS CORPORATION                                                                                                                      |          |
| 755 Eastgate Blvd., Garden City, NY 11530(516) 746-0880                                                                                          |          |
| T.E.S.T. INC., 16130 Stagg St., Van Nuys, CA 91406                                                                                               |          |
| 100 N. Strong Ave., Lindenhurst, NY 11757       (516) 842-5000         TM SYSTEMS, INC., 25 Allen St., Bridgeport, CT 06604       (203) 366-4571 |          |
| TOA ELECTRONICS, INC.                                                                                                                            |          |
| 1023 Grandview Dr., San Francisco, CA 94080       (415) 468-0910         TOCOM, INC., 3301 Royalty Row, Irving, TX 75062       (214) 438-7691    |          |
| TSC DEVELOPMENT LABORATORIES 2217 Purdue Ave., Los Angeles, CA 90064                                                                             |          |
| TT ELECTRONICS, INC.                                                                                                                             |          |
| 2214 Barry Avenue, Los Angeles, CA 90064                                                                                                         |          |
| TV-FILM FILEBOOK 164 Oakridge Dr., Scarborough, Ont. M1M 2A8, Canada(416) 261-8140                                                               |          |
| TV FILM SOURCE BOOKS<br>30 E. 42nd St., Suite 1211, New York, NY 10017 (212) 687-1668                                                            |          |
| TV GUIDE, Radnor, PA 19088                                                                                                                       |          |



Precision Video Distribution Amplifier

| (212) 924-0320                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | TELECOMMUNICATIONS INDUSTRIES LTD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TV PRO-LOG, 150 Fifth Ave., New York, NY 10011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 6335 Homewood Ave., Ste 204, Los Angeles, CA 90028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| TABER MFG. AND ENGINEERING CO.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1204-1216 National Press Bldg., Washington, DC 20045(202) 347-2004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 2081 Edison Avenue San Leandro, CA 94577                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TELECOMMUNICATIONS TECHNOLOGY 555 Del Rey Ave., Sunnyvale, CA 94086                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| THE PARTY OF THE P | TELECONCEPTS IN COMMUNICATIONS, INC.<br>145 E. 49th St., New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| TAD PRODUCTS CORPORATION 135 Cabot Street, Beverly, MA 01915                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | TELECTRO SYSTEMS CORPORATION (212) 651-8900 96-18 43rd Avenue, Corona, NY 11368 (212) 651-8900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 279 E. 44th St., New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TELEDYNE CAMERA SYSTEMS 131 North 5th Avenue, Arcadia, CA 91006                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| TALKING PICTURES<br>302 W. Cary St., Richmond, VA 23220                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | THE STANK SMEDOV CVCTEMO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| TALLAHASSEE CAMERA CENTER, INC. 117 N. Monroe St., Tallahassee, FL 32301                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 110 W. Timonium Rd., Timonium, MD 21093(301) 252-8220                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| TAMPA MANUFACTURING INSTITUTE 619 Emerald Lane, Holmes Beach, FL 33510 (813) 778-4722                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 51 E. 42nd St., New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| TANDBERG OF AMERICA, INC.  Labriola Court, Armonk, NY 10504                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | TELEMATION, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| TANDON DUY OF UNITED VENTURES INC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | P.O. Box 15068 Salt Lake City, UT 84115                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2323 H Bluemound Rd., Waukesha, WI 53186                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TELEMATRIX VIDEOTAPE PRODUCTIONS, INC. 5635 W. 80th St., Indianapolis, IN 46278                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 2810 S. 24th St., Phoenix, AZ 85034                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TELEMET DIV. OF GEOTEL INC.  185 Divor Ave. Amityville, Long Island, NY 11701                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| TAP PRODUCTIONS, INC. (Div. of Bruce Butte Assoates/ TAP Productions, Inc.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | TELEQUEST, INC., P.O. Box 25, Princeton, NJ 08540 (609) 799-2105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Sentry Hill Rd., Roxbury, CT 06783                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | TELEPHONE & DATA PRODUCTS, INC.<br>401 Washington Blvd., Mundelein, IL 60060                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| TAPE PRODUCTIONS, INC.,<br>60 E. 42nd St., New York, NY 10017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | TELEPHONE SALES & SERVICE CO. 25 De Forest St., Amityville, NJ 11701                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| TAPEATHON CORPORATION 502 South Isis Street, Inglewood, CA 90301                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | TELEPROMPTER MANHATTAN PRODUCTIONS (Div. of Tele-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| TAPEX CORPORATION Box 246, West Des Moines, IA 50265 (515) 274-3087                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | prompter Manhattan Cable TV)<br>5120 Broadway, New York, NY 10034 (212) 942-7200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| TAPEMAKER, 629 W. Merrick Rd., Valley Stream, NY 11582 (516) 561-6080                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | TELESCRIPT, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 2219-L S. 48th St., Tempe, AZ 85282(609) 905-5250                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 20 Insley Street Demarest, NJ 07627                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TAYLOREEL CORPORATION Box 114 (Murray St.), Rochester, NY 14601                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | TELESTRATOR DIVISION, INTERAND CORPORATION 450 East Ohio Street, Chicago, IL 60611                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| TEAC, Box 750, Montebello, CA 90640                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TELETRONICS INTERNATIONAL INC. (Div. of Video Corp. of America) 231 East 55 St., New York, NY 10022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 2518 North Blvd., P.O. Box 66824, Houston, TX 77006                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | THE THROUGH AND CONTROL OF THE CONTR |
| TECH LABORATORIES, INC. Bergen and Edsall Blvds., Palisades Park, NJ 07650 (201) 944-2221                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2440 S. Wolf Rd., Des Plaines, IL 60018                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| TECH SYSTEMS CORPORATION 401 Watertown Rd., Thomaston, CT 06787                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 122 Agency Ave., Richmond, VA 23225                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TECHNAMICS CO., 2232 Gardner Station, St. Louis, MO 63109 (314) 832-9640                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TELEVISION ASSOCIATES 2410 Charleston Rd., Mountain View, CA 94040                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| TECHNICAL APPLIANCE CORPORATION One Taco St., Sherburne, NY 13460                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | TELEVISION BUREAU OF ADVERTISING INC. (TvB) 1345 Ave. of the Americas, New York, NY 10019(212) 397-3456                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| TECHNICAL AUDIO PRODUCTS CORPORATION 3810 148th Ave. NE, Redmond, WA 98052                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | TELEVISION CENTER OF BROOKLYN COLLEGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| TECHNICAL MIDUCTRICS INC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 018 Whitehead Hall, Bedford Ave. & Ave H<br>Brooklyn, NY 11210                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 6000 Peachtree Rd., N.E., Atlanta, GA 30341                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | TELEVISION & COMPUTER DIV., FRONTIER ENGINEERING CORP., P.O. Box 265, Florham Park, NJ 07932 (201) 822-3030                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 401 Spence Lane, Nashville, TN 37210                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | TELEVISION DIGEST with CONSUMER ELECTRONICS 1836 Jefferson Pl. NW, Washington, DC 20036 (202) 872-9200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| TECHNICAL SERVICES COMPANY<br>514 Granville Dr., Winston-Salem, NC 27101 (919) 725-4803                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| TECHNICAL VIDEO SYSTEMS 245 Executive Park Blvd.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | TELEVISION ENGINEERING CURPORATION 519 Rudder Rd., Fenton, MO 63026                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 245 Executive Park Bivo. Winston-Salem, NC 27103                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | P.O. Box 260, South Salem, NY 10590                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TECHNOVATIONS, P.O. Box 25183, Portland, OR 97225 (503) 292-6370                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | TELEVISION FACTBOOK<br>1836 Jefferson Pl. NW, Washington, DC 20036 (202) 872-9200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| TEKNEKRON, INC., 2121 Allston Way, Berkeley, CA 94704 (415) 548-4100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | TELEVISION INDEX, 150 Fifth Ave., New York, NY 10011 (212) 924-0320                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TEKTONE SOUND & SIGNAL MANUFACTURERS 1331 S. Killian Dr., Lake Park, FL 33403(305) 844-2383                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | TELEVISION INFORMATION OFFICE (TIO) 745 Fifth Ave., New York, NY 10022(212) 759-6800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| TEKTRONIX INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | TELEVISION INTERNATIONAL P.O. Box 2430, Hollywood, CA 90028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| P.O. Box 500<br>Beaverton, OR 97077                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TELEVISION PRODUCTION SERVICES CORPORATION<br>30 W. Maple Ave., Bound Brook, NJ 08805 (201) 469-5743/356-1359                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| TEL-A-SCENE, 1121 N. McCadden, Hollywood, CA 90038 (213) 464-0288                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | TELEVISION PRODUCTS CO., INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| TEL-A-TRAIN, INC.<br>3661 Brainerd Rd., Suite 208, Chattanooga, TN 37411                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0040 Autotion Poulouard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| TELCIN INC 2604 Malt Ave., Commerce, CA 90040 (213) 726-2811                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Inglewood, CA 90301                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TELCO AMERICAN, P.O. Box 10207, Knoxville, TN 37919                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | TELEVISION/RADIO AGE<br>1270 Ave. of the Americas, New York, NY 10020(212) 757-8400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 1163 King Road, Burlington, Ont. Canada L7R 3X5 (416) 681-2450                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | TELEVISION TECHNOLOGY CORPORATION 5970 West 60th Street, Arvada, CO 80003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| TEL-EQUIPMENT COMPANY, INC.<br>11573 Frankstown Rd., Pittsburgh, PA 15235(412) 731-8850                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | TELEVISUAL (Div. of Dave Beatty Studios) 1414 S. Fifth, Springfield, IL 62703                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| TELE-CINE INC., 5434 Merrick Rd., Massapequa, NY 11758 (516) 798-2828 TELE-MEASUREMENTS, INC., 145 Main Ave., Clifton, NJ 07014 (201) 473-8822                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | TELEVICONANIUNICATIONS INC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| TO E TIME OVETENS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 9600 Aldrich Avenue South, Minneapolis, MN 55420                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 553 W. Golf Rd., Arlington Heights, IL 60005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8831 Sunset Blvd., Los Angeles, CA 90069(213) 652-8100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 985 Madison Ave., Paterson, NJ 07051                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | TELSTAR PRODUCTIONS, INC.<br>366 North Prior Avenue, St. Paul, MN 55104 (612) 644-4726                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| TELE-VUE OPTICS INC.<br>15 Green Hill Lane, Spring Valley, NY 10977 (914) 354-4262                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | TELTEK, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| TELECINE FILM STUDIOS INC. (Vocational Film Div.) 100 S. Northwest Hwy., Park Ridge, IL 60068                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | North 12316 Fairwood Dr. 53<br>Spokane, WA 99218                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| TEL COOMMAN INTO ATTOM TO TONAT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | TEMPO AUDIVISION INC., 290 Larkin St., Buffalo, NY 14210 (716) 855-2032                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Place des Nations, 1211, Geneva 20, Switzerland                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| TOYO OPTICS  3183-G Airway Avenue Costa Mesa, CA 92626                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TRACK AUDIO, INC., 33753 9th S., Federal Way, WA 98003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| TRACOR INC., 6500 Tracor Lane, Austin, TX 78721                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| TRAINEX CORPORATION, Box 116, Garden Grove, CA 92642                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| TRANS-AMERICAN VIDEO, INC. (Div. of Merv Griffin Productions) 1541 N. Vine St., Hollywood, CA 90028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| TRANS-LUX CORP., 625 Madison Ave., New York, NY 10022 (212) 751-3110 TRANSILWRAP COMPANY, INC. 2615 North Paulina, Chicago, IL 60614 (312) 528-8000 TRANSIST-O-SOUND, INC. 728 Yosemite Drive, Indianapolis, IN 46217 (317) 897-1549 TRANSITUBE INC., 300 Park Ave. So., New York, NY 10010 (212) 533-5580 TRANSTECTOR SYSTEMS DIV., KONIC INTERNATIONAL CORP. 532 Monterey Pass Rd., Monterey Park, CA 91754 (213) 283-9278 TRATEC, INC. 2040 Ave. of the Stars, Los Angeles, CA 90067 (213) 277-4717 TREISE ENGINEERING INC. 1941 First Street, San Fernando, CA 91340 (213) 365-3124 TRI CONTINENTAL FILM CENTER 333 Sixth Avenue, New York, NY 10014 (212) 989-3330 TRI-EX TOWER CORPORATION 7182 Rasmussen Ave., Visalia, CA 93277 (209) 732-8383 TRI-STATE TOWER & ERECTION INC. 5015 River Rd., New Orleans, LA 70123 (504) 733-8352 TRI-TRONICS, INC. 2921 W. Alameda Ave., Burbank, CA 91505 (213) 843-2170 TRIANGLE AUDIO-VISUAL MEDIA, INC. Branford Industrial Park, 50 Maple St., Branford, CT 06405 (203) 481-2306 TRIANGLE SCHOOL SERVICE (Div. of Chris-Cam Corp.) 1409 C Ave., Sioux Falls, SD 57104 (605) 336-3777 TRIPLE CROWN ELECTRONICS, INC. |
| TRANSILWRAP COMPANY, INC. 2615 North Paulina, Chicago, IL 60614                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 728 Yosemite Drive, Indianapolis, IN 46217                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| TRANSTECTOR SYSTEMS DIV., KONIC INTERNATIONAL CORP. 532 Monterey Pass Rd., Monterey Park, CA 91754                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 532 Monterey Pass Rd., Monterey Park, CA 91754                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| TRATEC, INC. 2040 Ave. of the Stars, Los Angeles, CA 90067                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| TREISE ENGINEERING INC.  1941 First Street, San Fernando, CA 91340. (213) 365-3124  TRI CONTINENTAL FILM CENTER  333 Sixth Avenue, New York, NY 10014 (212) 989-3330  TRI-EX TOWER CORPORATION  7182 Rasmussen Ave., Visalia, CA 93277 (209) 732-8383  TRI-STATE TOWER & ERECTION INC.  5015 River Rd., New Orleans, LA 70123 (504) 733-8352  TRI-TRONICS, INC.  2921 W. Alameda Ave., Burbank, CA 91505 (213) 843-2170  TRIANGLE AUDIO-VISUAL MEDIA, INC.  Branford Industrial Park, 50 Maple St., Branford, CT 06405 (203) 481-2306  TRIANGLE SCHOOL SERVICE (Div. of Chris-Cam Corp.)  1409 C Ave., Sioux Falls, SD 57104 (605) 336-3777  TRIPLE CROWN ELECTRONICS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| TRI CONTINENTAL FILM CENTER 333 Sixth Avenue, New York, NY 10014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| TRI-EX TOWER CORPORATION 7182 Rasmussen Ave., Visalia, CA 93277                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 7182 Rasmussen Ave., Visalia, CA 93277 (209) 732-8383 TRI-STATE TOWER & ERECTION INC. 5015 River Rd., New Orleans, LA 70123 (504) 733-8352 TRI-TRONICS, INC. 2921 W. Alameda Ave., Burbank, CA 91505 (213) 843-2170 TRIANGLE AUDIO-VISUAL MEDIA, INC. Branford Industrial Park, 50 Maple St., Branford, CT 06405 (203) 481-2306 TRIANGLE SCHOOL SERVICE (Div. of Chris-Cam Corp.) 1409 C Ave., Sioux Falls, SD 57104 (605) 336-3777 TRIPLE CROWN ELECTRONICS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| TRI-STATE TOWER & ERECTION INC.       5015 River Rd., New Orleans, LA 70123       (504) 733-8352         TRI-TRONICS, INC.       2921 W. Alameda Ave., Burbank, CA 91505       (213) 843-2170         TRIANGLE AUDIO-VISUAL MEDIA, INC.       Branford Industrial Park, 50 Maple St., Branford, CT 06405       (203) 481-2306         TRIANGLE SCHOOL SERVICE (Div. of Chris-Cam Corp.)       1409 C Ave., Sioux Falls, SD 57104       (605) 336-3777         TRIPLE CROWN ELECTRONICS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2921 W. Alameda Ave., Burbank, CA 91505                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Branford Industrial Park, 50 Maple St., Branford, CT 06405                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 1409 C Ave., Sioux Falls, SD 57104                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 42 hacine hoad, hexdale, Untario, Canada. (416) 743-1481                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TRIPLETT CORPORATION, Bluffton, OH 45817                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| TROMPETER ELECTRONICS 8936 Comanche Avenue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Chatsworth, CA 91311                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| TUFT'S EDUCATIONAL MEDIA CENTER 136 Harrison Ave., Boston, MA 02111                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| R.W. TULLY COMPANY, INC.<br>P.O. Box 30445, Honolulu, Hł 96820                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| TURNER DIVISION OF CONRAC CORPORATION 716 Oakland Road Northeast, Cedar Rapids, IA 52402 (319) 366-8311                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| TURNER ENGINEERING 14 Morris Ave., Mountain Lakes, NJ 07046. (201) 263-0023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| TURNER VIDEO PRODUCTIONS (Div. of Turner Communications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Corporation) 1018 W. Peachtree, Atlanta, GA 30309                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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| <b>TEMTRON ELECTRONICS, LTD.</b> 138-69 Francis Lewis Boulevard Rosedale, NY 11422                                                       |
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| <b>TENTEL</b> 50 Curtner Avenue Campbell, CA 95008(408) 377-6588                                                                         |
| TEPCO CORP., P.O. Box 680, Rapid City, SD 55709                                                                                          |
| 9020 Balboa Avenue, San Diego, CA 92123                                                                                                  |
| P.O. Box 7225, Inwood Station, Dallas, TX 75209                                                                                          |
| TEXSCAN CORPORATION 2446 N. Shadeland Ave., Indianapolis, IN 46219 (317) 357-8781                                                        |
| TEXTURE FILMS, INC., 1600 Broadway, New York, NY 10019 (212) 586-6960 THEATRE TECHNIQUES INC.                                            |
| 60 Connolly Parkway, Hamden, CT 06514                                                                                                    |
| THEATER VISION, INC. 671-A Southlawn Lane, Rockville, MD 20850                                                                           |
| THERMODYNE INTERNATIONAL, LTD.                                                                                                           |
| 12600 Yukon Avenue<br>Hawthorne, CA 90250                                                                                                |
| THOMPSON-MITCHELL AND ASSOC. 2996 Grandview Avenue Northeast, Atlanta, GA 30305                                                          |
| THOMSON-CSF ELECTRONIC TUBES 750 Bloomfield Ave., Clifton, NJ 07015                                                                      |
| 37 Brownhouse Rd., Stamford, CT 06902                                                                                                    |
| 321 Pennsylvania Ave., Linden, NJ 07036                                                                                                  |
| TIFFEN MANUFACTURING CORPORATION 90 Oser Ave., Hauppauge, NY                                                                             |
| TIFFEN SCENIC STUDIOS, INC. P.O. Box 39, Tiffin OH 44883                                                                                 |
| 3090 Oakmead Village Drive, Santa Clara, CA 95051                                                                                        |
| (Time Inc.) Time-Life Bldg., New York, NY 10020                                                                                          |
| 625 Katella Ave. #35, Orange, CA 92667                                                                                                   |
| P.O. Box 817, Cedar Hill, 1X 75104                                                                                                       |
| TIMES WIRE AND CABLE COMPANY                                                                                                             |
| 358 Hall Avenue<br>Wallingford, CT 06492                                                                                                 |
| TODD COMMUNICATIONS, INC. 7360 Ohms Lane                                                                                                 |
| Minneapolis, MN 55435                                                                                                                    |
| 1077 Independence Ave., Mountain View, CA 94043                                                                                          |
| 969 Horsham Road, Horsham, PA 19044 (800) 523-5947/(215) 675-2053 TOPAZ ELECTRONICS 3855 Ruffin Road, San Diego, CA 92123 (714) 279-0111 |
| TOPICATOR, 5395 S. Miller St., Littleton, CO 80123                                                                                       |
| 108 Carnforth Rd., Toronto, Canada M4A 2L4                                                                                               |
| 465 California St., Ste 430, San Francisco, CA 94104                                                                                     |
| 420 E. 51st St., New York, NY 10022                                                                                                      |



TOYO OPTICS OF AMERICA, INC.

3183-G Airway Avenue Costa Mesa, Ca. 92626 714/557-1080

| UNITED RADIO SUPPLY INC., Box 14040, Portland, OR 97214 (503) 233-7151                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HAUTED RECORDING ELECTRONICS INDUSTRIES                                                                                                                    |
| 8460 San Fernando Rd., Sun Valley, CA 91352                                                                                                                |
| 681 5th Avenue, New York, NY 10022(212) 751-4663                                                                                                           |
| UNITED SCENIC ARTISTS<br>1540 Broadway, New York, NY 10036                                                                                                 |
| U.S. DEPT. OF LABOR, MANPOWER ADMINISTRATION 601 D Street, N.W., Washington, DC 20213                                                                      |
| U.S. INDEPENDENT TELEPHONE ASSOCIATION 1801 K St. NW., Suite 1201, Washington, DC 20006 (202) 872-1200                                                     |
| UNITED STATES LEASING INTL. INC. 633 Battery St., San Francisco, CA 94111                                                                                  |
| LINITED VICTIAL AIDS INC                                                                                                                                   |
| 905 Fairway Dr., Bensenville, IL 60106. (312) 595-3544 UNITEL PRODUCTION SERVICES, INC.                                                                    |
| 510 W. 57th St., New York, NY 10019                                                                                                                        |
| 274 W. Rte 59, Tallman, NY 10956                                                                                                                           |
| 9 Dwinelle Hall, Berkeley, CA 94720(415) 642-2535                                                                                                          |
| UNIVERSITY OF CALIFORNIA – Educational Televsion<br>EMR, San Francisco, CA 94143                                                                           |
| UNIVERSITY OF COLORADO TELEVISION (Div. of Educational                                                                                                     |
| Stadium Building, Univ. of CO, Boulder, CO 80309                                                                                                           |
| MRB 17, University Park, Denver, CO 80208 (301) 753-3595                                                                                                   |
| UNIVERSITY OF IOWA — UNIVERSITY VIDEO CENTER E212 East Hall, University of Iowa, Iowa City, IA 52242 (319) 353-4333                                        |
| UNIVERSITY OF LOUISVILLE                                                                                                                                   |
| Belknap Campus, Strickler Hall, Louisville, KY 40208 (502) 588-6467 UNIVERSITY OF MAINE, Augusta, ME 04330 (207) 622-7131                                  |
| UNIV. OF MASSACHUSETTS VIDEOTAPE INSTRUCTIONAL PROGRAM, 113 Engineering Bldg. East, Amherst, MA 01003 (413) 545-2454                                       |
| LINDY OF MICHIGAN TV CENTER                                                                                                                                |
| 400 Fourth St., Ann Arbor, MI 48109                                                                                                                        |
| 3300 University Ave. SE, Minneapolis, MN 55455                                                                                                             |
| Studio A., Rarig Center, Minneapolis, MN 55455                                                                                                             |
| UNIVERSITY OF MISSOURI-KANSAS CITY SCHOOL OF DENTISTRY (Biomedical Communications Services) 650 E. 25th St., Kansas City, MO 64108 Ext. 281 (816) 221-3500 |
| LINUVEDCITY OF NEDDACKA                                                                                                                                    |
| P.O. Box 83111, Lincoln, NE 68501                                                                                                                          |
| 42nd and Dewey Ave., Omaha, NE 68105(402) 541-4304                                                                                                         |
| UNIVERSITY SOUND (Altec Div.) 1515 S. Manchester Ave., Anaheim, CA 92805                                                                                   |
| UNIVERSITY TELEVISION SERVICES (Div. of The Univ. of Alabama) P.O. Box X, University, AL 35486 (205) 348-6210                                              |
| UNIV. OF WASHINGTON PRESS, Seattle, WA 98105(206) 543-2100                                                                                                 |
| UNIVERSITY OF WISCONSIN—EXT. Electronic Media Programming in Eng.                                                                                          |
| 422 North Lake St., Madison, WI 53707 (608) 262-1234 UNIV. OF WISCONSIN – GREEN BAY                                                                        |
| Media Library, Educ. Communications, Green Bay, WI 54302 (414) 465-2121                                                                                    |
| Box 2000, Monument, CO 80132(303) 481-2223 (800) 525-9642                                                                                                  |
| URBAN MEDIA PRODUCTIONS<br>3104 W. Kilbourn, Milwaukee, WI 53208(414) 344-8950                                                                             |
| UTAH SCIENTIFIC INC.<br>2276 S. 2700 W., Salt Lake City, UT 84119 (801) 973-6840                                                                           |
| UTAH STATE UNIVERSITY RADIO AND TELEVISION                                                                                                                 |
| UMC 85, Logan, UT 84322Ext. 7773 (801) 752-4100                                                                                                            |
| UTILITY BODY COMPANY, 901 Gilman St., Berkeley, CA 94710(415) 524-9333<br>UTILITY TOOL CORP., 46 Nooks Hill Rd., Cromwell, CT 06416(203) 635-2200          |
| UTILITY TOWER COMPANY P.O. Box 12027, Oklahoma City, OK 73112                                                                                              |
| F.O. BOX 12027, Oxidificitia City, Ox 73112                                                                                                                |
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| V                                                                                                                                                          |
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| VCI, INC.<br>7601 Washington Ave. S., Minneapolis, MN 55435                                  | ) |
|----------------------------------------------------------------------------------------------|---|
| VMI (Visual Methods Inc.)                                                                    |   |
| Box 644<br>Westwood, NJ 07675(201) 391-7383                                                  | 3 |
| VTR PRODUCTIONS LTD. (Div. of Bushnell Communication Ltd.) 47 Scollard St., Toronto, Ontario | 7 |

| V.T.R. SERVICES CO. Rte. 5, Box 148, Joplin, MO 64801                                                               |
|---------------------------------------------------------------------------------------------------------------------|
|                                                                                                                     |
| T.J. VALENTINO, INC. 151 West 46th Street New York, NY 10036                                                        |
| VALLEY CINEMA/SOUND, INC.<br>20 First Ave., Chicopee, MA 01020(413) 592-4131/567-7960                               |
| VAMCO ENGINEERING, INC.<br>11104-C East 56th Street, Tulsa, OK 74145 (918) 252-5448                                 |
| VAN DE WATER ASSOCIATES, INC. 7914 Jason Ave., Canoga, Park, CA 91304 (213) 883-5992                                |
| VAN-LADDER INC.<br>Box 709, Cornbelt Industrial Site, Spencer, IA 51301 (712) 262-5810                              |
| VAN SAN CORPORATION<br>1180 Centre Drive, City of Industry, CA 91748                                                |
| VARIAN/BEVERLY, MICRO-LINK PRODUCTS<br>8 Salem Rd., Beverly, MA 01915                                               |
| VARIETY, 154 W. 46th St., New York, 10036                                                                           |
| Tower 58, Suite 23C, 58 West 58th St., New York, NY 10019 (212) 751-8600 VARIGRAPH INC., Box 690, Madison, WI 53701 |
| VECTOR ELECTRONIC COMPANY 12460 Gladstone Ave., Sylmar, CA 91342                                                    |
| VEGA ELECTRONICS 9900 Baldwin Place                                                                                 |
| EI Monte, CA 91731                                                                                                  |
| VERSA-COUNT                                                                                                         |
| 553 Lively Boulevard<br>Elk Grove Village, IL 60007                                                                 |
| VERSATILE PRODUCTIONS 324 Broadway, Cape Girardeau, MO 63701 (314) 335-8816                                         |
| VERSATILE VIDEO, INC. 151 Gibraltar Ct., Sunnyvale, CA 94806                                                        |
| VICON INDUSTRIES, INC.<br>125 E. Bethpage Rd., Plainview, NY 11803                                                  |
| VID-WEST STUDIOS 3413 Cahuenga Blvd. W., Los Angeles, CA 90068                                                      |
| 2711 E. Indian School Rd., Phoenix, AZ 85016                                                                        |
| VIDECOMM INTERNATIONAL                                                                                              |
| Toronto, Ontario, Canada M5C 1M3                                                                                    |
| VIDEO AIDS CORP. OF COLORADO 325 East Seventh Street (202) 667 2201                                                 |
| Loveland, CO 80537                                                                                                  |
| 4324 N. Woodward, Royal Oak, MI 48072                                                                               |
| 621 E. Main St., Rock Hill, SC 29730                                                                                |
| 8909 W. Cermak, North Riverside, IL 60546                                                                           |
| VIDEO ATLANTA, 445 Bishop St., Atlanta, GA 30318                                                                    |
| VIDEO AUTOMATION SYSTEMS, INC.<br>P.O. Box 21A, Rt. 1, Pound Ridge, NY 10576                                        |
| VIDEO CASSETTE SERVICES, INC.<br>1914-B Meyer Place, Costa Mesa, CA 92627                                           |
| THE VIDEO CENTER (Div. of Audio Video Enterprises, Beverly                                                          |
| 21624 Ventura Blvd., Woodland Hills, CA 91364                                                                       |
| 4310 Paradise Rd., Las Vegas, NV 89109. (702) 732-3201 VIDEO CENTERS INC.                                           |
| 1401 Madison St., Seattle, WA 98104                                                                                 |

### T.J. Valentino, Inc. 212-246-4675

151 North 46th Street New York, NY 10036

| VIDEO CINEMA INDUSTRIES, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7 Tallman Street Spring Valley, NY 10977                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 14) 352-4004                                                                                                                                                                     |
| VIDEO CITY, INC. (Div. of Video Corp. of America)<br>12100 N.E. 16th Ave., North Miami, FL 33161 (30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 05) 895-6400                                                                                                                                                                     |
| VIDEO COMMUNICATIONS, INC. (Div. of Q-CO Industries, Inc.) 33 W. 60th St., New York, NY 10023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                  |
| VIDEO COMPONENTS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                  |
| 601 South Main Street Spring Valley, NY 10977                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                  |
| VIDEO CONCEPTS, P.O. Box 25365, Houston, TX 77005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (4) 679-8888<br>(3) 666-1715                                                                                                                                                     |
| VIDEO CONCEPTS, INC.<br>1450 E. 289th St., Wickliffe, OH 44092                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 6) 585-5453                                                                                                                                                                      |
| VIDEO CONCEPTS, INC.<br>22530 W. Eight Mile Rd., Southfield, MI 48034                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3) 358-2670                                                                                                                                                                      |
| THE VIDEO CONSUMER<br>6750 W. 75th St., P.O. Box 2056                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |
| Shawnee Mission, KS 66201         (91           VIDEO CRAFTSMEN, INC.         6311 Romaine, Hollywood, CA 90038         (21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                  |
| VIDEO DATA SYSTEMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3/404-4331                                                                                                                                                                       |
| 40 Oser Avenue<br>Hauppauge, NY 11787                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 6) 231-4400                                                                                                                                                                      |
| VIDEO DEN, INC.<br>11319 Highway Seven, Minnetonka, MN 55343 (612) 933-723                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 5/933-0000                                                                                                                                                                       |
| VIDEODETICS CORPORATION 1335 S. Claudina Street                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                  |
| Anaheim, CA 92805                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                  |
| 3304 Silver Oak Lane, Vista, CA 92083                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |
| 5741 Culpepper Ct., West Bloomfield, MI 48033(31 VIDEO DUPLICATION, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |
| 1136 N. Highland Ave., Hollywood, CA 90038                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                  |
| 1600 Broadway, New York, NY 10019 (21: VIDEO EDUCATORS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                  |
| 3245 Walnut St., Harrisburg, PA 17109                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |
| VIDEOGRAPHY, 750 Third Ave., New York, NY 10017 (21)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 7) 329-3570<br>2) 697-8300                                                                                                                                                       |
| VIDEO IMAGES (Div. of H.W. Fuchs Agency, Inc.)<br>12200 W. Adler Lane, Milwaukee, WI 53214                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4) 475-0111                                                                                                                                                                      |
| VIDEO INFO PUBLICATIONS P.O. Box 1507                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |
| Santa Barbara, CA 93102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                  |
| 500 N. La Cienega Blvd., Los Angeles, CA 90048                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                  |
| 10 Presidential Blvd., Bala Cynwyd, PA 19004                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                  |
| 155 San Lazaro Ave., Sunnyvale, CA 94086                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |
| 276 Fifth Ave., New York, NY 10001 (212 VIDEO MASTERS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2) 689-9190                                                                                                                                                                      |
| Box 1963, Kansas City, MO 64141                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                  |
| VIDEOMAX, ORROX CORPORATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3) 474-8530                                                                                                                                                                      |
| VIDEOMAX, ORROX CORPORATION 3303 Scott Blvd., Santa Clara, CA 95050                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3) 474-8530<br>3) 988-2000                                                                                                                                                       |
| VIDEOMAX, ORROX CORPORATION       3303 Scott Blvd., Santa Clara, CA 95050       (408         VIDEO MEDIA CORPORATION       5959 E. Ten Mile, Warren, MI 48091       (313                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3) 474-8530<br>3) 988-2000                                                                                                                                                       |
| VIDEOMAX, ORROX CORPORATION       3303 Scott Blvd., Santa Clara, CA 95050       (408         VIDEO MEDIA CORPORATION       5959 E. Ten Mile, Warren, MI 48091       (313         VIDEOMEDIA       250 N. Wolfe Road                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3) 474-8530<br>3) 988-2000<br>3) 754-3193                                                                                                                                        |
| VIDEOMAX, ORROX CORPORATION       3303 Scott Blvd., Santa Clara, CA 95050       (408         VIDEO MEDIA CORPORATION       5959 E. Ten Mile, Warren, MI 48091       (313         VIDEOMEDIA       250 N. Wolfe Road         Sunnyvale, CA 94086       (400         VIDEO MICROSCOPE ASSOC.       (400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3) 474-8530<br>3) 988-2000<br>3) 754-3193<br>8) 733-6500                                                                                                                         |
| VIDEOMAX, ORROX CORPORATION       3303 Scott Blvd., Santa Clara, CA 95050       (408         VIDEO MEDIA CORPORATION       5959 E. Ten Mile, Warren, MI 48091       (31:         VIDEOMEDIA       250 N. Wolfe Road       (40:         Sunnyvale, CA 94086       (40:         VIDEO MICROSCOPE ASSOC.       13952 Weddington St., Van Nuys, CA 91401       (21:         VIDEO MIDWEST, INC. (Vaughn's, Inc., Minneapolis, MN)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3) 474-8530<br>3) 988-2000<br>3) 754-3193<br>3) 733-6500<br>3) 986-9527                                                                                                          |
| VIDEOMAX, ORROX CORPORATION       3303 Scott Blvd., Santa Clara, CA 95050       (408         VIDEO MEDIA CORPORATION       5959 E. Ten Mile, Warren, MI 48091       (31:         VIDEO MEDIA       250 N. Wolfe Road       (408         Sunnyvale, CA 94086       (408         VIDEO MICROSCOPE ASSOC.       13952 Weddington St., Van Nuys, CA 91401       (21:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3) 474-8530<br>3) 988-2000<br>3) 754-3193<br>3) 733-6500<br>3) 986-9527<br>2) 338-6825                                                                                           |
| VIDEOMAX, ORROX CORPORATION         3303 Scott Blvd., Santa Clara, CA 95050         (408           VIDEO MEDIA CORPORATION         5959 E. Ten Mile, Warren, MI 48091         (31:           VIDEOMEDIA         250 N. Wolfe Road         (40:           Sunnyvale, CA 94086         (40:           VIDEO MICROSCOPE ASSOC.         13952 Weddington St., Van Nuys, CA 91401         (21:           VIDEO MIDWEST, INC. (Vaughn's, Inc., Minneapolis, MN)         1097 Hiawatha Ave. S., Minneapolis, MN 55404         (61:           VIDEO MIDWEST, INC. (Div. of Video Midwest, Inc., Minne-         (61:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3) 474-8530<br>3) 988-2000<br>3) 754-3193<br>3) 733-6500<br>3) 986-9527<br>2) 338-6825<br>9) 359-0397                                                                            |
| VIDEOMAX, ORROX CORPORATION         3303 Scott Blvd., Santa Clara, CA 95050         (408           VIDEO MEDIA CORPORATION         5959 E. Ten Mile, Warren, MI 48091         (31:           VIDEOMEDIA         250 N. Wolfe Road         (40:           Sunnyvale, CA 94086         (40:           VIDEO MICROSCOPE ASSOC.         13952 Weddington St., Van Nuys, CA 91401         (21:           VIDEO MIDWEST, INC. (Vaughn's, Inc., Minneapolis, MN)         1097 Hiawatha Ave. S., Minneapolis, MN 55404         (61:           VIDEO MIDWEST, INC. (Div. of Video Midwest, Inc., Minneapolis, MN)         1017 State St., Bettendorf, IA 52722         (31:           VIDEO-MON SALES & SERVICE, INC.         (31:                                                                                                                                                                                                                                                                                                                                                                                                                      | 3) 474-8530<br>3) 988-2000<br>3) 754-3193<br>3) 733-6500<br>3) 986-9527<br>2) 338-6825<br>9) 359-0397<br>5) 265-8335                                                             |
| VIDEOMAX, ORROX CORPORATION       3303 Scott Blvd., Santa Clara, CA 95050       (408         VIDEO MEDIA CORPORATION       5959 E. Ten Mile, Warren, MI 48091       (31:         VIDEOMEDIA       250 N. Wolfe Road       (40:         Sunnyvale, CA 94086       (40:         VIDEO MICROSCOPE ASSOC.       13952 Weddington St., Van Nuys, CA 91401       (21:         VIDEO MIDWEST, INC. (Vaughn's, Inc., Minneapolis, MN)       1097 Hiawatha Ave. S., Minneapolis, MN 55404       (61:         VIDEO MIDWEST, INC. (Div. of Video Midwest, Inc., Minneapolis, MN) 1017 State St., Bettendorf, IA 52722       (31:         VIDEO-MON SALES & SERVICE, INC.       222 Truman N.E., Albuquerque, NM 87108       (50:         VIDEONEWS       8401 Connecticut Ave. NW, Washington, DC 20015       (30:         VIDEO ODYSSEY       6464 Sunset Blvd., Hollywood, CA 90028       (21:                                                                                                                                                                                                                                                         | 3) 474-8530<br>3) 988-2000<br>3) 754-3193<br>3) 733-6500<br>3) 986-9527<br>2) 338-6825<br>3) 359-0397<br>5) 265-8335<br>1) 652-5522                                              |
| VIDEOMAX, ORROX CORPORATION         3303 Scott Blvd., Santa Clara, CA 95050         (408           VIDEO MEDIA CORPORATION         5959 E. Ten Mile, Warren, MI 48091         (31:           VIDEOMEDIA         250 N. Wolfe Road         (400           Sunnyvale, CA 94086         (400           VIDEO MICROSCOPE ASSOC.         13952 Weddington St., Van Nuys, CA 91401         (21:           VIDEO MIDWEST, INC. (Vaughn's, Inc., Minneapolis, MN)         1097 Hiawatha Ave. S., Minneapolis, MN 55404         (61:           VIDEO MIDWEST, INC. (Div. of Video Midwest, Inc., Minneapolis, MN) 1017 State St., Bettendorf, IA 52722         (31:           VIDEO-MON SALES & SERVICE, INC.         222 Truman N.E., Albuquerque, NM 87108         (50:           VIDEONEWS         8401 Connecticut Ave. NW, Washington, DC 20015         (30:           VIDEO ODYSSEY         6464 Sunset Blvd., Hollywood, CA 90028         (21:           VIDEO ONE, INC.         1216 N. Blackwelder Ave., Oklahoma City, OK 73106         (405)                                                                                                 | 3) 474-8530<br>3) 988-2000<br>3) 754-3193<br>3) 754-3193<br>3) 986-9527<br>2) 338-6825<br>2) 359-0397<br>5) 265-8335<br>1) 652-5522<br>3) 463-3255                               |
| VIDEOMAX, ORROX CORPORATION         3303 Scott Blvd., Santa Clara, CA 95050         (408           VIDEO MEDIA CORPORATION         5959 E. Ten Mile, Warren, MI 48091         (31:           VIDEO MEDIA         250 N. Wolfe Road         (408           Sunnyvale, CA 94086         (408           VIDEO MICROSCOPE ASSOC.         13952 Weddington St., Van Nuys, CA 91401         (21:           VIDEO MIDWEST, INC. (Vaughn's, Inc., Minneapolis, MN)         1097 Hiawatha Ave. S., Minneapolis, MN 55404         (61:           VIDEO MIDWEST, INC. (Div. of Video Midwest, Inc., Minneapolis, MN) 1017 State St., Bettendorf, IA 52722         (31:           VIDEO-MON SALES & SERVICE, INC.         222 Truman N.E., Albuquerque, NM 87108         (50:           VIDEO-MEWS         8401 Connecticut Ave. NW, Washington, DC 20015         (30:           VIDEO ODYSSEY         6464 Sunset Blvd., Hollywood, CA 90028         (21:           VIDEO ONE, INC.         1216 N. Blackwelder Ave., Oklahoma City, OK 73106         (40:           VIDEO ONE, INC.         10160 West Nine Mile Rd., Oak Park, MI 48237         (31:    | 3) 474-8530<br>3) 988-2000<br>3) 754-3193<br>3) 754-3193<br>3) 986-9527<br>2) 338-6825<br>3) 359-0397<br>5) 265-8335<br>1) 652-5522<br>3) 463-3255<br>5) 524-2111                |
| VIDEOMAX, ORROX CORPORATION         3303 Scott Blvd., Santa Clara, CA 95050         (408           VIDEO MEDIA CORPORATION         5959 E. Ten Mile, Warren, MI 48091         (31:           VIDEOMEDIA         250 N. Wolfe Road         (400           Sunnyvale, CA 94086         (400           VIDEO MICROSCOPE ASSOC.         13952 Weddington St., Van Nuys, CA 91401         (21:           VIDEO MIDWEST, INC. (Vaughn's, Inc., Minneapolis, MN)         1097 Hiawatha Ave. S., Minneapolis, MN 55404         (61:           VIDEO MIDWEST, INC. (Div. of Video Midwest, Inc., Minneapolis, MN) 1017 State St., Bettendorf, IA 52722         (31:           VIDEO-MON SALES & SERVICE, INC.         222 Truman N.E., Albuquerque, NM 87108         (50:           VIDEONEWS         8401 Connecticut Ave. NW, Washington, DC 20015         (30:           VIDEO ODYSSEY         6464 Sunset Blvd., Hollywood, CA 90028         (21:           VIDEO ONE, INC.         1216 N. Blackwelder Ave., Oklahoma City, OK 73106         (408           VIDEO ONE, INC.         1216 N. Blackwelder Ave., Oklahoma City, OK 73106         (408 | 3) 474-8530<br>3) 988-2000<br>3) 754-3193<br>3) 754-3193<br>3) 986-9527<br>2) 338-6825<br>2) 359-0397<br>5) 265-8335<br>1) 652-5522<br>3) 463-3255<br>5) 524-2111<br>3) 543-8161 |

| THE VIDEO PICTURE COMPANY, INC.  1170 Commonwealth Ave., Boston, MA 02134                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 64-5115<br>52-1717<br>26-6741<br>59-1188<br>76-3330<br>34-2485<br>94-8686<br>52-5860<br>42-2867<br>34-1457 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 60-4454                                                                                                    |
| VIDEO SYSTEMS, INC.<br>2133 W. Governors Circle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                            |
| 2133 W. Governors Circle Houston, TX 77092                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                            |
| <b>VIDEO SYSTEMS, INC.</b> 8529 Manderville, Dallas, TX 75231                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 31,9053                                                                                                    |
| VIDEO SYSTEMS INC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                            |
| 9030 Aero, San Antonio, TX 78217                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 24-2311                                                                                                    |
| VIDEO SYSTEMS INC.           3602 Slide Road, Security Park B-14         (806) 79           Lubbock, TX 79414         (806) 79           VIDEO SYSTEMS NETWORK, INC.         12530 Beatrice St., Los Angeles, CA 90066         (213) 87           THE VIDEO TAPE COMPANY         10545 Burbank Blvd., No. Hollywood, CA 91601         (213) 98           VIDEO TAPE EXCHANGE (Div. of Cine Film Exchange)         855 Ave. of the Americas, New York, NY 10001         (212) 69           VIDEOTAPE PRODUCTION ASSOCIATION         63 West 83rd St., New York, NY 10024         (212) 93 | 71-0677<br>95-1666<br>95-6644                                                                              |
| VIDEOTAPE PRODUCTS P.O. Box 1077                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                            |
| Santa Monica, CA 90406                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1-1604                                                                                                     |
| VIDEOTAPEWORKS (Div. of Sibos, Inc.) 127 Beverly Rd., Worcester, MA 01605                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2-2700                                                                                                     |
| VIDEO TECHNIQUES, INC. 39 W. 55th St., New York, NY 10019. (212) 58:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1-1880                                                                                                     |
| VIDEOTEK, INC. 125 North York Street Pottstown, PA 19464                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                            |
| VIDEO T.E.N., INC. 121 La Veta Dr. N.E. Albuquerque, NM 87108                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                            |
| VIDEO III, INCORPORATED                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                            |
| 2515 Clearbrook Dr., Arlington Heights, IL 60005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3-2060<br>3-3181                                                                                           |
| 500 Highway 36, Atlantic Highlands, NJ 07716                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -5300                                                                                                      |
| 800 Community Dr., Manhasset, NY 10030(516) 627                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -5284                                                                                                      |

### Videotek Inc. 215-327-2292

125 North York Street Pottstown, PA 19464

|                                                                                                  | (0.47) 0.40 500.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| THE VIDEO WORKSHOP                                                                               | WAHLBERG ASSOCIATES, 79 Mystic St., Arlington, MA 02174 (617) 646-5394                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 468 Forest Ave Portland, ME 04101                                                                | WAIT SALES COMPANY, INC. DBA PERCEPTION PLUS P.O. Box 1015, 406 S. Peoria, Tulsa, OK 74120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| VIDEO WORLD, 3679 Sports Arena Blvd., San Diego, CA 92110 (714) 225-6225                         | THE PARTY OF A COCCUMENT OF THE PARTY OF THE |
| VIDICOPY CORPORATION 650 Vaqueros Ave., Sunnyvale, CA 94086                                      | 5701 Euclid Ave., Cleveland, OH 44103                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| VIDPRO, 295 W. 4th St., New York, NY 10014 (212) 924-4545                                        | WALNAT COMPANY<br>3430-32 N. Illinois St., Indianapolis, IN 46801 (317) 926-1521                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                  | THE PARTY OF THE P |
| 855 N. Cahuenga Blvd., Hollywood, CA 90038(213) 466-9741                                         | 841 Progress Ave. Ontario, Canada M1H 2X4 (617) 263-7507                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| MIDWEST STUDIOS<br>3413 Cahuenga Bivd. W., Hollywood, CA 90068 (213) 851-4737                    | WARNER OUBE PRODUCTIONS, INC. (Div. of Warner Cable Corp.) 75 Rockefeller Plaza, New York, NY 10019 (212) 484-8000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| VIEWMARK PRODUCTIONS INC. (612) 931-2821                                                         | A DIE CO (DE LA MARIE DE CO TOLOGO OH)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| VIEWMARK PRODUCTIONS INC.<br>P.O. Box 23292, Minneapolis, MN 55423                               | 1315 Peach St. Frie. PA 16512                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| VIKING FILMS, LTD.<br>525 Denison Street, Markham, Ontario, Canada L3R 1B8(416) 495-0522         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                                                  | P.O. Box 730, Hagerstown, MD 21740                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| VIKRON 520 Blanding Woods Road South, P.O. Box 737                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 520 Blanding Woods Road South, P.O. Box 737 St. Croix Falls, WI 54024                            | 2000 K St NW, Suite 800, Washington, DC 20006 (202) 296-5810                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| VILLAGE COMMUNICATIONS<br>1304 Marquette Dr., Romeoville, IL 60441 (312) 759-4600/(815) 886-9200 | WATERS MANUFACTURING, INC. Longfellow Center, Wayland, MA 01778                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| VIRGINIA VIDEO, 307 North Blvd. #6, Richmond, VA 23220 (804) 353-7624                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| VISCOUNT INDUSTRIES LTD. Marine Industrial Centre                                                | WAVELAND SOFTWARE, INC.<br>756 Waveland Ave., Chicago, IL 60613                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 105 East 69th Avenue, Vancouver, BC, Canada V5X 2W9 (604) 327-9446                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| VISION PRODUCTION COMPANY/PRODUCTION PLANNERS,                                                   | WAVETEK INDIANA, INC. 66 North First Avenue, Beech Grove, IN 46107(317) 783-3221                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| INC., P.O. Box 252, Sandy, UT 84070                                                              | WAYNE STATE UNIVERSITY 2978 West Grand Blvd., Detroit, MI 48202 (313) 577-2424                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 2831 15th St., N.W., Washington, DC 20009                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                                                                  | Loop 132 & Hwy 79, Olney, TX 76374                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| VISUAL ELECTRONICS CORPORATION<br>285 Emmett St., Newark, NJ 07114                               | WEAVER-REED COMPANY<br>28-83 E. Paris Ave., Grand Rapids, MI 49508                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| VISUAL HORIZONS                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 208 Westfall Road<br>Rochester, NY 14620                                                         | WEBB TELEMEDIA 622 East 6th Avenue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| VISUAL IMPACT PRODUCTIONS, INC.                                                                  | 622 East 6th Avenue Emporia, KS 66801                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| VISUAL IMPACT PRODUCTIONS, INC.<br>57 E. Canfield, Detroit, MI 48201                             | WEBB TELEMEDIA CORPORATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| VISUAL INFORMATION INSTITUTE, INC.  Box 33, Xenia, OH 45385                                      | 2813 East Lupine Avenue Phoenix, AZ 85028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| VICUAL INFORMATION SYSTEMS (Div. of Republic Corp.)                                              | Phoenix, AZ 85028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 15 Columbus Circle, New York, NY 10023                                                           | WEINSCHEL ENGINEERING COMPANY, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| LUCLIA DECORATION SYSTEMS INC                                                                    | One Weinschel Lane, Gaithersburg, MD 20/60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| VISUAL INSTRUCTIONS PRODUCTIONS (Div. of Victor Kayfetz                                          | WELLS GARDNER ELECTRONICS CORPORATION 2701 N. Kildare Ave., Chicago, IL 60639                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Productions, Inc.) 295 W. 4th St., New York, NY 10014                                            | A COLOR OF THE PROPERTY OF THE |
|                                                                                                  | 43 Railside Road, Don Mills, Ontario M3A 3L9 Canada                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| VISUAL LEARNING, INC.<br>965 Garfield Ave., Jersey City, NJ 07304(201) 434-3244                  | WELSH VIDEO SERVICES, INC.<br>414 W. 54th St., New York, NY 10019(212) 265-3477                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| VISUAL SYSTEMS COMPANY<br>3870 N. Peachtree Rd., Atlanta, GA 30341                               | and the second s |
|                                                                                                  | 2400 W 9th Lane Hislash FI 33010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| VITAL INDUSTRIES, INC. 3700 Northeast 53rd Avenue                                                | WESS PLASTIC, INC., 50 Schmitt Blvd., Farmingdale, NY 11735 (516) 293-8994                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 3700 Northeast 53rd Avenue (904) 378-1581                                                        | WEST PENN WIRE CORPORATION P.O. Box 762, Washington, PA 15301                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| VITEX                                                                                            | AND TO LEGATED ALIDIO VICUAL CENTER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 3700 N.E. 53rd Ave.<br>Gainesville, FL 32601                                                     | 181 Marbledale Rd - Tuckahoe, NY 10707(914) 793-0330                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                                  | WESTERN AMERICA FILMS, P.O. Box 217, Bozeman, MT 59715 (406) 586-2443                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 7505 Vickers St., San Diego, CA 92111                                                            | WESTERN BROADCASTING CO., LTD. (Aristocart Div.)<br>1960-505 Burrard St., Vancouver, BC V7X 1M6 Canada (604) 687-2844                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| VUE. 1900 W. Yale, Englewood, CO 80110                                                           | WESTERN COMMUNICATIONS SERVICE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| VULCAN BINDER AND COVER, Box 29, Vincent, AL 35178 (205) 672-2241                                | 320 W. 26th St., San Angelo, TX 76901(915) 653-3363                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| \A/                                                                                              | WESTERN ELECTRIC, 1111 Woods Mill, Ballwin, MO 63011 (314) 391-2597                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| W                                                                                                | WESTERN ELECTRONIC PRODUCTS<br>107 Los Molinos, San Clemente, CA 92672(714) 492-4677                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                                  | MEGTERAL INCTRUCTIONAL TELEVISION INC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| THE WACC JOURNAL 122 King's Road, London SW3 4TR, England                                        | 1438 N. Gower St., Los Angeles, CA 90028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| MUDI MOSO CHICACO                                                                                | WESTERN VIDEO 8050 Ronson Rd., San Diego, CA 92111 (714) 292-0337                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 5325 N. Lincoln Ave., Chicago, IL 60625 (312) 271-4629                                           | WESTON WOODS, Weston, CT 06883                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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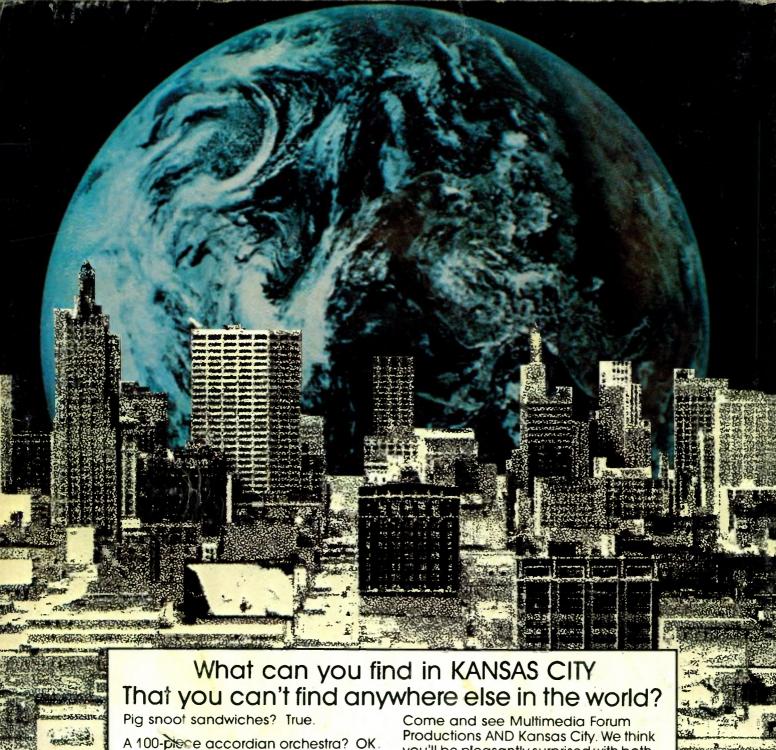
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