BROADCAST engineering

September 1980/$15.00

1980 BUYERS' GUIDE ISSUE

The broadcast industry's comprehensive product directory

New from Hitachi

A Colossal One-Inch Step

One-inch is the VTR format of the future. It's too important a step forward for a scaled-up 3/4" or a scaled-down 2" system. It deserves to be totally original, with every advance designed in. That's how we approached the new Hitachi HR-200, after almost 20 years of experience making quad machines. The result: a one-inch Type C VTR destined to establish new broadcast standards everywhere. In every department, the Hitachi HR-200 is miles ahead of the one-inch competition!

Fast, sure, easy operation

Hitachi one-inch VTR's are loaded with features—many of them Hitachi exclusives. Like the brake release for easier threading. Both video and audio confidence. A "B-wrap" configuration, for reduced dropout. A *precision* moveable tape guide for easy loading, with an incredible 1-micron tolerance that's accurate for up to 2 million threadings! Plus a sloped design and easier-to-see top mounted drum for still easier threading.

Dazzling performance extras

Imagine shuttling a 1-hour tape end-to-end in just 30 seconds! It's possible, only on the Hitachi HR-200, because an internal air compressor injects a column of air into the tape guides to reduce friction and increase acceleration. The same air compressor provides air for the non-contact air drum, cushioning the tape when in the standby or fast shuttle modes. For fumble-free shuttling and jogging and fast editing, a single knob controls both. There is audio spot erase capability. And a Hall-Effect head on the third channel reads the time code more accurately, regardless of tape speed.

A microprocessor makes the built-in editor the most advanced you'll find today. And, just as important: it can be re-programmed to interface with editing systems of the future. Serial or parallel logic for remote control? Both have advantages, so Hitachi gives you both. Built-in cable compensation boosts the signal so you can use cable up to 300 feet.

Uniquely simple service

Serviceable components have been human-engineered for easy access and replacement. The PC modules are front-mounted and can be removed in an instant. The six heads come as a pre-aligned drum assembly that snaps out and snaps back in minutes.

HR-100 Portable Model

The HR-200 is available as a console, or for tabletop use or 19" rack mounting. Best of all, it costs no more than ordinary 1-inch VTR's!

Smallest Type C portable ever!

The HR-100 portable model has many of the HR-200 features, yet it's the smallest Type C portable in the world. And the most serviceable too, with plug-in PC modules. Die-cast uniblock construction makes the HR-100 durable yet extremely light. And like the HR-200, it has a non-dropout tape path. Plus an extended tape path for less edge wear, an auto back space assemble editor, and 3-way power with built-in battery pack, AC adapter or external DC.

Take a big one-inch step. See the New Hitachi 1" VTR's...today.

Hitachi...Tomorrow's technology today.

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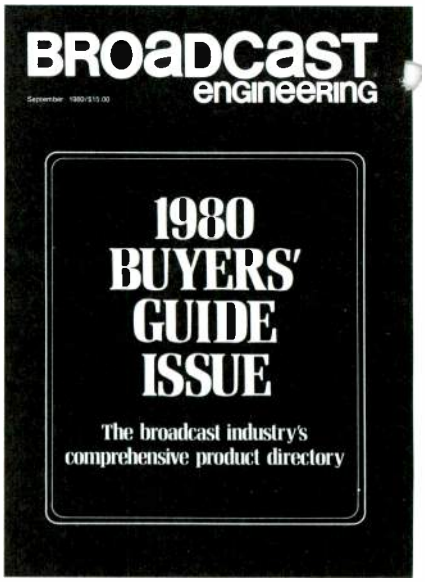


THE COVER
Graphic design by Joy Viscek

NEXT MONTH

- Preview of SMPTE and AES meetings
- The future of AM/FM
- First class license debate

Embarrassing questions to ask audio console salespeople

Sometimes it pays to ask questions. If the subject is audio consoles, asking difficult questions can be very revealing in comparing one console to another. Here are some of the questions that make most console salespeople squirm.

Is the console "human engineered"? Does the console have an esthetically "professional" appearance? Is the layout well defined and uncluttered? Are controls large? Do they fit the hand? Are they well labelled and lighted? Do they provide adequate visual feedback to affirm the position of the control? Is console nomenclature permanently engraved?

Easy to service? Are all components readily accessible and isolated for individual servicing? Are op-amps in plug-in sockets? Are there service loops in the wiring harness? Are extender boards provided? Are all wires uniquely numbered and referenced to your system documentation?

How responsive is the service department? Can they provide a history of fast, efficient customer service? Are they confident enough to furnish a complete list of customers for you to call?

How easy is installation? Is the console completely assembled and ready to install? Are installation points readily accessible? Are all program inputs and outputs uniquely transformer isolated?

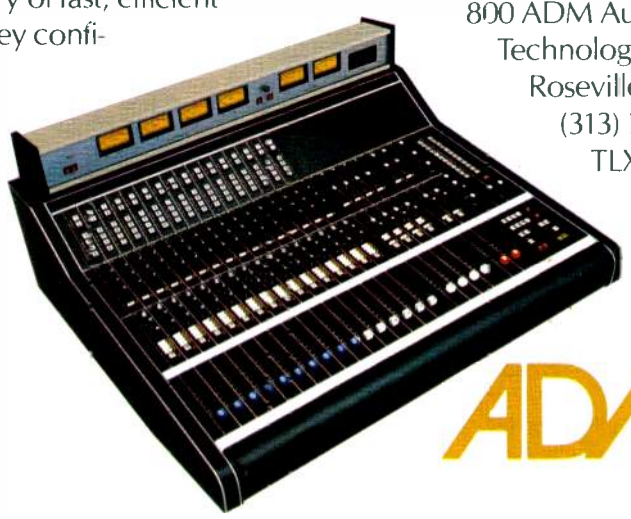
How about specifications? Are the manufacturers' published specifications consistent and easily understandable or mired in the game called "specsmanship"?

How good is reliability? Do all modules receive three levels of testing? Does the total system receive 4 levels of performance verification? Do both the modules and system receive extensive burn-in?

Is the console backed by a 5-year, all-inclusive warranty? (*Only* ADM answers "yes" to that one.)

ADM and only ADM answers all of these questions with a full, no weaseling, resounding "YES"! The only question remaining is, when would you like to talk to us about a new audio console?

For facts about our Series 3200, 2400, 1600, or 800 ADM Audio Consoles, contact ADM Technology, Inc., 16005 Sturgeon, Roseville, Michigan 48066. Phone (313) 778-8400. TLX 23-1114.



ADM 1600 Audio Console – Modest but mighty.

ADM® The Audio Company

BROADCAST ENGINEERING®

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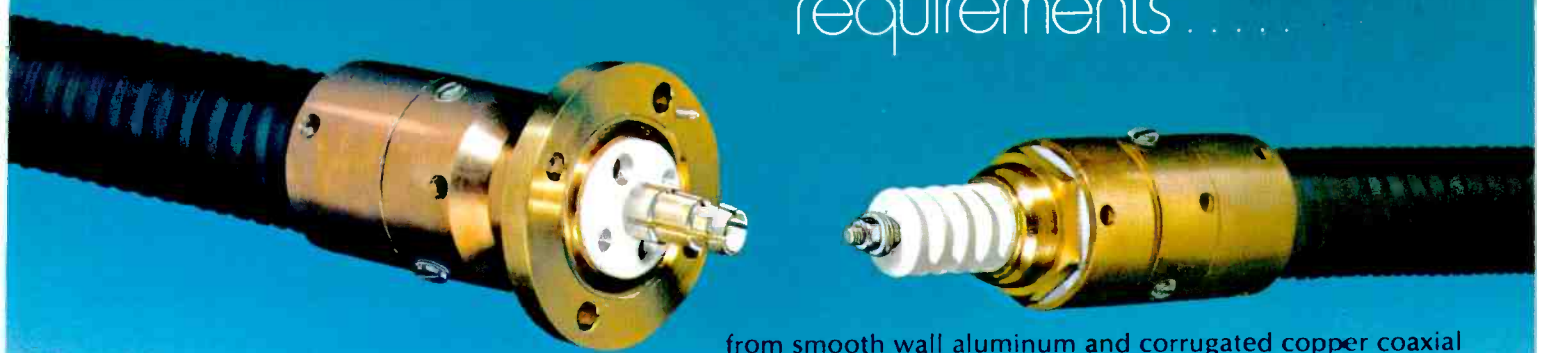

from smooth wall aluminum and corrugated copper coaxial cables in foam and air dielectric . . . to matching connectors for most standard interfaces . . . to hardware and installation accessories. All cables are jacketed for mechanical protection, and you can specify either standard or phase-stabilized versions. There's a full line of field assembled matching connectors, or if you desire . . . Cablewave will provide the completed cable assembly manufactured to your specific requirements. Most of your system requirements will be available from stock . . . all are fully tested, conservatively rated and backed by our field service organization.

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Complete in every detail, total information needed to plan, specify and purchase a complete system or component, plus complete engineering data and more.

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PERFECT TIMING

780 SERIES
RAM TIME PROGRAMMERS

When programming more than eight events, the **780 Series RAM Time Programmers** are the most cost-effective way of dealing with the problem. They are flexible, easy to use, and provide 32 events (expandable to 96) in 5¼ inches of rack space.

780 Series units operate from the power line, with a backup crystal time base and 72 hour battery/charger as an integral part of the equipment.

The front panel consists of:

- An eight digit real time display when day selection is required as on the ES 781, 784, 785, seven digits for ES 780, and six digits for the others.
- A two digit display of "Next Event" number.
- An eight digit display of "Next Event Time" when ES 780, 781, or 782 is specified, and 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.
- All displays are .3 inch red light emitting diodes.
- Controls, mounted below the displays, consisting of:

An "Active-Disable" Switch used when it is necessary to preempt the program temporarily.

Time Setting Controls—All recessed to avoid accidental bumping.

"Display"—The displays can be observed by actuating this control during a power outage. The unit will continue to operate, but the displays will be blanked to conserve battery energy.

"Event Select"—A two decade thumbwheel, used to set the event number when entering or reading data in the memory.

"Event Time Select"—An eight or six or four decade thumbwheel, used to enter the event time in the memory. The number of thumbwheels will be determined by the part number of the unit specified.

"Enter"—This pushbutton is actuated to enter data into the memory.

"Run-Read/Enter"—A two position switch, placed in the "Run" position for normal operation, and in the "Read/Enter" position whenever entering data or reading data.

STANDARD UNITS

EIGHT DIGITS OF PROGRAMMING CAPACITY:

ES 780—10 Days, 10 Outputs, Hours, 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

The size of the unit is 5¼" High x 19" Wide x 10" Deep—Relay Rack construction, totally enclosed, with a screen top.

ES 782, 788 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. Contacts are single pole, form A, reed type, and have a one amp rating.

THE 780 SERIES AS A MASTER CLOCK

By adding the **ES 187** Serial Time Code Generator and using a more accurate crystal, the 780 Series Ram Time Programmers can serve the dual functions of Master Clock and 96 event programmable timer.

750 SERIES
THUMBWHEEL PROGRAMMER/ COMPARATORS

When programming up to eight time events, the 750 Series is recommended. Thumbwheel switches are set to compare the time information from an ESE Clock or Timer.

An output (event) occurs each time the thumbwheel switch setting agrees with the time display.

One set of thumbwheels is required for each event. The standard 750 Series units are enclosed in a 3½ inch high relay rack panel and chassis.

STANDARD UNITS

ES 750—ES 112 and one 6 Digit Program
ES 751—ES 124 and one 6 Digit Program
ES 753—ES 112 and two 4 Digit Programs (Hrs & Min)
ES 754—ES 124 and two 4 Digit Programs (Hrs & Min)
ES 756—ES 510 and one 4 Digit Program (Min & Sec)
ES 758—ES 510 and two 4 Digit Programs (Min & Sec)

ES 760
ATS CLOCK

The **ES 760** is a six digit, 24 hour, programmable clock.

On the front panel are a six digit display of time, in hours, minutes and seconds, and two sets of four thumbwheels.

An internal comparator is fed "Clock Time" and "Thumbwheel Time," and when these two agree, a reed relay contact closure occurs, which is brought to a rear-mounted connector. The connector also provides four line parallel BCD time information.

If normal power is interrupted, ES 760 will automatically switch to its internal battery and crystal time base.

Mechanical: 3½" High x 19" Wide x 8" Deep.

PRESETTABLE TAPE TIMERS

ES 1296

For Off-Air taping, or operating tape recorders when nobody is there, ESE has created ES 1296.

ES 1296 is a six digit, twelve hour clock with LED displays and a programmable, 300 watt, 117V AC outlet on the rear.

There are four push-button controls (Fast, Slow, Set and Reset) and a four position selector switch. The Fast and Slow controls are used to set time of day and recorder start time.

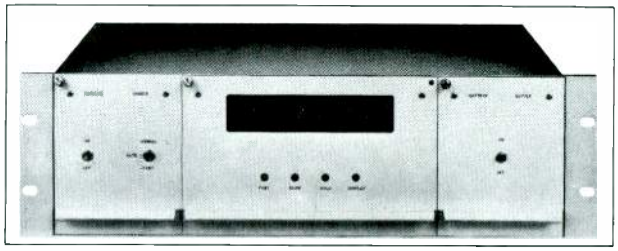
When setting the recorder start time, the Set control is used in addition to the Fast and Slow controls, to set the time to the nearest minute. A rear-mounted four position switch is used to pre-set the start time as far ahead as 96 hours.

Once the rear outlet is activated, it will remain on for 66 minutes.

The **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.

An additional option is **Sequential Turn-on,** for those machines that require Power, Play, Record in sequence.

A **Manual Override Switch** can be provided as an option, so that the user may operate his machine at any time without disconnecting from the ES 1296.



ESE Masters provide a means of keeping all time displays in the system in agreement, through the use of a Serial Time Code. Only one pair of wires is needed to distribute the time code to all remote serial input displays.

An ESE Master Clock System can operate digital displays, clocks with sweep second hands, printers and, in addition, tell your computer what time it is

Twelve hours of standby battery operation is standard in ES 160, 160/1 and 190.

MASTER CLOCKS

ES 160 Mounted in a 5¼" relay rack panel and chassis, displays six digits of time information on .3" LED displays, in 12 hour format.

ES 160 has three second per month accuracy. Its standard output is serial BCD, CMOS compatible, and can drive ES 161, 166, 171, 991 or 993 Remote Displays without buffering. All inputs and outputs are through rear-mounted connectors.

Dimensions: 5¼" High x 19" Wide x 15" Deep

ES 160/1 One second per month version of ES 160.

ES 190 The ultimate in accuracy! Similar to ES 160, 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. These tones are transmitted by radio Station WWV, with an oscillator accuracy of ±1 part in 10". ES 190 has an antenna and internal WWV receiver with audio-output. Displays are .3" red LED's. Serial output drives ES 161, 166, 171, 991 and 993 Remote Displays.

Dimensions: 5¼" High x 19" Wide x 15" Deep.

ES 192/194 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, 166, 171, 991 and 993. Displays are .6" incandescent type.

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

ES 196 TIME AND TEMPERATURE MASTER Basically the same as ES 192, but with gas discharge displays, panel mounting and separate serial BCD outputs for time and temperature. Displays 12 hour and °F format.

Dimensions: 3½" High x 19" Wide x 8" Deep.

ACCESSORIES

ES 161 REMOTE DIGITAL DISPLAY Decodes serial time data and displays six digits of time on .55" Gas Discharge Displays, in either 12 or 24 hour format.

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

ES 162 IMPULSE DRIVER 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.

ES 163 BATTERY AND CHARGER Plugs into the ES 160 or ES 190 chassis. Fast charge, 12 hours continuous use.

ES 164 REMOTE DIGITAL IMPULSE DISPLAY 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.

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

ES 166 JUMBO 1" CLOCK DISPLAY Features six digits of one inch gas discharge displays in 12 or 24 hour format. Receives serial time code input from any ESE Master Clock or ES 167.

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

ES 167 SERIAL TIME CODE GENERATOR An integral 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, 992, 994, 750, 751, 753, 754 and all 780 Series Time Programmers. Drives ES 161, 166, 171, 991 or 993 Remote Displays.

ES 169 TEMPERATURE SLAVE Receives serial code from ES 196, displays it on .55" Gas Discharge Displays.

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

ES 171 CONSOLE MOUNT REMOTE DISPLAY 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: 2¼" High x 4½" Wide x 4" Deep.

ES 1548 CONSOLE MOUNT TEMPERATURE DISPLAY In the same case as ES 171, receives the serial code from ES 196 and displays it on bright red .3" LED's.

Dimensions: 2¼" High x 4½" Wide x 4" Deep.

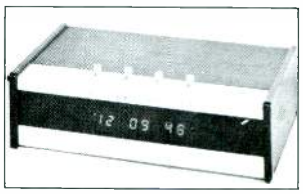
IMPULSE CLOCK When a sweep second hand is desired, specify the 3201.003 "Extra Flat" Impulse Clock. It has a 12 inch dial protected by a glass cover and metal bezel and is approximately one inch thick. As many as twenty impulse clocks can be driven by a Master Clock which has ES 162 as an accessory.

ES 991 4 DIGIT SERIAL INPUT SLAVE Decodes serial time data and displays four digits of time on large 2" gas discharge displays.

Dimensions: 10½" Wide x 4½" High x 6½" Deep, Desk Top Case.

ES 993 6 DIGIT SERIAL INPUT SLAVE Features four digits of 2" high gas discharge displays, and two digits (Seconds) of 1" gas discharge displays. Receives serial time code input from any ESE Master Clock or ES 167.

Dimensions: 5" High x 12" Wide x 3" Deep (Wall Mount).



ES 1372

The **ES 1372** is similar to the ES 1296, except that ES 1372 has two timed AC outlets. AC power is applied to outlet "1" at the alarm time and day selected and remains on for 138 minutes and 53 seconds. AC power is applied to outlet "2" 60 minutes after power has been applied to outlet "1" and remains on for 78 minutes and 53 seconds. All other specifications of the ES 1296 apply.

ES 251

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.

Dimensions: Aluminum Case 2¾" High x 8" Wide x 5⅜" Deep.

ES 252 SMPTE TIME CODE READER: Exactly like ES 251, but displays Minutes, Seconds and Frames.

ES 253 SMPTE TIME CODE READER: Similar to ES 251 and 252, but displaying EIGHT DIGITS of information—HOURS, MINUTES, SECONDS and FRAMES, using .3" red LED's.

ES 112/124

DIGITAL CLOCK

ES 112 (12 hr.) and **ES 124** (24 hr.) are solid state, six digit clocks. Can drive 80 Series and 90 Series slaves. Displays are incandescent filament, .6" high.
Dimensions: 2½" High x 8" Wide x 6" Deep.

ES 142/144

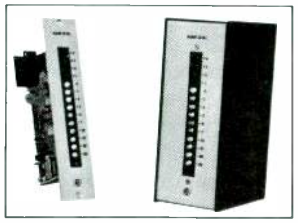
DIGITAL CLOCK THERMOMETER

ES 142 (12 hr.) and **ES 144** (24 hr.) are solid state digital clock/thermometers. Six digits of time (hours, minutes, seconds) and 3 digits of temperature (−50°F to +150°F or −45°C to +66°C) in gas discharge displays .55" high. Temperature sensor on 25 ft. cable included.
Dimensions: 2½" High x 10" Wide x 6" Deep.

ES 240/241

ES 240 DIGITAL THERMOMETER is calibrated for °F and °C. Displays are planar gas discharge, .55" high.
Dimensions: 2½" High x 8" Wide x 6" Deep.

ES 241 DIGITAL THERMOMETER is calibrated for °F and °C, alternating between the two every four seconds. Displays are planar gas discharge, .55" high.



ES 211/214

DYNAMIC AUDIO LEVEL INDICATOR

The **ES 214** is a highly accurate audio level indicator which is designed to simulate the action of a conventional VU-Meter but with superior dynamic characteristics. The LED meter is five to one hundred times faster in responding to complex waveforms than the mechanical meter without sacrificing the familiar meter "movement".

SPECIFICATIONS
Number of Indicators: 14 LED Lamps in 3 colors
Scale: +4, +3, +2, +1 dB—Red
0 dB—Yellow
−1, −2, −3, −5, −7, −10,
−15, −20, −25 dB—Green
Input Impedance: 2200 ohms at maximum sensitivity, 6800 ohms at +8dBm "House Level", 10,000 ohms at minimum sensitivity.
Input Circuit: Transformer isolated, balanced bridging.
Frequency Response: 20-20 KHz ± 1 dB (all modes).
Rise Times: Less than 250 MicroSec (Peak Mode), less than 25 MilliSec (Fast Averaging Mode), Approximately 300 MilliSec (Optional VU Standard).
Fall Time: (All Modes) About 300 MicroSec from full scale.
Modes of Operation: Peak Reading, Fast Averaging (Apparent Loudness), Slow Averaging (USA VU-Standard).

70 SERIES

CONSOLE MOUNT CLOCKS AND TIMERS

ES 172 SIX DIGIT, 12 HOUR CLOCK: Three setting controls—Fast Advance, Slow Advance and Hold.

ES 174 SIX DIGIT, 24 HOUR CLOCK: Otherwise identical to the ES 172.

ES 370 FOUR DIGIT, ONE HUNDRED MINUTE UP/DOWN TIMER: Six controls—Count Up, Count Down, Stop, Minutes Advance, Seconds Advance, Reset.

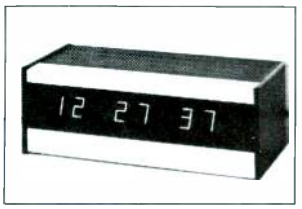
ES 371 UP/DOWN TIMER: Similar to the ES 370 except with Leverwheel Preset capability for faster setting of the desired time.

ES 570 FOUR DIGIT, SIXTY OR 100 MINUTE TIMER: 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.

ES 572 SIX DIGIT, 12 HOUR CLOCK OR TIMER: 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.

ES 574: A 24 hour version of ES 572.

ES 575: Exactly like ES 570, with the addition of a "freeze" button. When the button is released, the display "catches up" with the correct elapsed time.
Dimensions: 2.16" High x 4.5" Wide x 4.13" Deep.



80 SERIES

JUMBO CLOCKS AND TIMERS

Large, bright 1" gas discharge displays provide effortless long distance viewing from 40 feet.

ES 182 SIX DIGIT, 12 HOUR CLOCK: Three rear-mounted setting controls—Fast Advance, Slow Advance, and Hold.

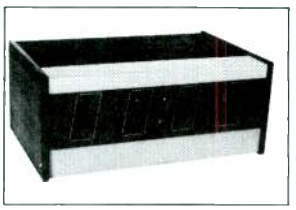
ES 184 SIX DIGIT, 24 HOUR CLOCK: Otherwise identical to the ES 182.

ES 380 FOUR DIGIT, 100 MINUTE UP/DOWN TIMER: Displays minutes and seconds, with rear-mounted connector to allow remote wiring of six momentary SPST CONTROLS—Count Up, Count Down, Stop, Minutes Advance, Seconds Advance and Reset. Other features similar to ES 301.

ES 381 UP/DOWN TIMER: Similar to ES 380, except that leverwheel preset is used.

ES 580 FOUR DIGIT, 60 MINUTE TIMER: Displays minutes and seconds. Rear connector allows remote wiring of three momentary SPST controls— Start, Stop and Reset. Reset returns all displays to zero, and timer will continue to run from zero if reset while running.

80 Series slaves are also compatible with other ESE clocks and timers: ES 112/124, 301, 302 and 510.
Dimensions: 4.45" High x 10.38" Wide x 6.58" Deep.



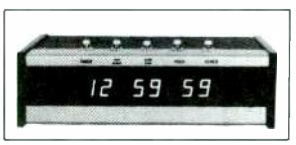
90 SERIES

2 INCH DISPLAYS— VIEWABLE AT 60 FEET

ES 391—Presettable Up/Down Timer: 100 Minute Range—Displays Minutes and Seconds, uses Leverwheel Preset. Controls are Count Up, Count Down, Stop, Reset and Preset.
Dimensions: 4.45" High x 10.38" Wide x 6.58" Deep.

ES 590—Sixty Minute Timer: Displays Minutes and Seconds. Rear-mounted connector provides for wiring to user's single pole, momentary, push-button controls: Start, Stop and Reset. Reset returns all displays to zero, and timer will continue to run from zero if reset while counting.
Dimensions: 4.45" High x 10.38" Wide x 6.58" Deep.

ES 992/994—6 Digit Clocks: ES 992 (12 Hr) and ES 994 (24 Hr)—Hours and Minutes on Two Inch Gas Discharge Displays, Seconds on One Inch Gas Discharge Displays. Three top-mounted setting controls—Fast Advance, Slow Advance and Hold.
Dimensions: 5" High x 12" Wide x 3½" Deep.



ES 562/564

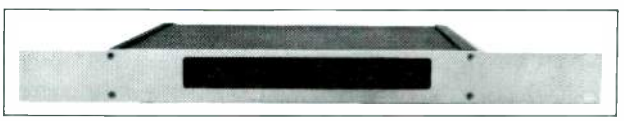
SIX DIGIT CLOCK/ TIMER WITH MEMORY

ES 562/564 is a combination six digit clock and 24 hour 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, minutes and seconds. Five pushbutton controls are mounted on the top of the unit, near the front of the desk-top case. When panel mounting is specified, they will be mounted on the front panel, below the display. The controls may also be remoted, through two rear-mounted five pin connectors (Option R or Option D). These controls are Clock, Fast/Start, Slow/Stop, Timer and Hold.
Display: Six digits of .55" Planar Gas Discharge Display.

ES 512/524

FOUR DIGIT CLOCK/ TIMER WITH MEMORY

Exactly the same specification as ES 562/564, except that time of day is displayed in hours and minutes, and the timer counts up to 60 minutes only.



ES 270 IRIG B TIME CODE READER

The **ES 270** TIME CODE READER has been designed to be an economical solution to the problem of receiving and displaying IRIG B.

Nine digits (Days, Hrs, Min, Sec) of time are shown on bright red LED's, .3" character height.

ES 270 comes in a rack mounting enclosure, 1¾"High, 19" Wide and 10" Deep.

The power requirement is 117V AC, 50/60 Hz, 230V AC, 50 Hz is available as an option.

ES 400

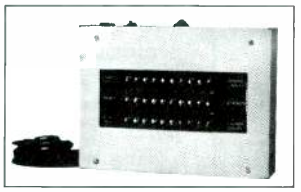
THREE DIGIT 10 MINUTE TIMER

The **ES 400** has three controls—Start, Stop, Reset. Displays up to 9:59. If stopped, display will hold time reading. If reset while running, timer will continue to run. Displays are incandescent filament, .6" high.
Dimensions: 2½" High x 6" Wide x 6" Deep.

ES 510

FOUR DIGIT 60 MINUTE TIMER

ES 510 is a four digit, sixty minute timer (59:59) with Start, Stop and Reset controls. If stopped, display will hold time reading and when restarted will continue with next count from last displayed figure. If reset while running, timer will continue to run. ES 510 can drive 80 Series and 90 Series Slaves.
Dimensions: 2½" High x 6" Wide x 6" Deep.



ES 203/205

ES 203/205 is a 20 input Timer/Source Interface. It was designed to provide a simple means of connecting a variety of sources such as carts and turntables to the remote input of ESE Timers. The most common application for this product is resetting either an ES 400 or ES 510 Timer each time a source is started.

The 20 inputs are divided into ten DC voltage inputs and ten contact closure inputs. Activation of any one of these inputs will cause an output which will momentarily reset an ESE timer.
Mechanical: Aluminum Case 8" x 6" x 2".

ES 301/302

100 MINUTE UP/DOWN TIMERS

ES 301 is a four digit, one hundred minute timer (99:59) with six controls: Count Up, Count Down, Stop, Minutes Advance, Seconds Advance, Reset. Counting can be activated up or down or set back to zero. When "Stop" control is pressed, the four digit display is held. Counting direction (up or down) can be changed or time can be reset to zero without stopping the count. The ES 301 can drive 80 Series and 90 Series Slaves. Displays are gas discharge, .55" high.

With the **ES 302,** the user can preset times much faster than with the ES 301, because lever-wheel type switches are used for the preset feature. The ES 302 can drive 80 Series and 90 Series Slaves.
Dimensions: ES 301: 2½" High x 8" Wide x 6" Deep.
ES 302: 2½" High x 10' Wide x 6" Deep.

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

Circle (5) on Reply Card

FCC update

September 1980

AM stereo: comments sought

The commission has issued a Further Notice of Proposed Rulemaking to gather additional data to aid it in selecting an AM stereophonic system from among those proposed by several companies. Systems under consideration are those proposed by Kahn Communications, Inc., Harris Corporation, Belar Electronics Laboratory, Inc., Motorola, Inc. and Magnavox Consumer Electronics Company.

The commission said that its purpose in issuing a Further Notice of Proposed Rulemaking was not to delay the selection of an AM stereo system, but to enable it to base a final decision on a full, accurate, and complete record. The commission said that the further rulemaking would allow all AM stereo proponents an additional opportunity to present evidence in any category where they feel their systems might have been improperly rated. It added that it owed it to the system proponents, broadcasters, and the public to seek additional information so that it may carry out a thoroughly objective analysis.

The commission is asking for comments on technical areas such as monophonic compatibility, adjacent channel protection, reduction in coverage, and signal degradation, as well as comments on the evaluation categories and methods to be used in choosing an AM stereophonic system.

In addition, the commission is asking for comment on whether it is preferable for the FCC to make decisions of this nature, or for such decisions to be left to the marketplace.

Finally, comments are sought on the possibility of a universal decoder that would allow reception of all five proposed systems.

Comment dates will be announced. (Docket no. 21313)

Rulemakings and inquiries

FM Quadraphonic broadcasting: Proposal to set standards for FM radio stations who wish to broadcast in quadraphonic sound. Alternatives being considered are FCC standards and general standards. Comments due November 10, replies due January 9, 1981. (Docket no. 21310.)

Status of broadcast stations

	July 1979	June 1980
AM Radio	4547	4557
FM Radio	3114	3216
FM Educational	993	1050
UHF TV Comm.	220	229
VHF TV Comm.	517	517
UHF TV Ed.	158	162
VHF TV Ed.	105	105

Model EEO programs

The commission has proposed changes in its Model Equal Employment Opportunity Program designed to give the commission a more complete and accurate picture of licensee EEO performance. The changes would help lighten the administrative burden of the program while providing a clearer picture of licensees' employment practices.

The major changes proposed by the commission include:

- Requiring all licensees, regardless of the size of their station, to report employment by race, sex, job title and category;
- Requiring a section on promotions including a summary of those promoted by race, sex, former job title and category and new job title and category;
- Requiring reporting of applicant flow and hiring showing recruitment source, race, sex, job title and category, and disposition of each application;
- Requiring that an annual update of the station's model program be kept in the public inspection files maintained by the licensee; and
- Exempting from most EEO record-keeping and reporting requirements those stations that employ women and minorities in numbers equal to at least 80% of their population in the area workforce.

The commission says that the best method to achieve its regulatory

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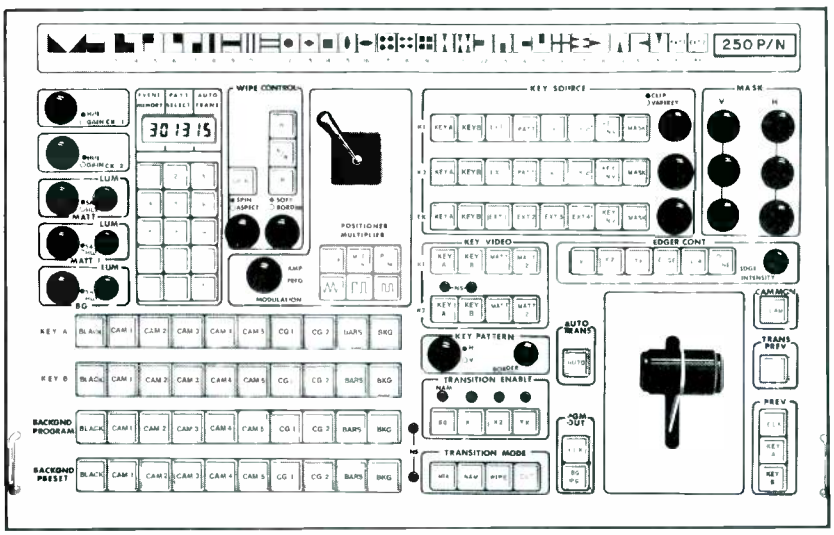

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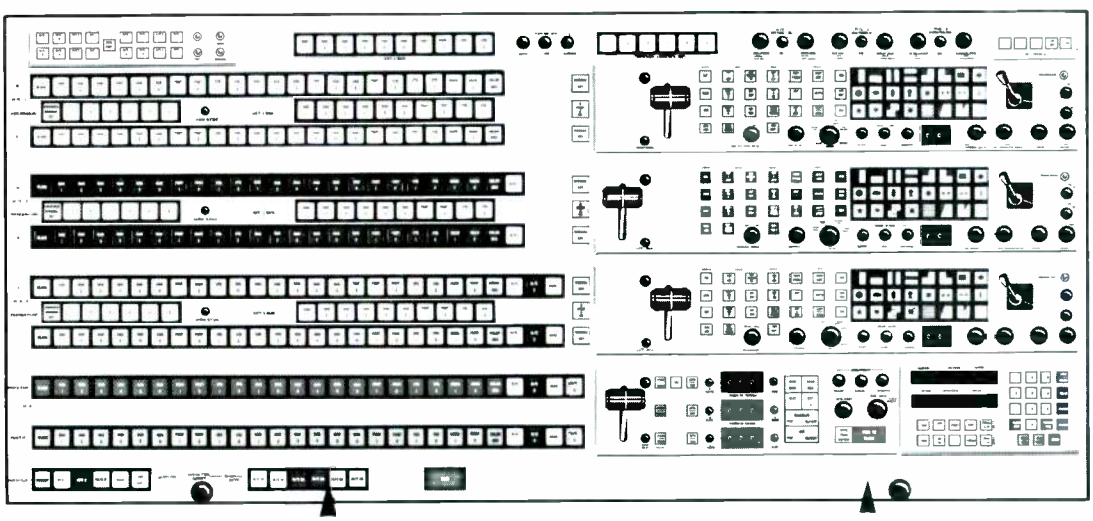

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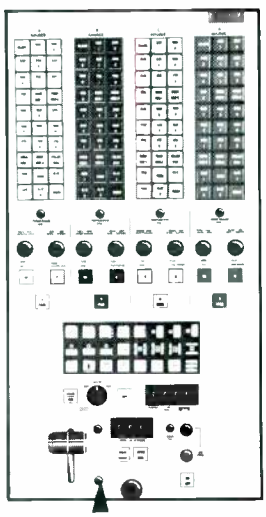

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aims in a manner responsive to the public and to broadcasters is to revise the model EEO program in ways that will make it more useful to the commission and those concerned about the broadcast industry's employment practices.

Comment dates will be announced when available. Docket no. 21474.

Children's TV programming

Calling the need for new children's television initiatives a "national commitment," commission chairman Charles D. Ferris urged the three major commercial networks to expand their weekday programming for children.

In an opening address to a conference of television programmers sponsored by two broadcast trade associations, Ferris said that the networks have, in the past decade, increased the number of Saturday and Sunday morning programs for children that are informational as well as entertaining. However, Ferris noted the continued scarcity of network children's programming on weekday afternoons and evenings.

Channel splitting scheme

The commission has approved a proposal by the Southern California Frequency Coordinating Committee to split channels to alleviate congestion on the 450/455MHz channels in Southern California, conditional on the results of the first year's operation under this scheme being reported to the FCC.

The committee is an organization of 21 broadcast licensees and three national television networks operating remote pick-up broadcast stations in Southern California in connection with licensed radio and TV station or network activities.

To help relieve congestion caused by increased use of this portion of the spectrum by RPU stations for electronic news gathering and caused by the peculiar terrain features of the area, the committee worked out a scheme requiring splitting of N1 channels of 50kHz each into two channels of 25kHz and splitting of "S" channels of 100kHz each into channels of 50kHz, which is not permitted under Section 74.402 an 74.462 of the rules. Therefore, the committee requested that a waiver of Section 74.402 be granted.

'Postcard size' renewal form

The commission has proposed it take a major step to eliminate government paperwork by shortening to postcard size the renewal application each radio and television licensee must file every three years, and substitute random complete audits of selected broadcasters as a more effective enforcement tool.

More than 9000 renewal applicants receive a review every three years of their past, present and proposed operations for compliance with FCC rules and the Communications Act. The FCC is proposing to allow most of these stations to file a short form containing only a few questions, which could be processed by a computer. It would supplement this review with random audits and field inspections that would allow an in-depth analysis of the operations of at least 5% of all licensees.

In this way, the commission said, it could modify the cost of the renewal process without altering its substance, and in fact increase its effectiveness, at a great savings to both the public and the industry.

In addition to the long form renewal evaluation and field investigations conducted by the Broadcast Bureau's EEO and Compliance branches, the commission proposed investigations by its Field Opera-

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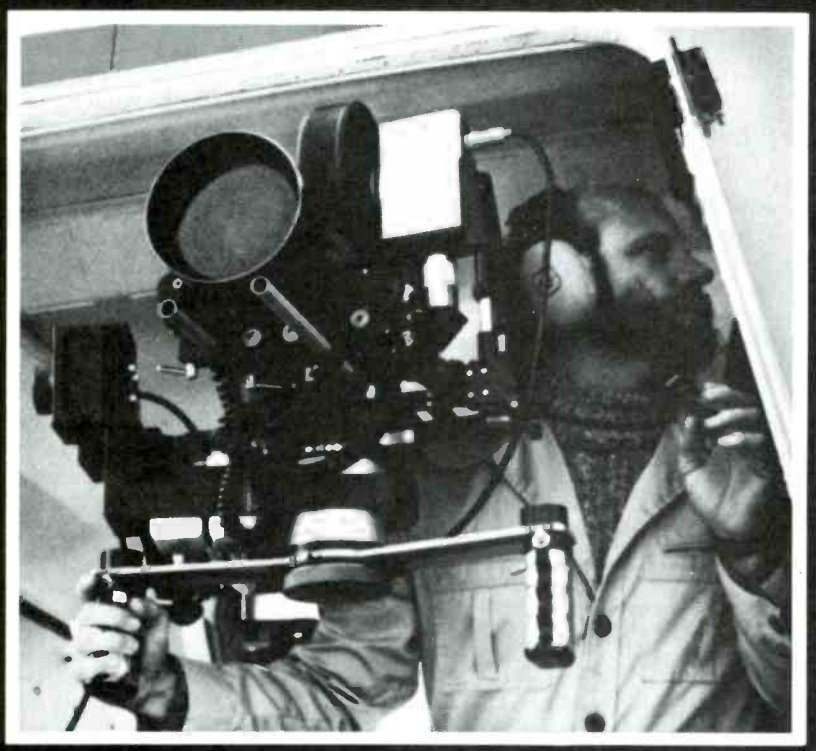

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FCC

tions Bureau to be made of a randomly selected group of stations, for instance, 80 every two months. The Broadcast Bureau would coordinate these inspections with FOB. The Field Operations Bureau would verify the licensee's technical inspections with FOB. The Field Operations Bureau would verify the licensee's technical engineering compliance and inspect the station's public files to assure that the data and information required by the FCC rules is contained therein.

Comment and reply dates will be announced when they are set.

Sewell named acting chief

Richard J. Shiben, chief of the broadcast bureau, announced that Stephen F. Sewell, assistant chief, complaints and compliance division has been appointed acting chief of that division.

3rd class operator permit abolished

The commission has abolished the Radiotelephone Third Class Operator Permit in a deregulation move that will eliminate issuing more than 50,000 permits every year and save four work-years annually for the next five years.

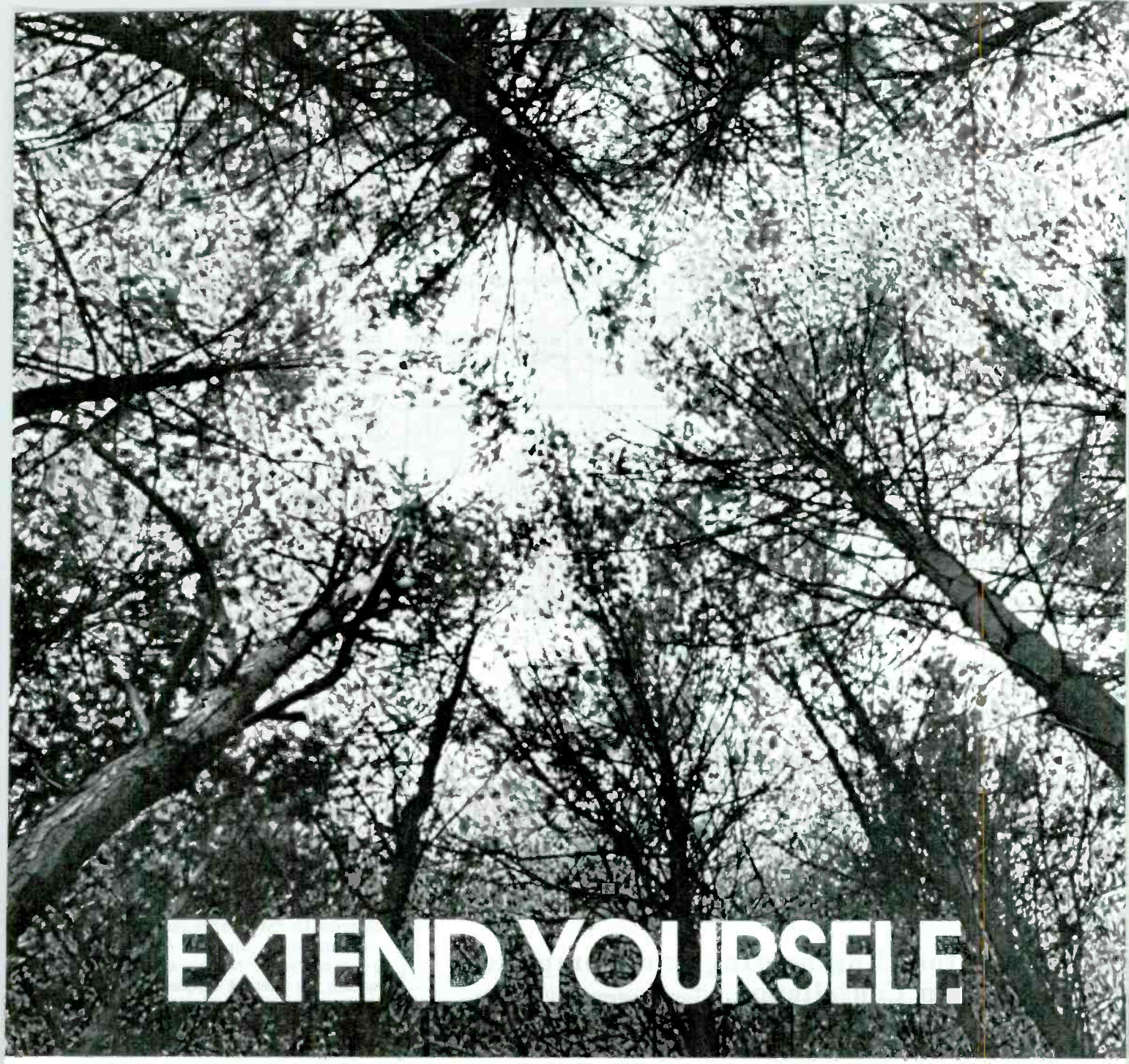
The commission retained without change its first and second class and its restricted operator permits. It determined that almost all of the 53,000 third class permits it is now issuing annually are unnecessary, largely as a result of other radio deregulation actions it has taken.

First class licenses, awarded after comprehensive examination, are required only in broadcasting. The operator responsible for installation, maintenance and repair of transmitting equipment at an AM, FM or TV station must hold a first class license. Second class licenses, awarded to applicants who pass examinations on basic radio laws and operating practice and on electronic theory, are required of operators responsible for installation, maintenance and repair of two-way radio equipment.

Third class permits, granted to those passing the simpler basic practice and law examination, authorize their holders to become routine operators at AM, FM and TV stations. Routine operations also may be performed by holders of the restricted permit, which requires no examination.

Standards for FM quadraphonic

The commission has asked for



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public comments on two approaches for setting standards for FM radio stations broadcasting in quadraphonic—using four audio signals that give the listener the effect of hearing the program material from four directions.

Specifically, the commission is seeking comments on these two approaches:

• Adoption of standards that would clearly specify most operating characteristics of the quadraphonic system, along the lines of those proposed by RCA and QSI, including the frequency of the subcarrier necessary to transmit the one or two additional subchannels and requirements for minimum equipment performance such as the maximum permitted audio distortion, minimum channel separation, maximum subchannel crosstalk, etc. These standards would provide for a compatible 4-3-4/4-4-4 quadraphonic system.

• Adoption of a general standards approach that would rely on the marketplace to determine which quadraphonic systems would be used. Only the minimum standards necessary to protect the existing allocation structure and ensure the compatibility of a transmitted signal with existing receivers would be adopted. Operation of any quadraphonic transmission system that meets the general standards would be permitted under this approach.

The commission found that quadraphonic broadcasting would not create greater adjacent channel interference than currently allowed monophonic or stereophonic transmissions and that the existence of quadraphonic broadcasting would have a minimal effect on proposals to reduce FM channel spacing.

There are three basic quadraphonic systems: (1) a discrete system in which the four audio signals are transmitted as a main channel and three subchannels are to be decoded at the receiver into four audio signals [4-4-4]; (2) a semidiscrete system in which the four audio signals are encoded and transmitted as a main channel and two subchannels are to be decoded at the receiver into four audio signals [4-3-4]; and (3) a matrixed system in which the four audio signals are encoded and transmitted as two channels (stereo) to be decoded at the receiver into four audio signals [4-2-4].

This proceeding was begun June 2, 1977, by notice of inquiry in response to petitions by Pacific FM Inc., the General Electric Company and CBS Inc. On January 2, 1979, noting that there was a substantial interest in FM quadraphonic broadcasting and that a 4-4-4/4-3-4 system could be accommodated within the current frequency assignment plan without objectionable degradation to monophonic and stereophonic service, the FCC issued a further inquiry notice on establishing standards.

In this latest rulemaking notice, the commission said there were two basic differences between the general and specific standards as proposed. Adoption of specific standards would ensure compatibility and would allow manufacturers to concentrate on the design of equipment meeting these standards. However, if a new quadraphonic system were developed that had vastly improved separation characteristics but offered this advantage only with slightly reduced frequency response, it would not be acceptable under the specific standards approach.

The general standards would ensure that the FCC's concerns regarding interference and interna-

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tional agreements were adequately covered but would not set forth minimum limits on performance characteristics which are of interest to listeners.

The standards also would allow the use of any quadraphonic system that protected the FCC's concerns regarding interference, compatibility with existing receivers and international agreements even though such systems might be incompatible with other quadraphonic systems available or already in use.

To enhance its ability to choose between the two alternatives, the commission is seeking economic information, including:

- What is the expected selling price and cost of installation (including any necessary modification to existing equipment) for various systems?;
- The added cost to consumers of receiving equipment which has each system's quadraphonic reception capability;
- Can systems be designed that will enable reception of all or more than one of the proposed transmission modes?;
- If a universal receiver is possible, what would be the additional cost to the consumer?;
- What are manufacturer's attitudes toward manufacturing and marketing multi-system equiment?;
- Is FM quad sufficiently advanced to enable the FCC to make a choice that would narrow the technological focus or should open technological development be allowed to continue?;
- If technology is to be narrowed to one or a few methods of producing FM quad, is the FCC the appropriate entity to make a selection or is there a better alternative?;
- Would either specific or general standards adversely affect the degree of competition domestically or internationally?; and
- If the FCC narrows the technological choices available to broadcasters, what criteria should it use to do so and how should they be weighed?

Comment dates will be announced later.

$43 million in fee refund

By the end of July, the commission has returned more than $43 million to eligible broadcasters, common carriers, electronic equipment manufacturers, aviation and marine radio users and certain amateurs in Phase I of its Fee Refund Program.

The refund program was developed in response to four decisions by the US Court of Appeals for the District of Columbia Circuit in December 1976. The court held that fees collected by the FCC between August 1, 1970, and December 31, 1976, were unlawful in that they exceeded commission costs. The commission was directed to recalculate those fees and make appropriate refunds.

Approximately 58,500 refund requests totaling about $54 million have been filed. The $43 million paid represents 40,340 requests. Affected licensees under Phase I have until December 15, 1982, to file for a refund.

Advice needed on 9kHz generated station

The commission has asked all interested persons for advice on how the 12 new AM radio channels, which will be created if 9kHz channel spacing is adopted, should be used.

The commission asked those interested in applying for new stations that could go on the air by the end of 1987 to file statements of intent telling it where the stations would be and what type of service they would offer. Those interested in expanding the service of existing stations by 1987 were asked to file similar statements. The commission asked for these by October 1. □

Demand for satellite communications to double

Demand for international satellite communications will almost double by the end of 1984. This was a prediction of the INTELSAT Global Traffic Meeting that closed after a week of deliberation in Washington, DC.

INTELSAT, the International Telecommunications Satellite Organization, is the 104 member country organization that owns and operates the global system used by 143 countries and territories for international communications and by 16 countries for domestic communications.

More than 100 countries were represented by about 240 delegates at the 1980 meeting.

The purpose of the meeting was to determine, by taking into account the traffic requirements of individual countries, demand forecasts for the services to be provided by the INTELSAT system. This information is used by INTELSAT, which currently carries about 60% of the world's international transoceanic telecommunications, in planning its satellite system.

Johnny Carson receives Governors Award from ATAS

Johnny Carson has been selected by the Board of Governors of the Academy of Television Arts & Sciences as the recipient of its prestigious Governors Award, presented on the Emmy Awards telecast, September 7 on NBC.

The Governors Award, the highest honor bestowed by the academy, is awarded for achievement so extraordinary that it goes beyond the scope of the awards presented in the categories or areas of achievement.

Cramer audio/video system's first open house

The greater Boston "Professional Video and Audio Show" sponsored by Cramer Video drew nearly 800 visitors to view the latest professional audio and video equipment.

The 45 exhibitors displaying at the show included Advent, 3M/Mincom, Microwave Associates, Microtime, Panasonic, Sony, Sharp, Videomedia, Teac, Tascam, JBL, AKG and Crown. They exhibited their newest products and conducted seminars on subjects ranging from technological developments, programming, editing/production techniques and analysis to the setting up of a satellite network for teleconferences. One of the features of the show was a microwave link from a local television tower across Rt. 128 (Technology Roadway) to the Microwave Associate's booth at the show.

The show dealt with the application of small computers in video.

Three win 1980 AMP awards

Three engineers at Ampex have won the 1980 Alexander M. Poniatoff awards, the highest honor for technical achievement given to employees.

Larry Evans, a staff engineer in the Audio-Video Systems Division, won the gold award and a cash prize of $3000 for his contributions to the development of the Ampex video art graphics system.

Two silver awards—each worth $1500—went to John Corcoran, manager, special projects development section, Data Systems Division and Ray Ravizza, senior staff engineer, AVSD.

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Industry News

Evans was cited for his contributions in the field of computer interactive graphics that led to development of the AVA system. He joined Ampex in 1977 as project engineer in the design and development of AVA. He holds a master's degree in computer science from the University of Utah.

Ravizza was cited for his work in the development of the reverse slow motion capability for the VPR Series of helical scan videotape recorders. He joined Ampex in 1966, and has been a member of the AVSD engineering department since 1972. He has been involved in development work on the VPR Series of recorders, the SMC-60 slow motion controller, and automatic scan tracking (AST) technology.

Corcoran was cited for his contribution to advancements in high density digital recording, work done while he was a member of the Advanced Technology Division.

Corcoran joined Ampex in 1968 and has specialized in the investigation and design of laser systems for analog and digital data storage and retrieval employing photographic and magneto optic media. He is currently investigating advanced optical processing and optical digital recording techniques and is doing research in the analysis of advanced recording systems, with special emphasis on high density recording.

Joint venture radio seminar attracts 55 New England broadcasters

A joint venture among three radio equipment manufacturers and a program syndicator drew 55 New England broadcasters to a one-day seminar and

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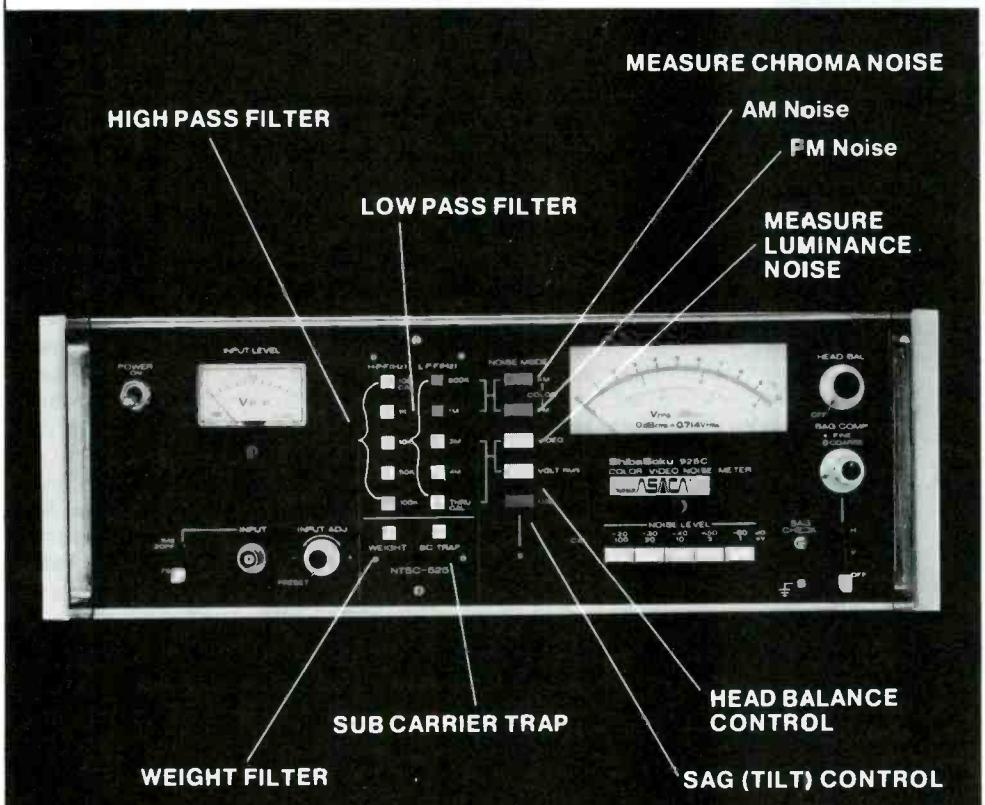

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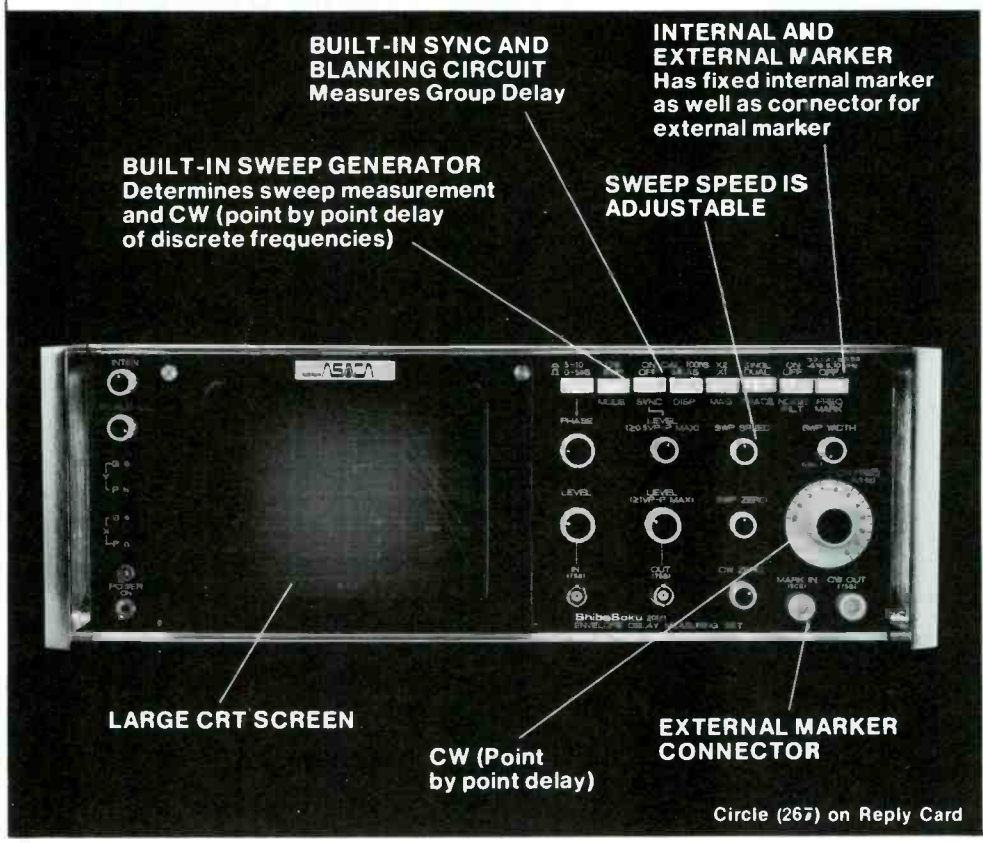

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Industry News

workshop in Newton, MA, June 19.

The program was made up of tutorial presentations in the morning and smaller workshop sessions in the afternoon. Participants heard presentations on new multi-cart playback equipment (Andy Rector, International Tapetronics), program syndication services (Redd Gardner, Peters Productions) program automation (Andy McClure, Cetec Broadcast Group), and computer-aided billing, accounting and traffic (Larry Pfister, Station Business Systems). A fifth speaker, Douglas V. Lane, gave an overview of how he has used program automation, a business system, program syndication, and modern tape-handling techniques in building WWDL-FM and WICK-AM in Scranton, PA, which he owns and operates.

The 55 broadcasters/guests came from as far away as metropolitan New York, Maine, and New Hampshire, as well as the Boston area. There was no charge for the event, but advance registration by mail was required.

The seminar/workshop was proposed at an informal meeting of the four organizations during the NAB Convention in Las Vegas in April. Andy McClure of Cetec Broadcast Group, who called the exploratory meeting, said the group was motivated in part by the fact that both NAB and NRBA national events are scheduled for western locations this year and next, thus depriving both East Coast broadcasters and suppliers from exchanging information and showing new products and systems.

Based on results of the Boston area program, scheduling of additional radio broadcast seminars in other key East Coast cities appears probable, McClure said.

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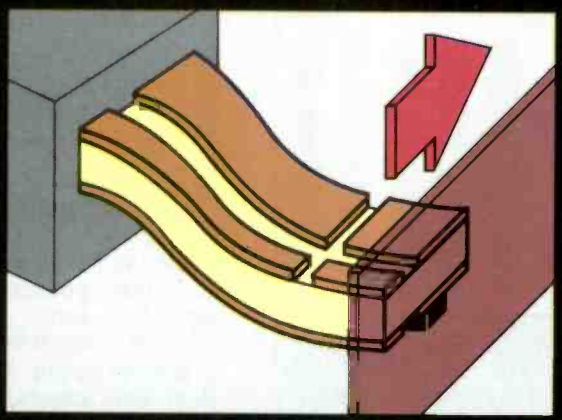

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association news

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NAB announces committees

Vincent T. Wasilewski, NAB president, and board chairman Thomas E. Bolger, president, WMTV, Madison, WI, have announced NAB's 1980-81 committees. They are:

Bylaws—John H. Lemme, president and general manager, KLTF, Little Falls, MN, chairman; William R. Brazzil, vice president and general manager, WTVJ-TV, Miami, FL; Gert H. W. Schmidt, chairman of the board, WTLV-TV, Jacksonville, FL; Thom Smith, general manager, WDEN, Macon, GA; and Marion Stephenson, vice president, radio and industry relations, NBC, *New York City*.

Children's Television—Don Curran, president, Field Communications, San Francisco, CA, chairman; Leonard A. Swanson, vice president and general manager, WIIC-TV, Pittsburgh, PA, vice chairman; William Dilday Jr., general manager, WLBT-TV, Jackson, MS; Michael McCormick, president, WTMJ-TV, Milwaukee, WI; Lucy Salhaney, vice president for programming, Taft Broadcasting Company, Philadelphia; PA; and Irwin Starr, vice president and general manager, KREM-TV, Spokane, WA.

Congressional Liaison—Eugene S. Cowen, vice president, Washington, ABC, and Jerry Lee, president, WDVR, Bala Cynwyd, PA, co-chairmen; Eugene Bohi, president, WGHP-TV, High Point, NC; Don Curran; Edward O. Fritts, president, Fritts Broadcasting, Indianola, MS; W. Frank Harden, president, State Telecasting Company, Columbia, SC; Arnold S. Lerner, chairman, WLLH, Lowell, MA; William Lilley III, vice president, Washington, CBS; Robert H. Pricer, president, WCLT-Radio, Newark, OH; Mark Smith, vice president and general manager, Landmark Broadcasting Company, Las Vegas, NV;

Cullie Tarleton, vice president, radio, Jefferson Pilot Broadcasting Company, Charlotte, NC; William F. Turner, division president and general manager, KCAU-TV Sioux City, IA; and J. T. Whitlock, president and general manager WLBN, Lebanon, KY.

Convention—Tarleton and Mark Smith, co-chairmen; Harry E. Barker, president and general manager, KQMS, Redding, CA; Bohi; Kathryn F. Broman, president, Springfield Television Corporation, Springfield, MA; Dilday; Bruce F. Johnson, president, Shamrock Broadcasting Company, Hollywood, CA; Stanley W. McKenzie, president and general manager, KWED, Seguin, TX; Schmidt; Stephenson; Walter M. Windsor, general manager, WFTV, Orlando, FL; and Charles E. Wright, president and general manager, WBYS, Canton, IL.

Engineering Advisory—Robert W. Flanders, vice president and director of engineering, McGraw-Hill Broadcasting Company, Indianapolis, IN; Leslie G. Arries Jr., president, WIVB-TV, Buffalo, NY; William E. Garrison, vice president for engineering and government relations, Multimedia Broadcasting Company, Greenville, SC; Cliff Gill, president and general manager, KWVE, El Camino Broadcasting Corporation, San Clemente, CA; Albin R. Hillstrom, vice president, engineering, KOOL Radio and Television, Phoenix, AZ; Eugene D. Jackson, president, National Black Network, New York, NY; Walter E. May, president, WPKE, Pikeville, KY; Martin H. Meany, director, allocations engineering, NBC Television Network, New York, NY; Robert A. O'Connor, director, transmission engineering, engineering and development department, CBS Television Network, New York, NY; R. LaVerne Pointer, vice president, broadcast engineering, American Broadcasting Companies, New York, NY; Doyle D. Thompson, director of engineering, broadcast division, Landmark Communications, Norfolk, VA; and William Wisniewski, vice president, engineering, Mutual Broadcasting System, Arlington, VA.

First Amendment—Brazzil, chairman; Reid G. Chapman, vice president and general manager, WANE-TV, Fort Wayne, IN; Herbert W. Hobler, president, Nassau Broadcasting Company, Princeton, NJ; Lilley; McKenzie; Walter L. Rubens, president and general manager, KOBE/KOPE, Las Cruces, NM; Martin Rubenstein, president and chief executive officer, Mutual Broadcasting System, Arlington, VA, and Thom Smith.

NAB

Hundred Plus Markets Television—Harden, chairman; Carl Anderson, president and general manager, KREX-TV, Grand Junction, CO; Bill Bengtson, vice president and general manager, KOAM-TV, Pittsburg, KS; Lawrence Busse, general manager, WEAU-TV, Eau Claire, WI; Walter Dickson, president, WABI-TV, Bangor, ME; Marvin Reuben, vice president and general manager, WDAM-TV, Hattiesburg, MS; and Donald Smullin, president, KOBI-TV, Medford, OR.

International—Arch L. Madsen, president, Bonneville International Corporation, Salt Lake City, UT, chairman; Brazzil; Raymond E. Carow, vice president and general manager, WALB-TV, Albany, GA; Robert R. Hilker, president and general manager, WCGC, Belmont, NC; Arthur H. Holt, president, WZZO, Bethlehem, PA; Wayne Kearl, group president, Harte-Hanks Television, San Antonio, TX; Peter B. Kenney, vice president, Washington, National Broadcasting Company, Washington, DC; Donald A. Thurston, president, Berkshire Broadcasting Company, North Adams, MA; and Daniel Kops, president, Kops-Monahan Communications, New Haven, CT.

Membership—Ted A. Smith, president and general manager, KUMA, Pendleton, OR, chairman; Chapman; Fred L. Conger, president and general manager, KWBW, Hutchinson, KS; Harden; Roy A. Redmon, general manager, WFTM, Maysville, KY; William L. Stakelin, vice president and general manager, WHOO Radio, Orlando, FL; Stephenson; and Windsor.

Small Market Radio—Roy A. Mapel, general manager/secretary-treasurer, KIML, Gillette, WY, chairman; Gary L. Capps, president and general manager, KGRL, Bend, OR; Charles B. Cooper, president and general manager, WKOR, Starkville, MS; Karen Mass, vice president and general manager; KIUP-AM/KRSJ-FM, Durango, CO; Rex Marshall, president and general manager, WNHV, White River Junction, VT; Dick Painter, president, KYSM, North Mankato, MN; Robert E. Thomas, manager, WJAG, Norfolk, NE; Douglas J. Tjapkes, president and general manager, WGHN, Grand Haven, MI; and Whitlock.

Medium Market Radio—Rubens, chairman; Martin F. Beck, president, Beck-Ross Communications, Rockville Centre, NY; Fredric A. Danz, president, Sterling Recreation Organization, Bellevue, WA; Elliott E. Franks, III, general manager, WOIC, Columbia, SC; Ralph E. Hacker, vice president and general manager, WVLK, Lexington, KY; Joseph McMurray, president and general manager, KNUU, Las Vegas, NV; Pricer; and Ted L. Snider, president, KARN, Little Rock, AR.

Metro Market Radio—Len Hensel, vice president and general manager, WSM, Nashville, TN, chairman; Willie D. Davis, president, KACE-FM, Los Angeles, CA; George Duncan, president, Metromedia Radio, Secaucus, NJ; J. William Grimes, senior vice president, CBS Radio Division, CBS, New York, NY; Richard Harris, president, Radio Station Group, Westinghouse Broadcasting, New York, NY; Thomas E. McKinney, president, Sheridan Broadcasting Corporation, Pittburgh, PA; Rubenstein; Gary Stevens, president, Doubleday Broadcasting Company, Minneapolis, MN; and Carl Wagner, executive vice president, radio, Taft Broadcasting Company, Cincinnati, OH.

Research—Windsor, chairman; Richard Dudley, president, Forward Communications Corporation, Wausau, WI; Jay Eliasberg, vice president, research, CBS Broadcast Group, CBS, New York, NY; Ben Hoberman, president, ABC radio, American Broadcasting Companies, New York, NY; Michael O. Lareau, executive vice president, WOOD Broadcasting, Grand Rapids, MI; Lee; Robin B. Martin, president and chief executive officer, Deer River Broadcasting Group, New York, NY; William Rubens, vice president, research, National Broadcasting Company, New York, NY; Schmidt; and Paul Sonkin, vice president, ABC Television Network, New York, NY.

Science and Technology—Lilley, chairman; Paul Bortz, managing partner, Brown, Bortz & Coddington, Denver, CO; Joel Chaseman, president, Post-Newsweek Stations, Washington, DC; Thomas Cookerly, president/general manager, WJLA-TV, Washington, DC; and David E. Henderson, president, WJAR-TV, Providence, RI.

Task Force on Radio Allocations—Lerner, chairman; Ralph Green,

NAB

vice president of engineering, CBS Radio Network, New York, NY; Jackson; Johnson; Lareau; Lee; May; and Wright.

UHF Television—Broman, chairman; Chapman, vice chairman; Frederick Breitenfeld Jr., executive director, WMPB-TV, Maryland Public Broadcasting Commission, Owings Mills, MD; Curran; James C. Dowdle, vice president and general manager, WTOG-TV, St. Petersburg, FL; Milton D. Friedland, vice president and general manager, WICS-TV, Springfield, IL; Robert Ratcliff, executive vice president and general manager, WKPT-TV, Kingsport, TN; Cyril E. Vetter, president and general manager, WRBT-TV, Baton Rouge, LA; and Bob J. Wormington, president and general manager, KBMA-TV, Kansas City, MO.

Canadian service

James J. Popham, deputy general counsel of the NAB, asked that US broadcasters be *justly compensated* for providing service to Canadians. A Canadian law penalizes Canadian advertisers who choose to reach their Canadian market by purchasing advertising on US radio and television stations.

Testifying before a committee of The Office of the United States Trade Representative, Popham said the law made it prohibitively expensive for Canadians to advertise on US stations. Furthermore, Popham said, the law sets a dangerous precedent. "As satellites become the dominant method of program transmisson and pay TV is introduced in Canada, it will be even more important that domestic and foreign broadcasters receive equitable, nondiscriminatory treatment and just compensation for their services."

Radio deregulation

The NAB renewed its request for the elimination of unneeded regulations currently imposed on the radio broadcasting industry, citing significant new data that demonstrate radio stations', programs triple the present FCC's minimum for nonentertainment programming.

This conclusion was drawn from a survey of nonentertainment programming aired on 269 AM and 143 FM stations. The study revealed that the average percentage for AM outlets was 25.10, more than three times the FCC minimum of 8%, and 17.50 for FM stations, almost three times the 6% called for by the FCC. □

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Worldwide Color TV Standards: Similarities and Differences

Part II

By D. H. Pritchard and J. J. Gibson, RCA Laboratories, Princeton, NJ

There is an accelerated interest in worldwide digital video standards as the industry prepares for the "1980s—The Digital Decade." In this two-part series the authors discuss the similarities and differences in the various color standards that have evolved. Part I was in the August issue.

In NTSC color standards, the chrominance information is carried as simultaneous amplitude and phase modulation of a subcarrier chosen to be in the high frequency portion of the 0-4.2MHz video band and specifically related to the scanning rates as an odd multiple of one-half horizontal line rate as shown by the vector diagram in Fig. 6. The hue information is assigned to the instantaneous phase of the subcarrier. Saturation is determined by the *ratio* of the instantaneous amplitude of the subcarrier to that of the corresponding luminance signal amplitude value.[2,3,4]

The choice of the I and Q color modulation components relates to the variation of color acuity characteristics of human color vision as a function of the field of view and spatial dimensions of objects in the scene. The color acuity of the eye decreases as the size of the viewed object decreases and occupies a small part of the field of view. Small objects, represented by frequencies above about 1.5 to 2.0MHz, produce no color sensation (*mixed-highs*). Intermediate spatial dimensions (0.5 to 1.5MHz range) are viewed satisfactorily if reproduced along a preferred orange-cyan axis. Larger objects (0-0.5MHz) require full three-color reproduction for subjectively pleasing results. Thus, the I and Q bandwidths are chosen accordingly and the preferred colorimetric reproduction axis is obtained when only the I signal exists by rotating the subcarrier modulation vectors by 33°. Thereby the principles of *mixed-highs* and *I, Q color-acuity axis* operation are exploited.

At the encoder, the Q-signal component is band-limited to about 0.6MHz and is representative of the green-purple color-axis information. The I-signal component has a bandwidth of about 1.5MHz and contains the orange-cyan color axis information. These two signals are then used to individually modulate the color subcarrier in two balanced modulators operated in phase quadrature. The *sum products* are selected and added to form the composite chromaticity subcarrier. This signal, in turn, is added to the luminance signal along with the appropriate horizontal and vertical synchronizing and blanking signals to include the color-synchronizing burst. The result is the total composite color video signal.

Quadrature synchronous detection is used at the receiver to identify the individual color signal components. When individually recombined with the luminance signal, the desired R, G, and B signals are re-created. The receiver designer is free to demodulate either at I and Q and matrix to form B-Y, R-Y, and G-Y, or, as in nearly all present-day receivers, at B-Y and R-Y and maintain 500kHz equi-band color signals.

The chrominance information can be carried without loss of identity provided that the proper phase relationship is maintained between the encoding and decoding processes. This is accomplished by transmitting a reference *burst* signal consisting of eight or nine cycles of the subcarrier frequency at a specific phase [-(B-Y)] following each horizontal synchronizing pulse, as shown in Fig. 7.

The specific choice of color subcarrier frequency in NTSC was dictated by at least two major factors. First, the necessity for providing horizontal interlace to reduce the visibility of the subcarrier requires that the frequency of the subcarrier be precisely an odd multiple of one-half horizontal line rate.

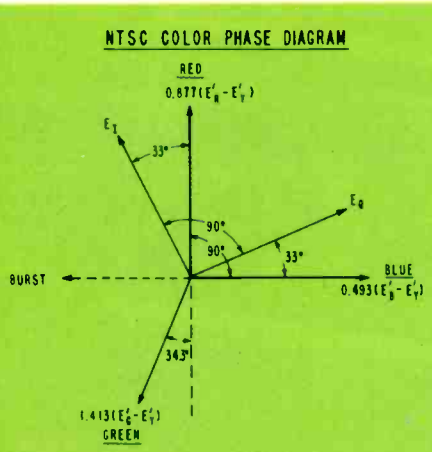

Fig. 6. NTSC color modulation phase diagram

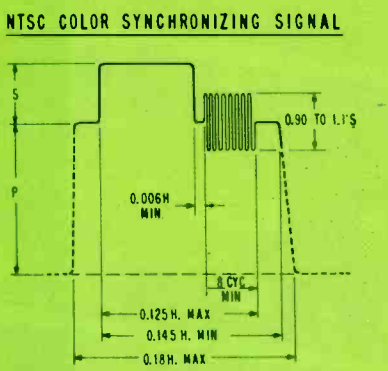

Fig. 7. NTSC color burst synchronizing signal

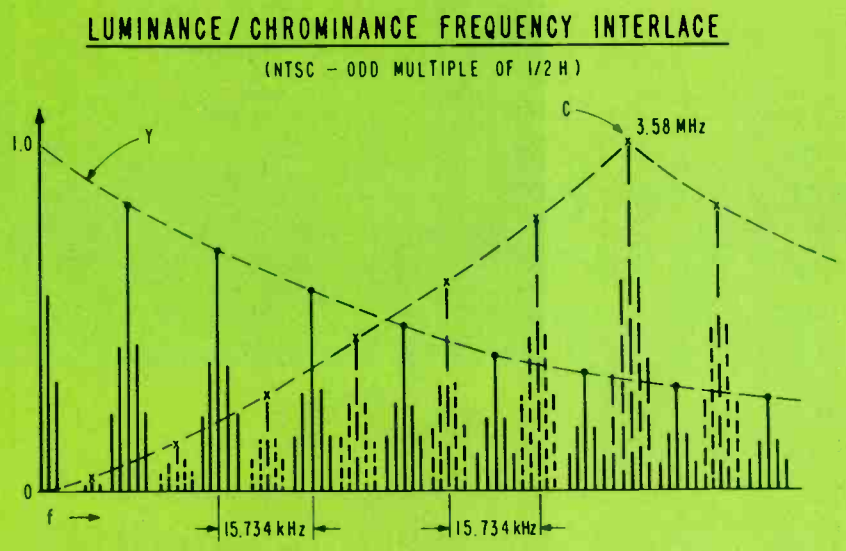

Fig. 8. Basic TV horizontal frequency interlace principle

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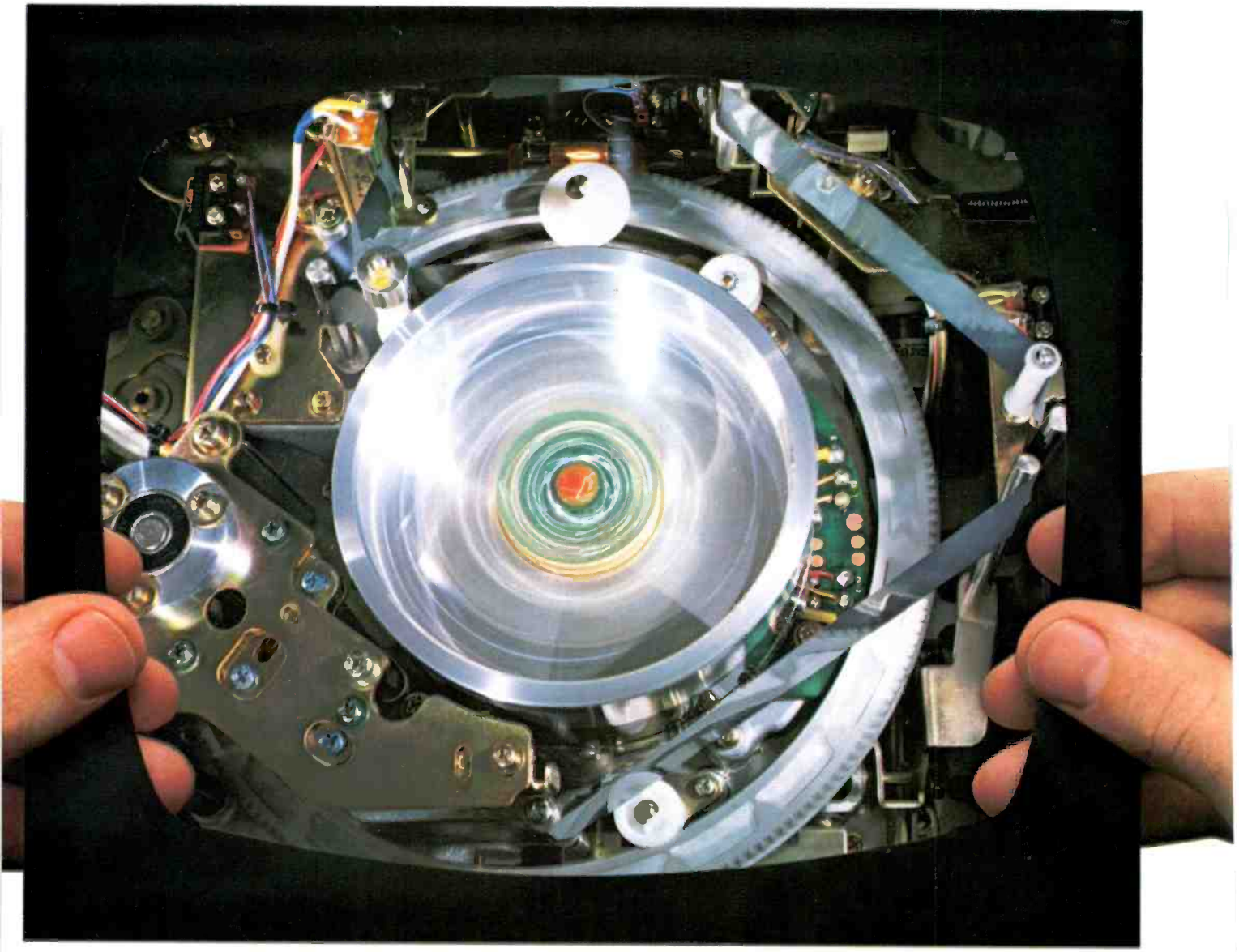

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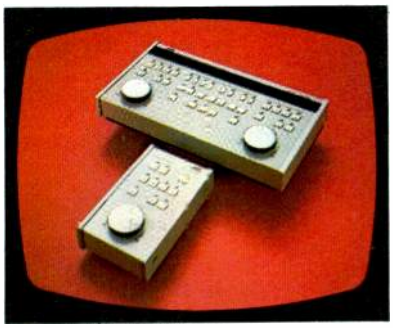

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$$f_{SC} = \frac{13 \times 7 \times 5}{2} \times f_{LINE}$$

$$f_{SC} = \frac{455}{2} \times f_{LINE}$$

$$f_{SC} = \frac{455}{2} \times \frac{4.5 \times 10^6}{286} \text{ cps}$$

$$= \underline{3.579545} \text{ MHz}$$

Fig. 9. Calculation of NTSC Specific Line, Field and Color Subcarrier Frequencies.

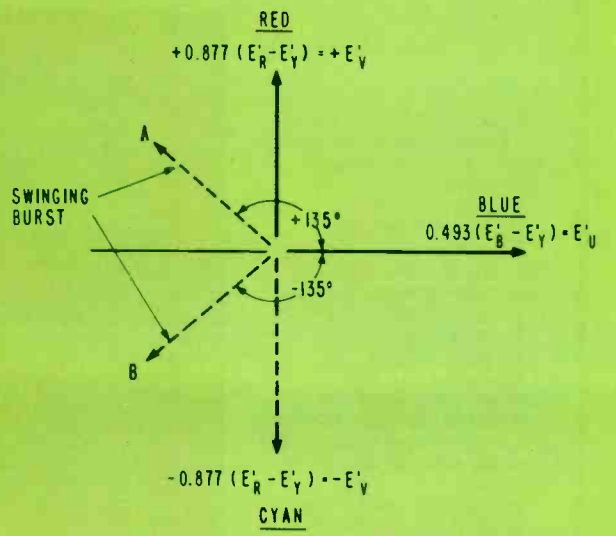

Fig. 10. PAL Color Modulation Phase Diagram.

Color standards

The energy spectrum of the composite NTSC signal for a typical stationary scene is shown in Fig. 8. This interlace provides line-to-line phase reversal of the color subcarrier, thereby reducing its visibility. Second, it is advantageous to also provide interlace of the beat-frequency (about 920kHz) occuring between the color subcarrier and the average value of the sound carrier. For total compatibility reasons, the sound carrier was left unchanged at 4.5MHz and the line number remained at 525. Thus, the resulting line scanning rate and field rate varied slightly from that of the monochrome values, but stayed within the previously existing tolerances. A good rule of thumb is that the difference is exactly one part in a thousand. The exact specifications and method of calculating the frequencies are shown in Fig. 9. It is seen that the line rate is 15.734kHz, the field rate is 59.94Hz and the color subcarrier is 3.579545MHz.

The NTSC system fundamentals have been reviewed in detail because it was the first truly compatible system placed in commercial use and because the other systems subsequently proposed make use of most of the basic principles, differing mainly in the techniques of color encoding (primarily to overcome early implementation difficulties).

PAL color system

Except for minor details, the color encoding principles for PAL are the same as those for NTSC. However, the phase of the color signal, EV = R-Y, is reversed by 180° from line-to-line. This is done for the purpose of averaging, or cancelling, certain color errors resulting from amplitude and phase distortion of the color modulation sidebands. These distortions might occur as a result of equipment or transmission path problems.

The NTSC chroma signal expression within the frequency band common to both I and Q is given by:

$$C_{NTSC} = \frac{B\text{-}Y}{2.03} \sin(\omega_{sc}t) + \frac{R\text{-}Y}{1.14} \cos(\omega_{sc}t). \quad (3)$$

The PAL chroma signal expression is given by:

$$C_{PAL} = \frac{U}{2.03} \sin(\omega_{sc}t) \pm \frac{V}{1.14} \cos(\omega_{sc}t). \quad (4)$$

where: U and ±V have been substituted for B-Y and R-Y signal values, respectively.

The PAL employs equal bandwidths for the U and V color-difference signal

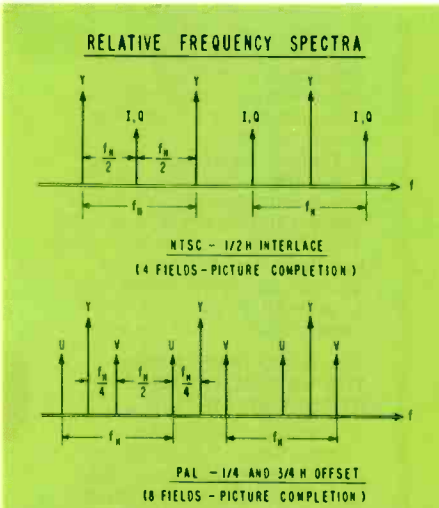

Fig. 11. NTSC and PAL Frequency Interlace Relationship.

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components, which are about the same as the NTSC I signal bandwidth (1.3MHz at 3dB). There are slight differences in the U and V bandwidth in different PAL systems because of the differences in luminance bandwidth and sound carrier frequencies as discussed later (see the CCIR documents for specific details).

The V component was chosen for the line-by-line reversal process since it has a lower gain factor than U and, therefore, is less susceptible to switching rate (½fH) imbalance. The vector diagram for the PAL quadrature modulated and line-alternating color modulation approach are indicated in Fig. 10.

The result of the switching of the V signal phase at line rate is that any phase errors produce complementary errors from V into the U channel. In addition, a corresponding switch of the decoder V channel results in a constant V component with complementary errors from the U channel. Thus, any line-to-line averaging process at the decoder, such as the retentivity of the eye (simple PAL), or an electronic averaging technique such as the use of a 1-H delay element (standard PAL), produces cancellation of the phase (hue) error and provides the correct hue but with somewhat reduced saturation—this error being subjectively much less visible.

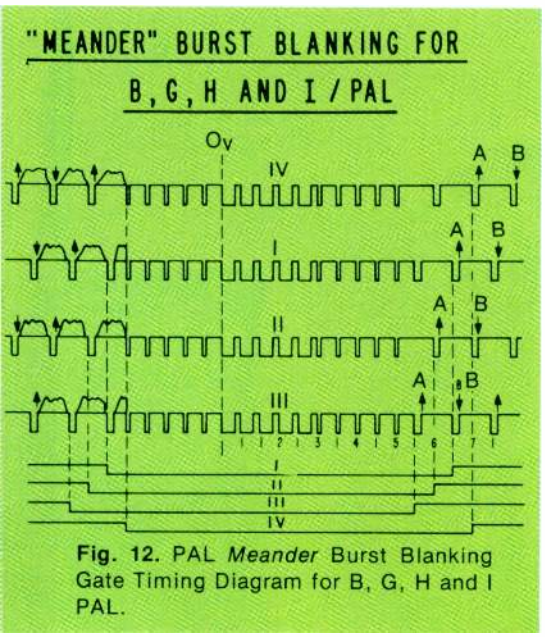

Fig. 12. PAL *Meander* Burst Blanking Gate Timing Diagram for B, G, H and I PAL.

Obviously, the PAL receiver must be provided with some means by which the V signal switching sequence may be identified. The technique employed is known as AB sync, PAL sync, or *swinging burst* and consists of alternating the phase of the reference burst by ±45° at a line rate as shown in Fig. 10. The burst is constituted from a fixed value of U phase and a switched value of V phase. Since the sign of the V burst component is the same sign as the V picture content, the necessary switching sense or identification information is available. At the same time, the fixed-U component is used for reference carrier synchronization.

The degree to which horizontal frequency (dot) interlace of the color subcarrier components with the luminance components is achieved in PAL is shown in Fig. 11 and may be summarized as follows: In NTSC, the Y components are spaced at f_H intervals due to the horizontal sampling (blanking) process. Thus, the choice of a color subcarrier, which has harmonics also separated by f_H, (as being an odd multiple of ½f_H), provides a half-line offset and results in a perfect dot interlace pattern that moves upward. Four complete field scans are required to repeat a specific picture element dot position.

In PAL, the luminance components are also spaced at f_H intervals. Because the V component is switched symmetrically at the half-line rate, only odd harmonics exist, resulting in V components spaced at intervals of f_H. They are spaced half-line from the U components that, in turn, have f_H spacing intervals due to blanking. If half-line offset were used, the U components would be perfectly interlaced, but the V components would coincide with Y and thus not be interlaced—creating vertical, stationary, dot patterns.

Therefore, in PAL, a ¼ line offset for the subcarrier frequency is used as shown in Fig. 11. The expression for determining the PAL subcarrier specific frequency for 625-line/50-field systems is given by:

$$f_{SC} = (¼)\ 1135\ f_H + ½\ f_V \quad (5)$$

The additional factor $½f_V = 25Hz$ is introduced to provide motion to the color dot pattern, thereby reducing its visibility. The degree to which interlace is achieved, although not perfect, is acceptable, and eight complete field scans must occur before a specific picture element dot position is repeated.

One additional function must be accomplished in relation to PAL color synchronization. In all systems, the burst signal is eliminated during the vertical synchronizing pulse period. Because, in the case of PAL, the swinging burst phase is alternating line-by-line, some means must be provided for ensuring that the phase is the same for the first burst following vertical sync on a field-by-field basis. Therefore, the burst reinsertion time is shifted by one line at the vertical field rate by a pulse referred to as the *meander* gate. The timing of this pulse relative to the A vs. B burst phase is shown in Fig. 12.

The transmitted signal specifications for PAL systems include the basic features discussed above. Although description of a great variety of receiver decoding techniques is outside the scope and intent of this paper, a brief review of the major features is as follows: *Simple* PAL relies upon the eye to average the line-by-line color switching process and can be plagued with line beats (*Hanover bars*) caused by the system nonlinearities introducing visible luminance changes at line rate. *Standard* PAL employs a 1-H delay line element to separate U color signal components from V color signal compo-

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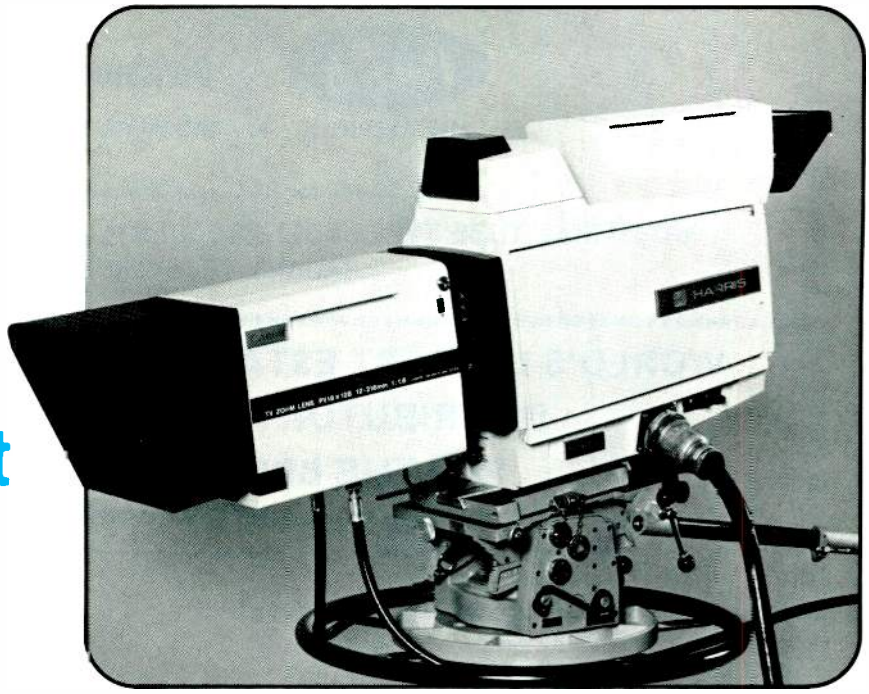

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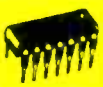

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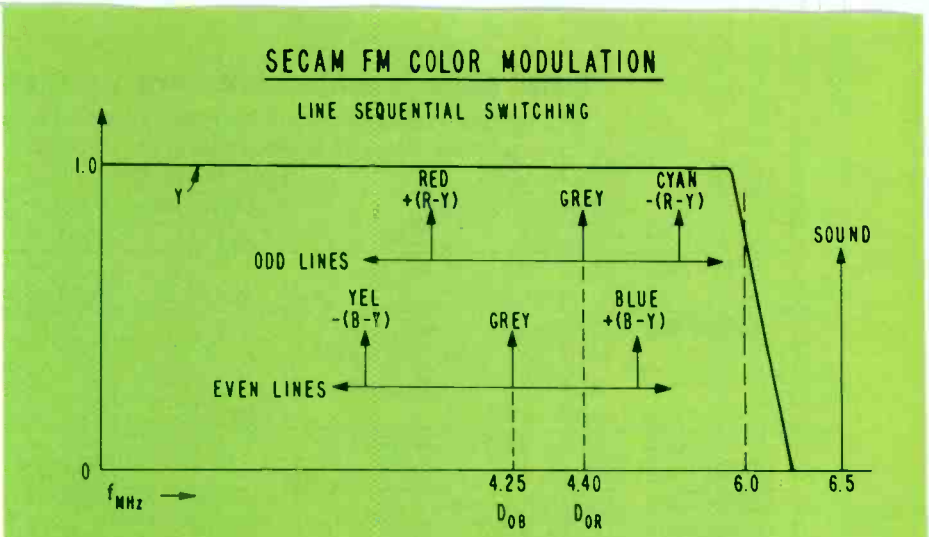


Fig. 13. SECAM FM Color Modulation System.

Color standards

nents in an averaging technique coupled with summation and subtraction function. Hanover bars can also occur in this approach if imbalance of amplitude or phase occurs between the delayed and direct paths.

For a discussion of the variety of other decoder approaches such as Chroma Lock, Super PAL, New PAL or PALN (not to be confused with N (PAL), see reference (3).

In a PAL system, vertical resolution in chrominance is reduced as a result of the line averaging processes. The visibility of the reduced vertical color resolution, as well as the vertical time coincidence of luminance and chrominance transitions differ, depending upon whether the total system (transmitter through receiver) includes one or more averaging (comb filter) process.

Thus, PAL provides a similar system to NTSC and has gained favor in many areas of the world, particularly for 625-line/50-field systems.

SECAM color system

The *optimized* SECAM system, called SECAM III, is the system adopted by France and the USSR in 1967. The SECAM method has several features in common with NTSC, such as the same E'_Y signal and the same E_B-E'_Y and E_R-E'_Y color-difference signals. However, this approach differs considerably from NTSC and PAL in the manner in which the color information is modulated onto the subcarrier(s).

First, the R-Y and B-Y color difference signals are transmitted alternately in time sequence from one successive line to the next—the luminance signal being common to every line. Because there is an odd number of lines, any given line carries R-Y information on one field and B-Y information on the next field. Second, the R-Y and B-Y color information if conveyed by frequency-modulation of different subcarriers. Thus, at the encoder, a 1-H delay element, switched in time synchronization with the line switching process at the encoder, is required in order to have

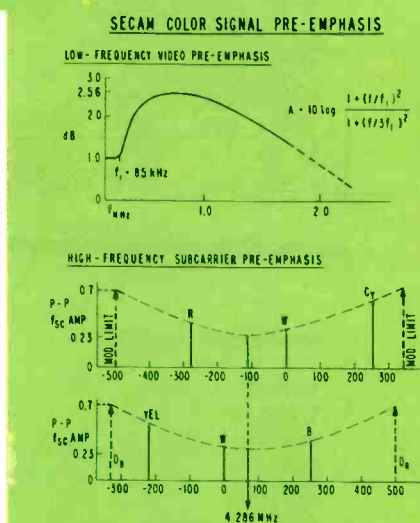


Fig. 14. SECAM Color Signal Pre-emphasis Characteristics.

simultaneous existence of B-Y and R-Y signals in a linear matrix to form the G-Y component.

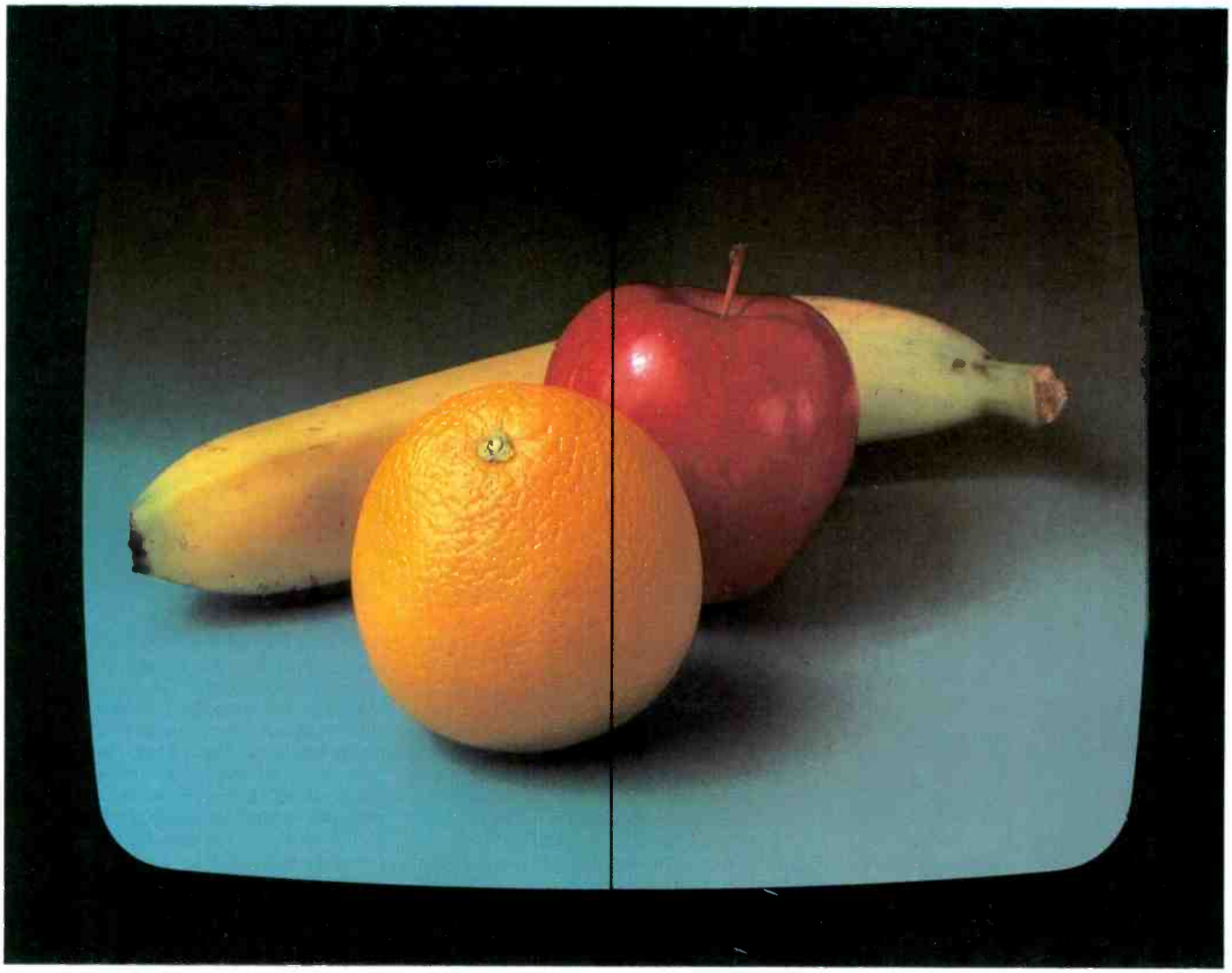
The R-Y signal is designated as D'_R and the B-Y signal as D'_B. The undeviated frequency for the two subcarriers, respectively, is determined by:

$$f_{OB} = 272\ f_H = 4.250000\ \text{MHz}.$$
$$f_{OR} = 282\ f_H = 4.406250\ \text{MHz}. \quad (6)$$

These frequencies represent zero color difference information (zero output from the FM discriminator), or a neutral gray object in the televised scene.

As shown in Fig. 13, the accepted convention for direction of frequency change with respect to the polarity of color difference signal is opposite for the D_{OB} and D_{OR} signals. A positive value of D_{OR} means a decrease in frequency whereas a positive value of D_{OB} indicates as increase in frequency. This choice relates to the idea of keeping the frequencies representative of the most critical color away from the upper edge of the available bandwidth to minimize instrumentation distortions.

The deviation for D'_R is ±280kHz and for D'_B is ±230kHz. The maximum allowable deviation for D'_R = -506kHz



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FIELD	LINE #	COLOR	SUBCARRIER Ø
ODD (1)	n	f_{OR}	0°
EVEN (2)	n + 313	f_{OB}	180°
ODD (3)	n + 1	f_{OB}	0°
EVEN (4)	n + 314	f_{OR}	0°
ODD (5)	n + 2	f_{OR}	180°
EVEN (6)	n + 315	f_{OB}	180°
ODD (7)	n + 3	f_{OB}	0°
EVEN (8)	n + 316	f_{OR}	180°
ODD (9)	n + 4	f_{OR}	0°
EVEN (10)	n + 317	f_{OB}	0°
ODD (11)	n + 5	f_{OB}	180°
EVEN (12)	n + 318	f_{OR}	180°

Note: • 2 frames (4 fields) for picture completion.
• Subcarrier interlace is field-to-field and line-to-line of same color.

Fig. 15. Color Vs. Line and Field Timing Relationship for SECAM.

Color standards

and +350kHz while the values for $D_B^{'}$ = -350kHz and +506kHz.

Two types of pre-emphasis are employed simultaneously in SECAM. First, as shown in Fig. 14, a conventional type of pre-emphasis of the low-frequency color difference signals is introduced. The characteristic is specified to have a reference level break-point at 85kHz (f_1) and a maximum emphasis of 2.56dB. The expression for the characteristic is given as:

$$A = \frac{1 + j\,(f/f_1)}{1 + j\,(f/3f_1)} \quad (7)$$

A second form of pre-emphasis (Fig. 14) is introduced at the subcarrier level where the amplitude of the subcarrier is changed as a function of the frequency deviation. The expression for this inverted bell-shaped characteristics is given as:

$$G = M_O \frac{1 + j16\left(\frac{f}{fc} - \frac{fc}{f}\right)}{1 + j1.26\left(\frac{f}{fc} - \frac{fc}{f}\right)} \quad (8)$$

This type of pre-emphasis further reduces the visibility of the frequency modulated subcarriers in low luminance level color values and improves the signal-to-noise (S/N) ratio in high luminance and high saturated colors. Thus, monochrome compatibility is better for pastel average picture level objects but sacrificed somewhat in favor of S/N in saturated color areas.

Of course, precise interlace of FM subcarriers for all values of color modulation cannot occur. However, the visibility of the interference represented by the existence of the subcarriers may be reduced somewhat by the use of two separate carriers as is done in SECAM. The line-switching sequence (Fig. 15) indicates that, at the undeviated resting frequency situation, the two-to-one vertical interlace in relation to the continuous color difference line-switching sequence produces adjacent line pairs of f_{OB} and f_{OR} signals. To further reduce the subcarrier dot visibility, the phase of the subcarriers (phase carries no picture information in this case) is reversed 180° on every third line and between each field. This, coupled with the bell pre-emphasis, produces a degree of monochrome compatibility considered subjectively adequate.

As in PAL, the SECAM system must provide some means for identifying the line-switching sequence between the encoding and decoding processes. This is accomplished, as shown in Fig. 16, by introducing alternate D_R and D_B color identifying signals for nine lines during the vertical blanking interval following the equalizing pulses after vertical sync. These bottle-shaped signals occupy a full line each and represent the frequency deviation in time sequence of D_B and D_R at zero luminance value. These signals can be thought of as fictitious green color that is used at the decoder to determine the line-switching sequence.

During horizontal blanking, the subcarriers are blanked and a burst of f_{OB}/f_{OR} is inserted and used as a gray level reference for the FM descriminators to establish proper operation at the beginning of each line.

Thus the SECAM system is a line sequential color approach using FM subcarriers. A special identification signal is provided to identify the line-switch sequence and is especially adapted to the 625-line/50-field wideband systems available in France and the USSR.

It should be noted that SECAM, as practiced, employs AM of the sound carrier as opposed to the FM sound modulation in other systems.

Additional systems of historical interest

Of the numerous system variations proposed since the initial development of the NTSC system, at least two others[3], in addition to PAL and SECAM, should be mentioned. The first of these is ART (Additional Reference Transmission)

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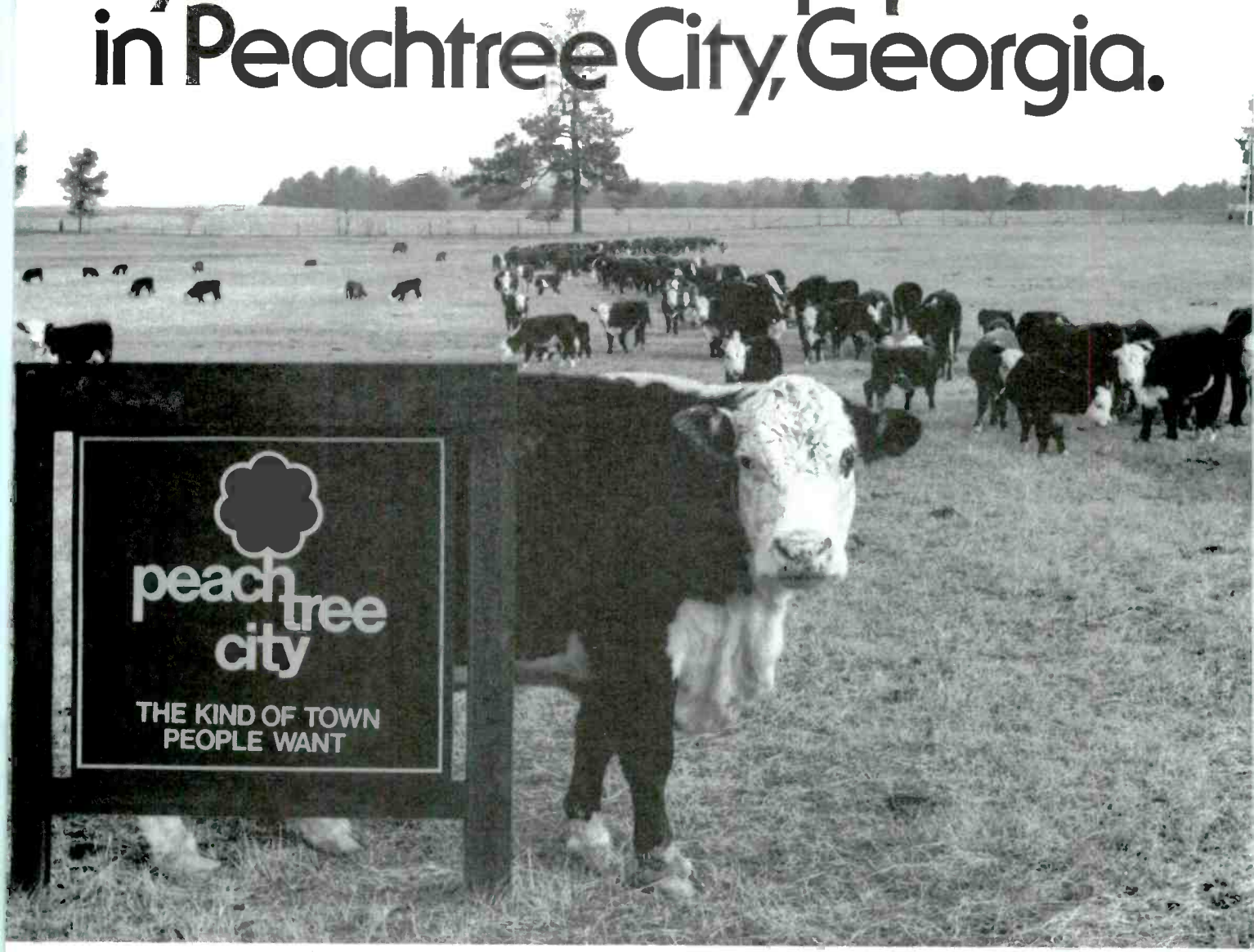

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Color standards

which involves the transmission of a continuous reference pilot carrier in conjunction with a conventional NTSC color subcarrier quadrature modulation signal. A modification of this involved the *multiburst* approach that utilizes three color bursts, one at black level, one at an intermediate gray level, and one at white level to be used for correcting differential phase distortion.

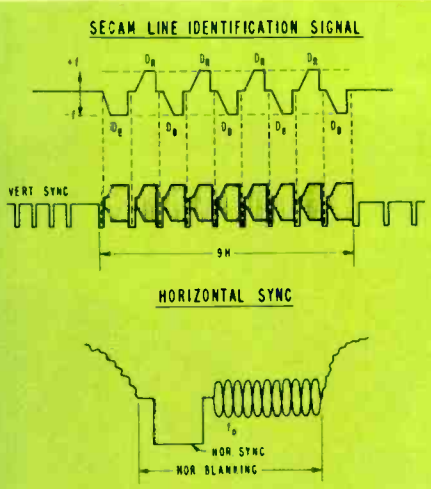

Fig. 16. SECAM Line Identification Technique.

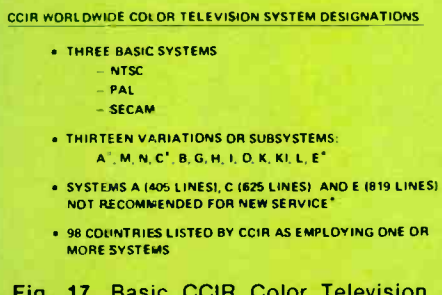

Fig. 17. Basic CCIR Color Television Designations.

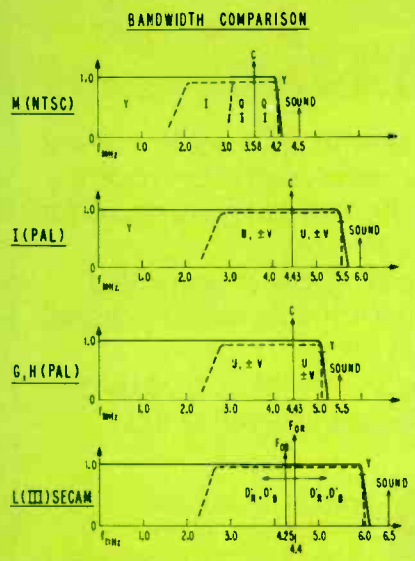

Fig. 18. Bandwidth Comparison Between NTSC, PAL, and SECAM.

Perhaps a better known system, referred to as NIR (SECAM IV), was developed by the USSR (Nautschnuiu Issledowatelskaja Rabota). This system consists of alternating lines of (1) an NTSC-like signal (m) using an amplitude and phase-modulated subcarrier and (2) a reference signal (r) having *U* phase used to demodulate the (m) signal. In the linear version, the reference is unmodulated and in the nonlinear version, the amplitude of the reference signal is modulated with chrominance information.

To the authors' knowledge, neither of these systems are used for commercial broadcasts.

Summary and comparisons of systems standards and specifications

History shows that it is impossible to obtain total international agreement on *universal* TV broadcasting standards. Even with the first scheduled broadcasting of monochrome TV in 1936 in England, the actual telecasting started using two different systems on alternate days from the same transmitter. The Baird system was 250 lines (non-interlaced) and 50Hz frame rate while the EMI (Electric and Musical Industries) system was 405 lines (interlaced) and a 25Hz frame rate.

These efforts were followed in 1939 in the US by broadcasting a 441 line interlaced system at 60 fields per second (RAM, the Radio Manufacturers Association system). In 1941, the NTSC initiated the present basic monochrome standards in the US of 525 lines (interlaced) at 60 fields per second, designated as system M by the CCIR. In those early days, the differences in power line frequency were considered as important factors and were responsible for the proliferation of different line rates vs. field rates as well as a variety of video bandwidths. However, the existence and extensive use of monochrome standards over a period of years soon made it a top-priority matter to assume reciprocal compatibility of any developing color system.

The CCIR documents[5] define recommended standards for world-wide color TV systems in terms of these three basic color approaches—namely NTSC, PAL, and SECAM, as shown in Fig. 17. The variations (at least 13) are given in alphabetical letter designations, some representing major differences while others only relate to minor frequency allocation differences in channel spacings or to the differences between the VHF and UHF bands. As of 1978, at least 98 countries either employ or are considering one or more of the proposed systems in monochrome and/or color format.

The key to understanding the CCIR designations lies in the recognition that the letters refer primarily to *local*

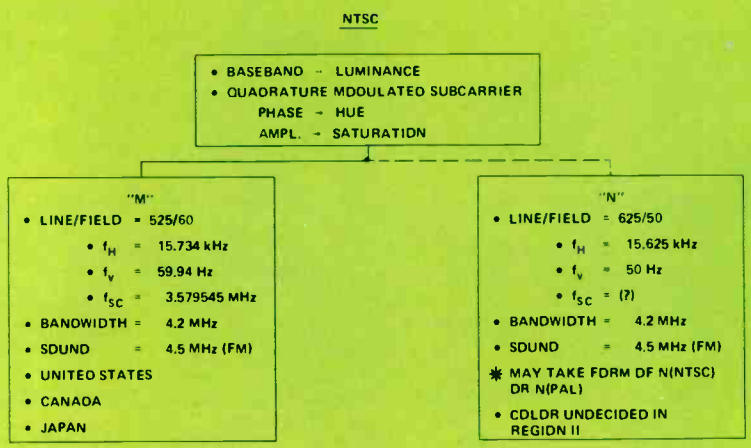

Fig. 19. Summary of CCIR Designation for NTSC System.

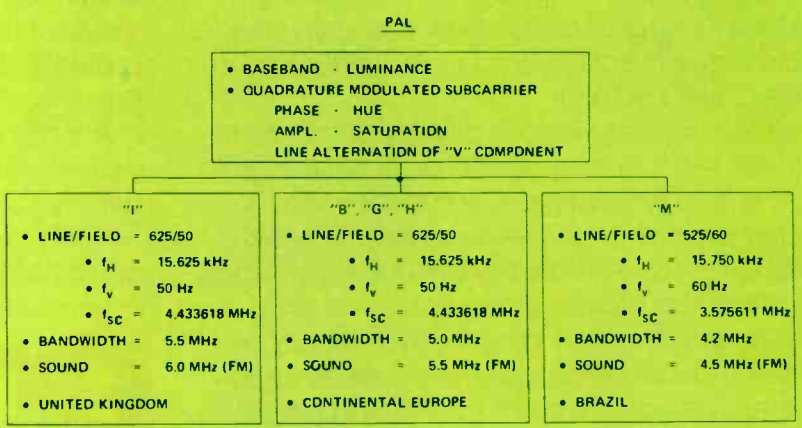

Fig. 20. Summary of CCIR Designation for PAL System.

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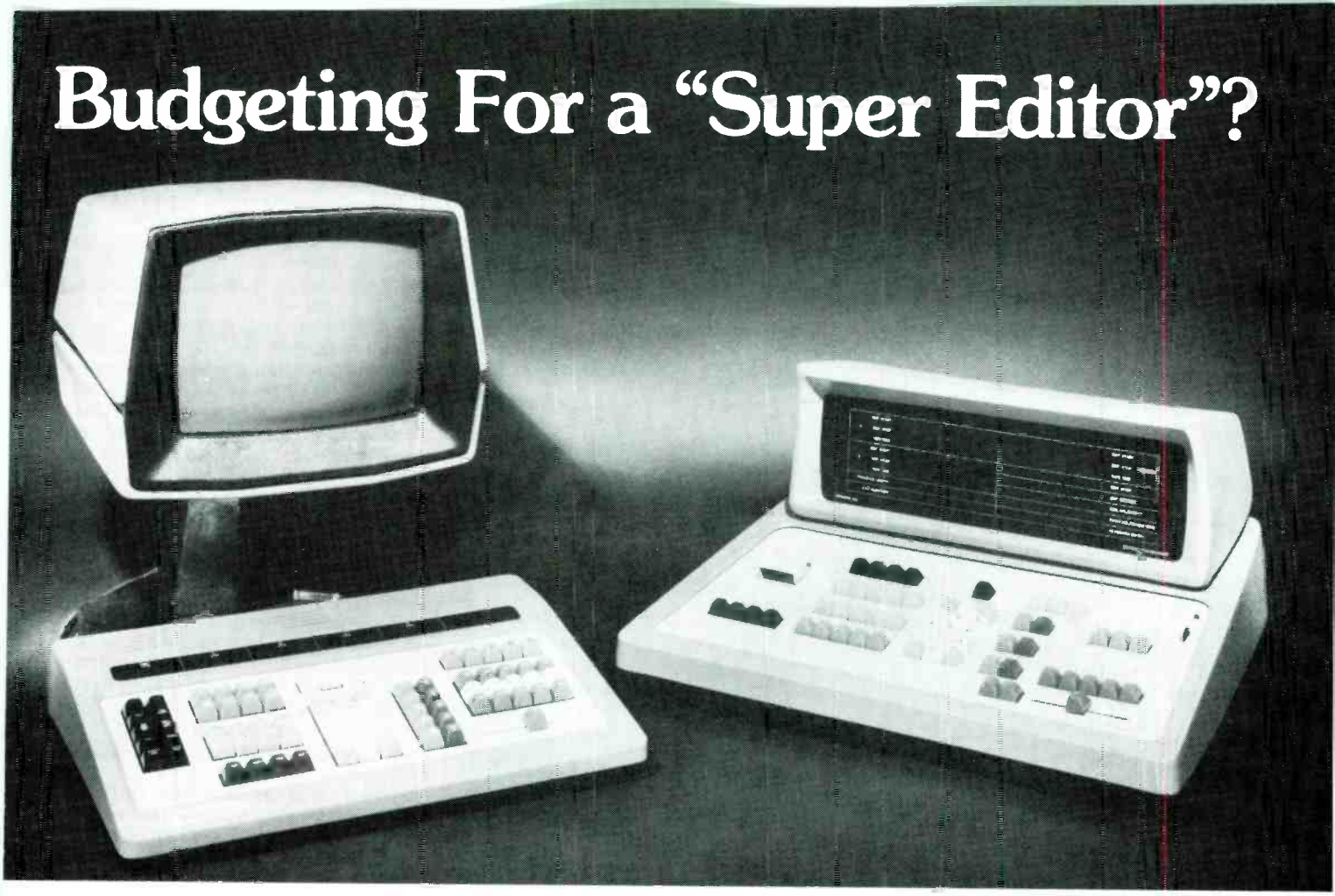

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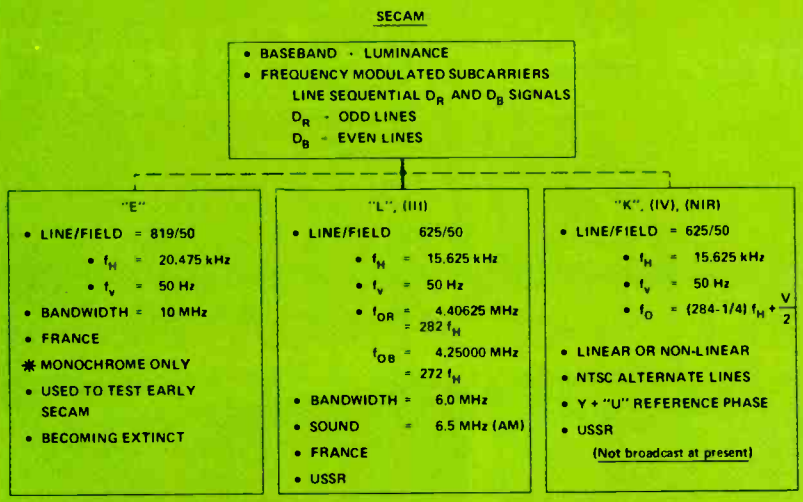

Fig. 21. Summary of CCIR Designation for SECAM System.

SYSTEMS COMPARISON SUMMARY
PART I – GENERAL

	NTSC	PAL	SECAM
• TV SYSTEM	M	G, I	L
• FIELD RATE (f_v Hz)	59.94	50	50
• TV LINES	525	625	625
• LINE RATE (f_H kHz)	15.734	15.625	15.625
• LUMA BANDWIDTH (MHz)	4.2	(5.0) (5.5)	6.0
• SOUND (MHz)	4.5 (F 3)	(5.5) (6.0) (F 3)	6.5 (A 3)
• VERTICAL INTERLACE	2:1	2:1	2:1
• GAMMA	2.2	2.8	2.8
• WHITE	ILL. "C" (D6500)	D6500	D6500

Fig. 22. General System Technical Summary—Part I.

SYSTEMS COMPARISON SUMMARY
PART II – CHROMINANCE ENCODING

	NTSC	PAL	SECAM
• COLOR SUBCARRIER (MHz)	3.579545	4.433618	4.250000 = f_{OB} 4.406500 = f_{OR}
• f_{SC} MULTIPLE OF f_H	$\frac{455}{2}$ f_H	$\frac{1135}{4}$ $f_H + \frac{f_v}{2}$	272 f_H = f_{OB} 282 f_H = f_{OR}
• CHROMA ENCODING	PHASE & AMP. QUAD. MOD.	PHASE & AMP. QUAD. MOD. (LINE ALTERNATION)	FREQUENCY MODULATION (LINE SEQUENTIAL)
• COLOR DIFFERENCE SIGNALS	I, Q, (1.3 MHz) (0.6 MHz)	U, V (1.3 MHz) (1.3 Mhz)	D_R (f_{OR}) (- 1.0 MHz) D_B (f_{OB}) (- 1.0 MHz)
• COLOR BURST PHASE	-(B-Y)	U and - V	f_{OR} AND f_{OB} 180° PHASE SWITCH EVERY 3rd LINE AND EVERY FIELD
• COLOR SWITCH IDENT.	NOT REQUIRED	SWINGING BURST - 45°	9 LINES OF D_R AND D_B DURING VERTICAL INTERVAL
• ADDITIONAL SIGNALS	NONE	"MEANDER" GATE $f_{H/2}$	$f_{H/2}$, $f_{H/4}$, f'_v, $f_{v/2}$

Fig. 23. Chrominance Encoding Systems Comparison—Part II.

SYSTEMS COMPARISON SUMMARY
PART III – CHROMA SEQUENCE

	LINE (N)	LINE (N + 1)	LINE (N + 2)	LINE (N + 3)
NTSC:				
CHROMA:	I, Q	I, Q	I, Q	I, Q
BURST PHASE:	-(B-Y)	-(B-Y)	-(B-Y)	-(B-Y)
PAL				
CHROMA:	U, + V	U, - V	U, + V	U, - V
BURST PHASE:	-U + V = + 135	-U - V = +225	-U + V = + 135	-U - V = +225
SECAM: (FM)				
CHROMA:	D_R - 280 kHz	D_B - 230 kHz	D_R - 280 kHz	D_B - 230 kHz
BURSTS:	(D_R DEVIATION = + 350 kHz / - 500 kHz)		(D_B DEVIATION = + 500 kHz / - 350 kHz)	

CHROMA SWITCH IDENT. LINES DURING VERTICAL INTERVAL

LINE =	7	8	9	10	11	12	13	14	15
	320	321	322	323	324	325	326	327	328
INDENT SIGNALS:	D_R	D_B	D_R	D_B	D_R	D_B	D_R	D_B	D_R

(NOTE: Phase reversed 180° every 3rd line and every field).

Fig. 24. Line-To-Line Chroma Signal Sequence Comparison—Part III.

Color standards

monochrome standards for line and field rates, video channel bandwidth, and audio carrier relative frequency. Further classification in terms of the particular color system than adds NTSC, PAL, or SECAM as appropriate. For example, the letter *M* designates a 525-line/60-field, 4.2MHz bandwidth, 4.5MHz sound carrier monochrome system. Thus, M(NTSC) describes a color system employing the NTSC technique for introducing the chrominance information within the constraints of the above basic monochrome signal values. Likewise, M(PAL) would indicate the same line/field rates and bandwidths but employing the PAL color subcarrier modulation approach.

As another example, the letters *I* and *G* relate to specific 625-line/50-field, 5.0- or 5.5MHz bandwidth, 5.5- or 6.0MHz sound carrier monochrome standards. Thus, G(PAL) would describe a 625-line/50-field, 5.5MHz bandwidth color system utilizing the PAL color subcarrier modulation approach. The letter *L* refers to a 625-line/50-field, 6.0MHz bandwidth system to which the SECAM color modulation method has been added (often referred to as SECAM III).

System *E* is an 819-line/50-field, 10MHz bandwidth, monochrome system that was used in early SECAM tests and is gradually becoming less used in broadcasting.

Some general comparison statements can be made about the underlying monochrome systems and existing color standards: (1) There are four different scanning standards; 405-lines/50-fields, 525-lines/60-fields, 625-lines/50-fields and 819-lines/50-fields. (2) There are six different spacings of video-to-sound carriers, namely: 3.5, 4.5, 5.5, 6.0, 6.5, and 11.15MHz. (3) Some systems use FM and others use AM for the sound modulation. (4) Some systems use positive polarity (luminance proportional to voltage) modulation of the video carrier while others, such as the US M(NTSC) system, use negative modulation (5) As previously discussed, there are also the differences in techniques of color subcarrier encoding represented by NTSC, PAL, and SECAM. Of course, in each case there are many differences in the details of various pulse widths, timing and tolerance standards so that one must refer to the CCIR documents for accurate determination of results.3,5

A comparison of the relative bandwidths, color subcarrier frequencies, and sound carrier spacing for the major color systems used today is presented in Fig. 18.

The M(NTSC) system occupies the least total channel width which, when the vestigial sideband plus guard bands are included, requires a minimum radio frequency channel spacing of 6MHz. The L(III) SECAM system occupies a 14MHz channel space with a full 6MHz luminance bandwidth. The two versions of PAL occupy 8MHz channel widths and vary in vestigial sideband width as well as color luminance bandwidths.

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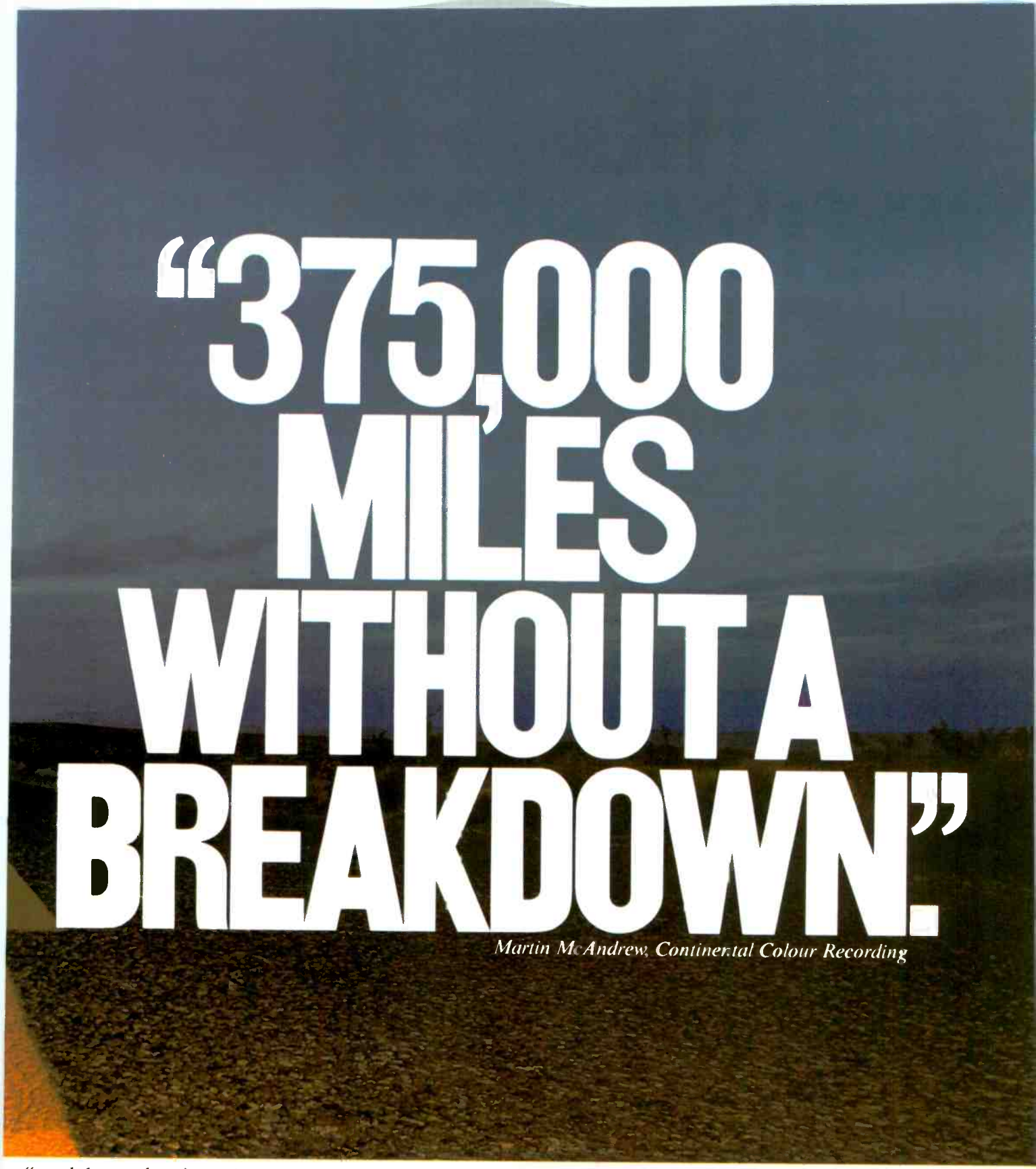

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Color standards

NTSC is the only system to incorporate the I, Q color acuity bandwidth variation. PAL minimizes the color quadrature phase distortion effects by line-to-line averaging and SECAM avoids this problem by only transmitting the color components sequentially at a line-by-line rate.

An organization chart shows (Figs. 19-24), the CCIR designations for NTSC, PAL, and SECAM basic system identifications and characteristics. In Fig. 19, M(NTSC) identifies the system used in the US, Canada, Japan, Mexico, the Philippines and several other Central American and Carribean area countries. The N system may be implemented in color either in the NTSC or the PAL format. At the present, many Latin American countries are in the process of adopting one or the other version of this approach.[6]

In Fig. 20, a summary of the PAL systems is provided. These systems are predominately used in Continental Europe, the UK, some African countries, and China. However, an *M* (525-line) version of PAL has been in use in Brazil for some time.

The SECAM III system, which is in use primarily in France and the USSR, is summarized in Fig. 21. The SECAM IV system, as a proposal[1], almost gained favor in 1966 as a universal European approach but to the authors' knowledge has never been used for normal broadcasting. The *E* 819-line band system, originally used in France, is limited to monochrome broadcasts and is slowly becoming extinct.

A summary-at-a-glance of the major color television system general characteristics as presently practiced, whether it be monochrome only or including the addition of chrominance information, is provided in Fig. 22.

The fundamental features relating to the differences between NTSC, PAL, and SECAM in the critical areas of color encoding techniques are characterized in Fig. 23.

Similarly, Fig. 24 indicates the color encoding line-by-line color sequence operation for the three systems.

The information represented in these last seven charts highlight the technical equalities and differences and attempts to place a degree of order in understanding the existing world-wide standards situation, and point out the difficulties in creating *universal system.*

International exchange of images

The international exchange of images in broadcast television, in view of the variety of standards, is difficult. It should be remembered that all TV systems, both monochrome and color, can be operated from movie film. Special television camera chains have been manufactured that are capable of operating at 625-lines and 48-field rate—the field rate being compatible with the 24 frame rate motion picture standards.

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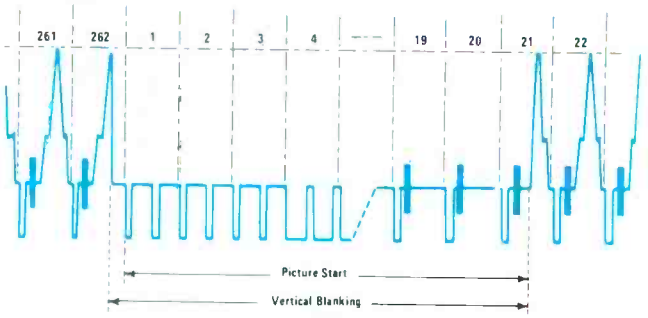
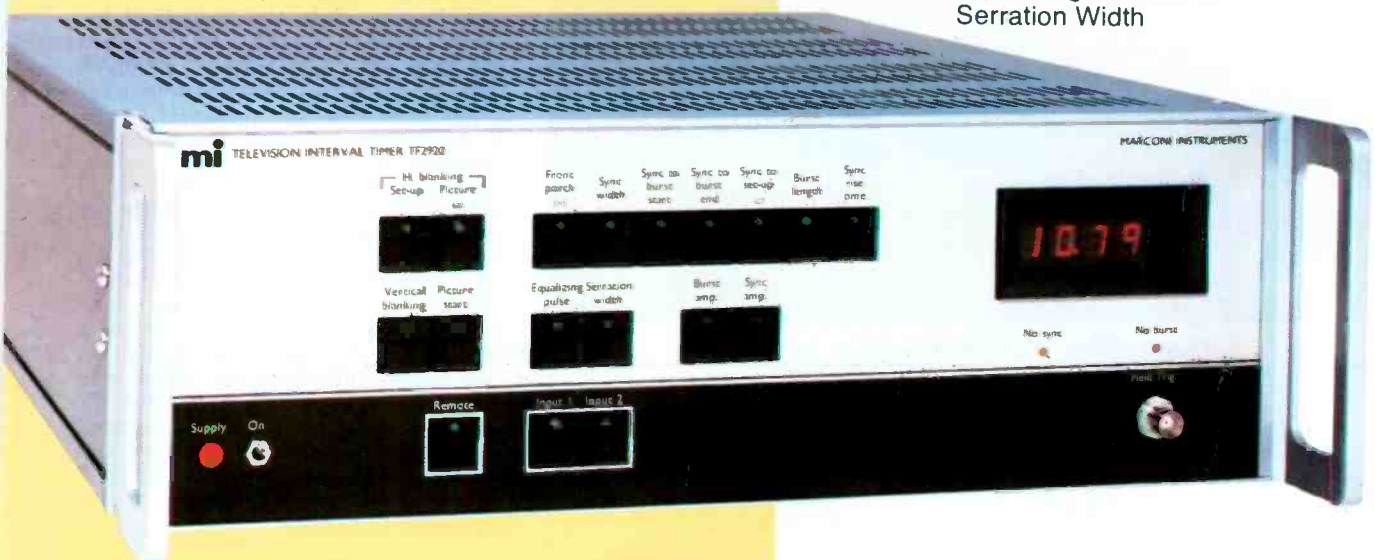


VERTICAL BLANKING MEASUREMENTS

Total Vertical Blanking Interval
Picture Start
Equalizing Pulse Width
Serration Width



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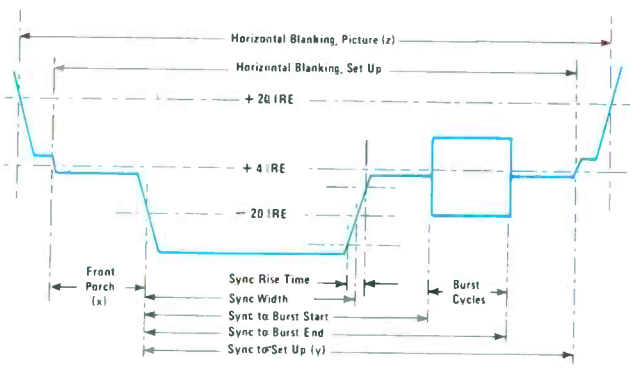

HORIZONTAL BLANKING MEASUREMENTS

Set Up Blanking (+4 IRE)
Picture Blanking (+20 IRE), (z)
Front Porch, (x)
Sync Width
Sync to Burst Start
Sync to Burst End
Sync to Set-Up, (y)
Burst Length in cycles
Sync Rise Time

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exchange television program material by tape, microwave, or satellite between areas employing the same scanning rates (the video bandwidth differences are, of course, not equivalent, but do not result in major image degradation). Electronic standard converters have been developed for converting between 50 and 60 field rate systems.

The direct exchange of color TV programs between the three major systems is obviously more complex. Special transcoding systems have been developed to translate color subcarrier frequencies between similar color systems having different scanning rates. More complex transcoders are possible which translate from one color technique to another, although with degradation of resolution or reduction of performance. Even the translation between different scanning rates as well as different color systems, such as 525-line NTSC and 625-line PAL, has been accomplished.

As previously stated, the advent of satellite worldwide television relay, coupled with recent advances in digital processing of TV signals, has made the topic of standards conversion rise to a new level of importance relative to the exchange of program material internationally. Thus, the intent of this worldwide color systems standards review is to highlight the similarities as well as the major differences for those who desire an overview of the related TV concepts and standards. A thorough understanding of those concepts and standards by many people is essential if effective international exchange of programming is to grow.

Acknowledgement

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7. J. Roizen, "Universal Color Television: An Electronic Fantasia," *IEEE Spectrum*, March 1967. □

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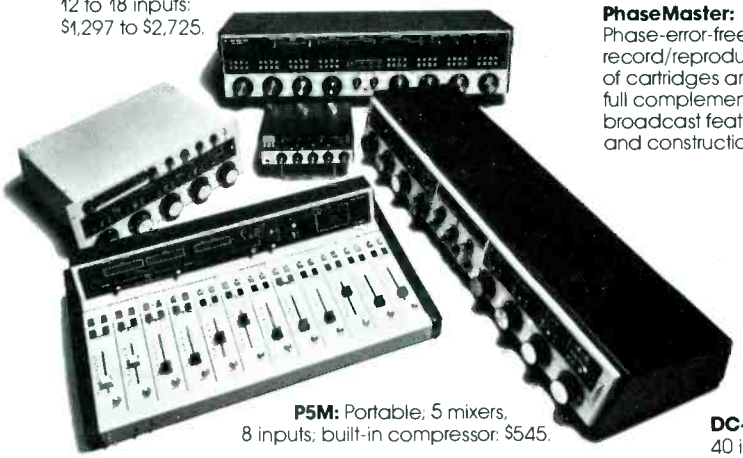

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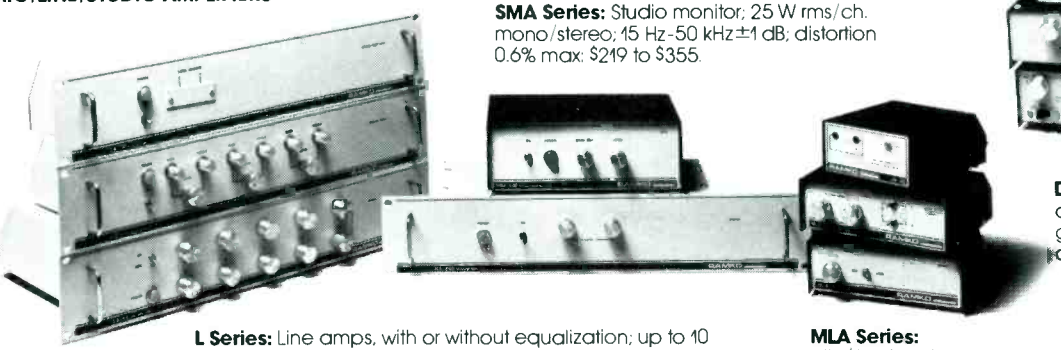

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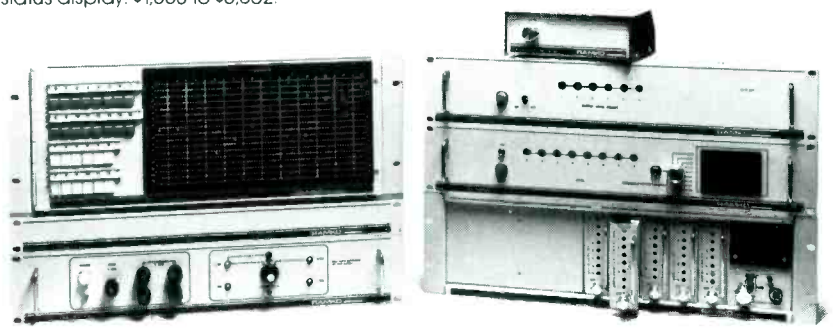

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A Dream Come True:
Public Radio's Satellite System*

By Dick Cassidy, director of engineering, National Public Radio

June marked the culmination of a five-year effort by the Corporation for Public Broadcasting (CPB) and National Public Radio (NPR) to interconnect many of the nation's public radio stations by satellite. On June 1st, the 200th NPR satellite earth terminal was installed, with 17 of those terminals equipped for transmission of two-channel stereo programming to the entire system.

Five years ago, while the Public Broadcasting Service (PBS) was developing a satellite interconnection system for public TV, NPR engineers were comparing notes on performance tradeoffs expected with various dish sizes, satellite EIRPs, LNA noise temperatures, and analog *vs.* digital transmission techniques. NPR satellite systems engineer Wayne Hetrich, architect of the system now in place, was surveying state-of-the-art companding techniques to determine if a cost-effective, high-quality analog signal could be provided with a dish smaller than 10m and relatively low satellite EIRPs. Engineers were also busy preparing technical showings to the FCC demonstrating that 4.5m antennas met the FCC interference criteria for both reception and uplinking purposes. And they were writing complex computer programs to determine the maximum number of audio channels that could be fitted into one transponder of Western Union's Westar I.

Late in 1978, installation of more than 150 10m terminals throughout the country was completed for PBS stations. A main origination terminal (MOT), equipped with two 11m antennas was built near Springfield, VA. At that time, NPR was completing design acceptance of all equipment to be provided for the public radio satellite interconnection system. Construction of equipment and preparation of sites was getting under way. NPR's main uplink equipment was installed at the PBS Virginia MOT site and an 11GHz, two-hop microwave relay was installed to transmit signals to the MOT from NPR's main studios in downtown Washington.

The project was completed under a contract with Collins/Rockwell, employing seven field teams throughout the US (including Alaska) to perform the terminal installations over a 12-month period. During this period, public radio station engineers have been barraged with shipments of terminal equipment arriving at their stations, along with construction crews digging trenches, laying foundations, hoisting antennas, and otherwise disturbing the surroundings where the antennas were to be placed.

In the majority of cases, the antennas were located relatively close to the radio studios, preventing the need for expensive microwave interconnection. Forty-seven stations were able to share a local PBS 10m antenna. The precise location of each dish was determined after extensive site surveys were conducted at each station. The final choice of location was, in many cases, difficult. Not only did the dish have to be located in a quiet RF environment (since satellite transmissions share the 6 and 4GHz bands with terrestrial common carrier microwave services), but the entire orbital arc between 90° and 135° W longitude had to be visible to the dish so it could see both Westars I and II (Westar II is NPR's back-up satellite).

Often aesthetic and political considerations were important determinants in locating the antennas. For example, many public radio stations are located on college campuses. In one such instance, the building and grounds staff was instructed by the president of the university to bar the site crews from completing a complex rooftop installation of a 4.5m antenna visible from the president's office. When the president was told the cost of relocating the antenna, its aesthetic impact was re-evaluated and the site crew completed its work. On another campus, the dish was placed aesthetically in the midst of an orange grove.

But appearance is not a serious problem in all locations. In fact, public radio has the only operational satellite uplink within the Metropolitan New York area. It's on the grounds of the sewage disposal plant in south Brooklyn.

Technically, the satellite system is complex. In summary, the audio performance on each channel is within +0.5 to -1.0dB from 30mHz to 15kHz, with total harmonic distortion under 1%. The dynamic range is greater than 70dB, and interchannel phase differences are kept well below 10°. The system utilizes a specially designed dBx 3:1 compandor, which greatly lowers satellite power requirements.

NPR utilizes an SCPC (single-channel-per-carrier) analog FM signal, with 75kHz peak deviation for each channel. Transponder 2 on Westar I is used and each channel is operated at 16.5dBW EIRP. This allows use of 4.5m antennas for transmission and reception. Uplinks are equipped with two 100W TWT, HPAs, one for each channel, and uplink power is 58dBW EIRP per channel. Downlink achieve a carrier-to-noise ratio in excess of 14dB with a nominal G/T greater than 21dB.

NPR began two-channel satellite transmission on Westar I October 1, 1979. Four-channel transmission began on January 1, 1980; according to Billy Oxley, NPR senior vice president for distribution, this appears to be just the beginning. NPR's satellite system has the ultimate potential for transmission

*See detailed coverage in **BE** May and July issues.

The KUOM terminal in Seattle. The 4.5 meter antenna is equipped with a transmit feed, and the shelter in the background houses the upconverters, HPAs and downconverters.

Camera shown with optional 12:1 zoom lens.

Introducing 4,551 reasons to buy the Panasonic AK-750B three-tube Plumbicon® camera.

The first 4,550 reasons to buy the Panasonic AK-750B are the 4,550 dollars we've shaved off the price of last year's comparably equipped model. The other big reason is 2-line enhancement—a $2,000 option last year, but included as standard equipment at this year's low $16,000* price. Other standard features include genlock, rechargeable battery and charger, microphone, and VTR cable.

At the heart of the AK-750B are three ⅔" Plumbicon tubes in parallel for great sensitivity over lighting extremes, superior static and dynamic resolution, and low burn-in.

Inside the AK-750B you'll find a durable aluminum die-cast chassis and an impressive list of features like a Y I/Q encoder, color bar generator, and optical black and automatic white balance. There's also electronic color conversion, and a filter wheel behind the lens so you can make the most of both indoor and outdoor lighting. Plus adjustable horizontal and vertical blanking to fit a variety of recording requirements.

For the field, the AK-750B is a fully self-contained camera with timing and phase adjustments built in, but weighing in at only 16 lbs. (not including lens). And it's just as light on power, using only 23 watts. The camera comes with a C-mount adapter. And it can interface with an EFP system because it accepts single-cable external sync.

The AK-750B can also be used as a studio camera with our optional Remote Control Unit and 4.5" CRT viewfinder.


Optional studio configuration.

But whether you're indoors or out, the AK-750B performs superbly with a S/N ratio of 50dB, and horizontal resolution is 500 lines at center (recommended illumination of 200 footcandles at f/4). There's even a +6dB gain for minimum illumination of just 15 footcandles at f/1.8.

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of 20 channels. With uplinks located in 17 cities around the nation, satellite access is available to a host of potential users: other public stations, independent producers, educators, and program syndicators.

Public radio managers, program directors, engineers, and operations people are excited about the changes in their daily station operation as a result of satellite interconnection. Program directors are facing an ever-increasing menu of high-quality programs from many sources, and must make critical decisions on how best to integrate these offerings into their own local programming for their audiences. Operations personnel are concerned with making sure that board operators tune the satellite demodulators to the correct channels at the correct times to capture programs for live transmission or for recording and later broadcast. Even listeners are wondering why suddenly NPR's *All Things Considered* host, Susan Stamberg, really sounds like she's in their living rooms. And engineers and production staffs are increasingly aware of the need for high quality, properly maintained production and transmission equipment to take full advantage of the high quality that satellite interconnection offers.

At the 1980 annual Public Radio Conference, technical sessions focused on initial operational and maintenance experience with the new system. Station engineers described various approaches to route, monitor and record the incoming satellite program channels. Uplink chief engineers compared notes on uplink equipment performance, initial operations, and the inevitable *first mile* problems of obtaining high-quality terrestrial interconnection between a program's origination source and the uplink. With a serious shortage of microwave frequencies available to AM and FM broadcasters for remote pickup, STL and intercity relay use, future NPR engineering efforts will focus on the use of mobile satellite uplinks and the possible use of terrestrial digital carrier facilities for *first mile* delivery.

For the most part, stations are coping with the increased operational complexities of multiple-channel satellite delivery, but capturing and broadcasting or recording feeds places new loads on small station staffs.

NPR is beginning implementation of its Satellite Operating Support system (SOS) which will ease this burden. It includes four major subsystems: a computerized audio routing switcher located in NPR's Technical Center in Washington, DC; a Netcue control system that will utilize a narrow-band data SCPC satellite channel for the transmission of control pulses to automatically tuned demodulators and record feeds; a communications system utilizing this data channel for transmission of scheduling messages and program information to hard-copy printers at each station; and a computer-based uplink remote control system which will coordinate transmissions from the 17 uplinks. The SOS system is scheduled for completion by fall of 1981, when the level of satellite activity is expected to far exceed the current use with four channels.

At the Public Radio Conference, this future activity was examined not only technically, but also for programming and economics. Station managers, program directors, independent producers, educators, and syndicators participated, as did FCC Chairman Charles Ferris. He noted that the recent ruling by the FCC to allow PBS stations to share earth terminal facilities with commercial users logically should apply to public radio as well. At a time when public radio is expanding, financial resources, particularly government funding, is shrinking. Ferris expressed the hope that public broadcasting will be more imaginative in trying some non-traditional opportunities for funding and that the satellite facilities can yield a dividend to the public by providing a source of revenue.

As the use of the system grows, it is hoped public radio stations will have the opportunity to utilize their satellite terminal facilities for a multitude of purposes. Beyond transmission of NPR programs, the system can support wire and data services, educational services, teleconferencing and non-broadcast audio services.

With additional equipment, the station terminals can also receive satellite video transmissions. In fact, the future may see public radio and television stations becoming a telecommunications center for their communities.

In the near future, NPR and its affiliate stations will be concentrating on improving production standards and operational procedures to take full advantage of the state-of-the-art audio quality available on the satellite system. But even now public radio can begin *fine tuning the future* afforded by the new system, as it faces the challenges and opportunities which lie ahead. □

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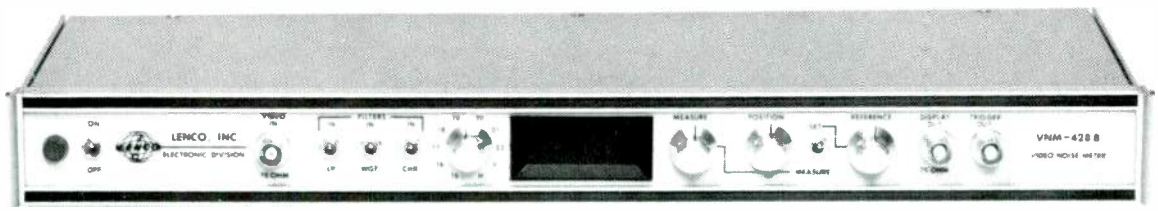

Some people think that video noise is a bore. They just couldn't care less about it. They figure that if they ignore it, it'll go away.

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So if you're *really* concerned about video noise, call your nearest Lenco sales office today. We'll be happy to give you a no-obligation demonstration.

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Circle (52) on Reply Card

Stations evaluate Technics turntable*

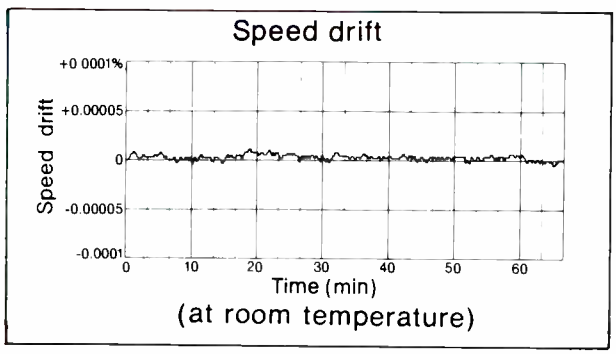
Following a growing trend that began in the mid '70s, an increasing number of US radio stations are equipping their control rooms with high-end hi fi components that not only meet professional standards, but often surpass the performance of conventional studio hardware.

The move is notable in the area of turntables; Technics quartz synthesizer direct-drive units are in use by 75 of the top 100 stations in the country. Research revealed that 10 of the 11 commercial classical radio stations in the top 10 US markets are using Technics turntables.

Most of the country's classical music audience listens to the 10 stations that serve New York, Los Angeles, Chicago, Philadelphia, Boston, San Francisco, Washington, DC, Dallas and Houston. Discussions with officials at some of these radio stations disclosed that previously used studio turntables were often unsatisfactory in providing listeners with the high-quality, low-distortion

*Editor's note: Information compiled by Grey & Davis, Public Relations Company, New York. An article on a classical FM station using the turntables is scheduled for early next year.

SP-10MKII
Quartz-Controlled Direct-Drive Turntable

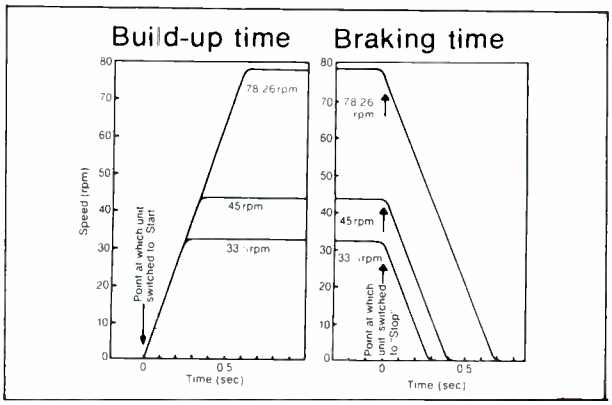


Rated speed reached within 0.25 sec (33⅓ rpm)

The enormous starting torque of the SP-10MKII—6 kg cm (5.2 lbs in)—accelerates the heavy platter to rated 33⅓ rpm within 0.25 sec. (This compares with the 1-second build-up time considered satisfactory in professional broadcast equipment). The platter reaches rated speed after only a 25 degree turn. If the stylus is set in a silent groove between two bands of an LP, then the SP-10MKII will have reached standard speed long before the first note is heard and there's no sacrificing platter weight 2.9 kg (6.4 lbs).

Speed accuracy within 0.036 sec per LP side

The direct-drive motor of the SP-10MKII is controlled by elaborate servo circuitry that uses a quartz oscillator as its reference. The rotational speed of the SP-10MKII is totally independent of the ac power line and its notorious frequency variations, from temperature and other external factors, and from the passage of time. If speed drift remains within 0.002% which translates into a maximum aberration of 0.036 sec over the 30 minute playing time of a typical LP side.



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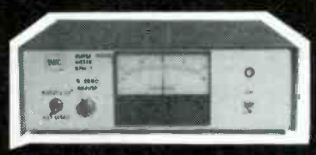
BURST PHASE METER
BPM-1 $650, BPM-1R $695, Opt 02 $800, 02R $845, 03 $1000
Technicians and engineers alike find the burst phase and H phase (options 02, 02R, 03) meter easier to use, more accurate and convenient, and one-fifth the cost of traditional vectorscopes. The BPM's small size and low-cost make this instrument ideal for recording rooms, TV studios and remote vans.



COLOR GENLOCK SYNC GENERATOR
MODEL 5000 $1995
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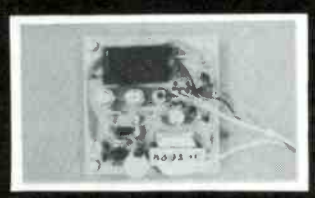
ELECTRO OPTICAL ISOLATORS
NEW MODEL 800 $175, VL-1 $250
The model 800 converts the latest Sony color TV receivers with push button audio to a high quality color receiver/monitor combination with 80 dB common mode rejection between coax and monitor. The VL-1 video line isolator provides this same 80dB isolation in a self contained unit for eliminating ground loop hum problems. Isolators are still available for older Sonys (specify model number).



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Model PLS-1 handles up to 10 headset units
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Small cabinet for mounting near camera, etc.

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VIDEO ACTIVATED POWER SWITCH
MODEL VPS-1 $75
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.

Circle (53) on Reply Card

In WNCN's main studio, station manager Bob Richer watches announcer Gordon Spencer cue up recording on Technics SP-10 turntable.

sound required for classical music's wider dynamic range.

Several broadcasters said that other turntables caused problems with vibration and rumble, a result of the high-speed motors in many professional units. There were also complaints of wow, hum and slippage. These stations found that, unlike standard studio equipment, Technics turntables don't use the high-speed moving parts that generate vibration. Also, there are no belts, idlers or other speed-changing transmission elements. In addition, electronic sensing and control make the direct-drive motor, which has only one moving part, more precise than conventional turntables.

WQXR, the New York Times station, was the first classical station to use Technics direct-drive turntables. Chief engineer "Doc" Masoomian said, "The minute I heard the SP-10 perform, I said I had to have it—this turntable meant the end of wow and flutter." Technics turntables' wow and flutter is below 0.03% WRMS, rumble is better than -70dB and buildup to normal speed is within one-half rotation of the platter.

WQXR, which has seven model SP-10 MKII turntables in its New York control and production rooms, as well as two SL-120s in the station's listening room, purchased its first SP-10 in 1973.

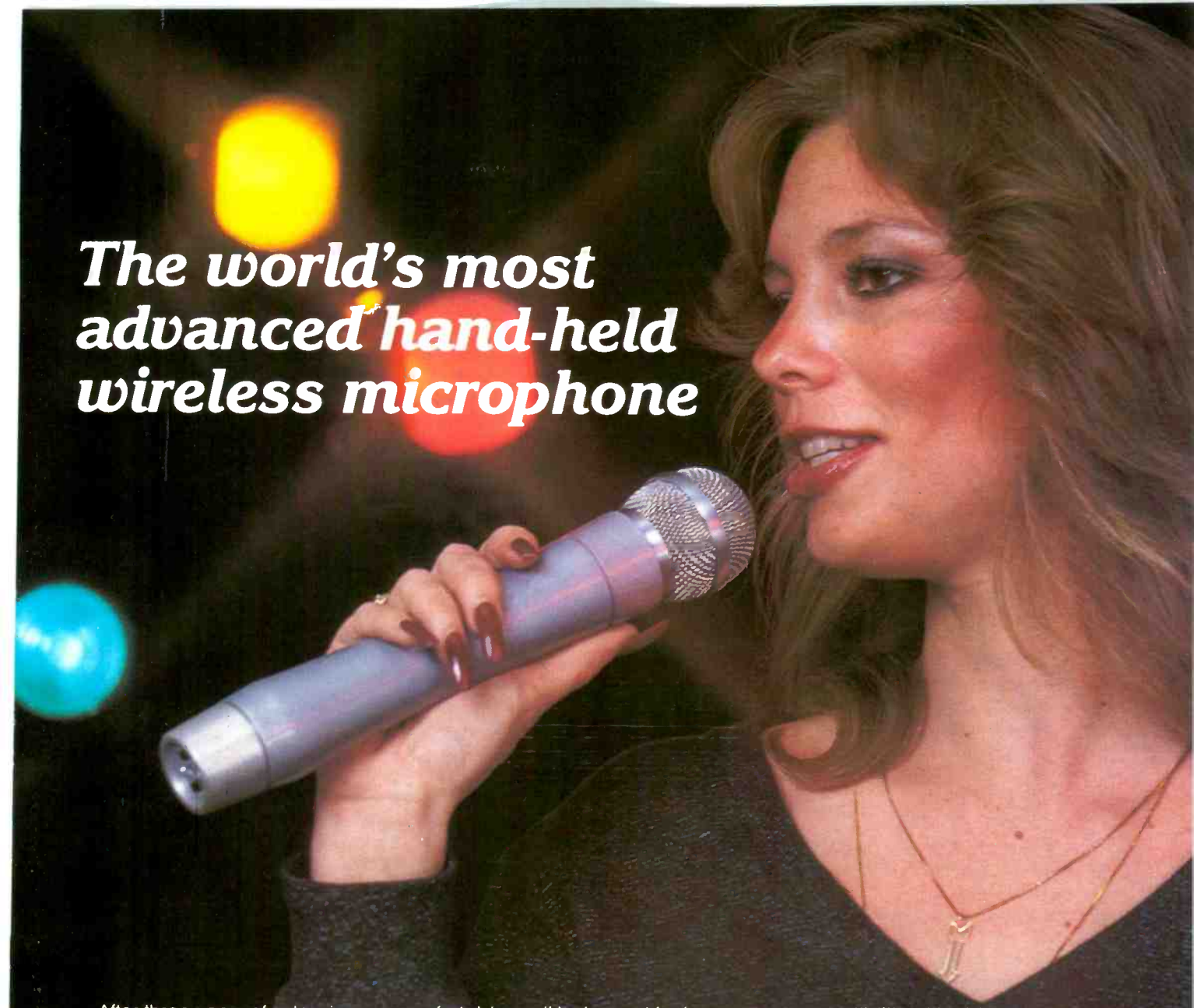
"From that day on," said Masoomian, "we had nothing but clear, beautiful sound."

In addition to its broadcasting functions, WQXR also uses the Technics units for auditioning. This enables station management to hear exactly how a record will sound on the air. According to Masoomian, Technics is "the epitome of superior turntables."

At New York's WNCN, the entire studio floats on shock absorbing pins to minimize vibrations. They use Technics turntables 24 hours a day. There are two SP-10s in the station's main studio and two in the production room.

"We've used them for 2½ years, and they've never been down," said Bob Richer, station manager. "Their reliability is spectacular."

In 1976, GAF acquired WNCN from Starr Broadcasting and Dick Sequerra, audio consultant was brought in to choose the equipment for the station's new studio. Among the first units Sequerra ordered



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After three years of extensive research, Vega proudly announces two all-new hand-held wireless microphones designed for use by discriminating professional performers, or anyone who must have superior sound quality without a mic cable. These microphones are a substantial improvement over all previous hand-held wireless mics, offering not only top audio performance, but also a revolutionary case/antenna system. Because the antenna is incorporated into the microphone housing, unsightly dangling wires and "rubber duckies" have been eliminated. This new design assures that the RF output is equal to, or better than, that which could be achieved with an external antenna—no matter how the microphone is held. Light weight and a gracefully contoured shape contribute to the mic's comfortable, well-balanced feel.

The Model 80 is equipped with an Electro-Voice EV-671 mic capsule, and the Model 81 utilizes a Shure SM-58 capsule. Due to very low distortion and a flat transmitter-to-receiver frequency response of ±2 dB from 40 Hz to 15 kHz (±1 dB 100 Hz to 12 kHz), the sound is as clear as you would expect from the best of conventional hard-wired microphones. Used with a Vega "Dynex" receiver, overall system dynamic range is better than 90 dB, eliminating the mixer gain control riding and distortion caused by compresion and clipping. (The mics are available without Dynex for compatibility with older Vega receivers or those of different manufacture.)

Both models use a standard 9V alkaline battery, offering from 7 to 9 hours continuous use, and a range of up to 1000 feet. Since operation is in the 150 to 216 MHz VHF range, there is no interference from CB radios or FM broadcast stations in normal use. An audio gain control on the bottom of the case lets the user adjust the mic's sensitivity. Optimum setup can be verified with an adjacent LED indicator that doubles as a battery monitor. The mics also include a Power On/Off switch, plus a separate Audio On/Off switch so you can keep the receiver quiet when you want to temporarily silence the mic.

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WQXR's chief engineer "Doc" Masoomian with the Technics SP-MKII.

WFMT producer Rich Warren.

Turntables

were Technics turntables. "We wanted to design a station to deliver music that would sound as good as the finest equipment consumers had in their homes," said Richer.

Richer says that the turntables, although some of the least expensive hardware purchased, are some of WNCN's best pieces of sound equipment.

Chicago's fine arts station, WFMT, has been using Technics turntables since 1977. It is currently equipped with both SP-10 and SP-15 models.

Don Tait, announcer and producer of *Collector's Item*, a program devoted to antique records, calls the SP-15 "the greatest advance yet for people working with special record collections. For example, if you're playing an off-speed 78, instead of fussing around with a strobe, you just use the fine adjustments to obtain the right speed. The SP-15 is fantastic."

Variable speed control on the SP-10 was also praised by Al Antlitz, WFMT chief engineer, who conducts a special collector's program on the station. "We have no trouble finding the correct speed when it's a question of 78s that were pressed off-speed," he said. "It's a terrific turntable.

"Also, I like its fast-start capability. Even though as a classical station we don't have to worry about a tight board (with quick segues from record to record), it's nice to know that when you push a button, the turntable is up and ready to go."

WFMT, in addition to reaching 400,000 adults weekly in the Chicago Metro area and 300,000 cable subscribers on a direct basis, is America's first radio "superstation," relayed by satellite to cable systems from coast to coast.

Of Technics turntables, John Major, director of research and marketing, said, "The units provide us with reliability, solidity and flexibility." According to Rich Warren, producer, model SP-15 offers "tremendous versatility and performance." "It's an unusually designed machine," he said.

Other top-rated classical stations in the United States using Technics turntables are KFAC, Los Angeles; WFLN, Philadelphia; WCRB, Boston; KIBE/KDFC, San Francisco; WGMS, Washington, DC; WRR, Dallas; and KLEF, Houston. □

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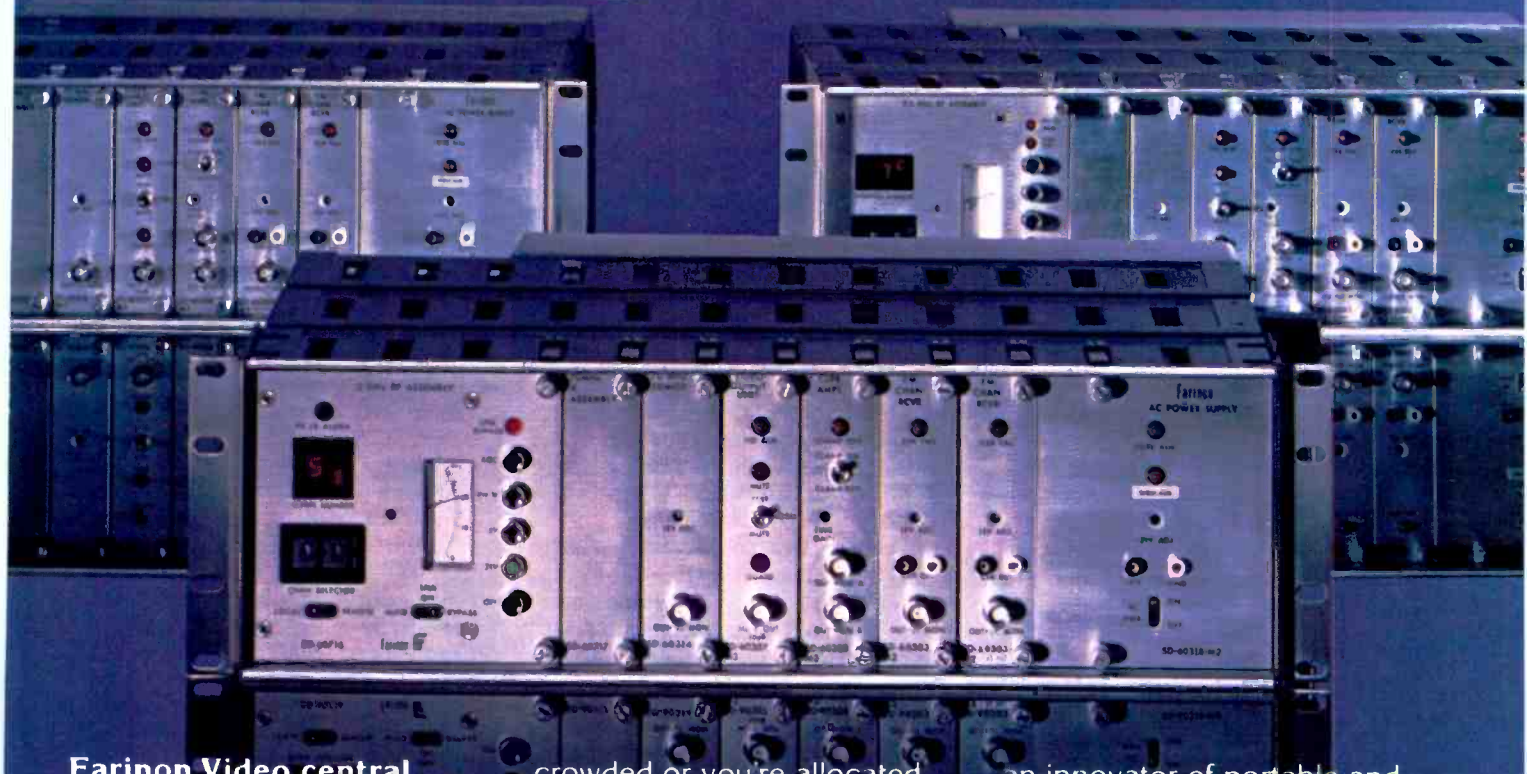

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Measuring envelope delay distortion

By John H. DeWitt, consulting engineer, Nashville

The term envelope delay distortion, when applied to a TV system, might be called differential delay distortion. There is delay in every part of the system, from the camera to the picture tube, but uniform delay of all picture components does not cause any distortion, because it is impossible to tell whether the transmitting station is 10 miles away or 25 by looking at the TV set.

Envelope delay distortion comes about when the various components of the picture signal, which make up the individual picture elements, arrive at the picture tube at different times. Transmission through space or through a short transmission line suffers little, if any, differential delay. But when a video signal is put through the transmitter-tuned circuits, the filters and other equipment that limit the bandwidth introduce envelope delay distortion.

The same is true in the receiver. If this distortion exceeds certain limits, the picture is not as crisp. To help avoid this possibility, an FCC rule (illustrated in Figure 1) requires that a transmitter carrying color signals meet close tolerances with respect to envelope delay distortion. This specification also requires that a certain amount of predistortion be introduced to compensate for the delay distortion introduced by the *typical* receiver.

Many think envelope delay distortion measurement is difficult, or requires expensive test equipment. For that reason, operators have relied heavily on equipment manufacturers to build the required characteristics into the transmitting equipment, and it's assumed that the equipment will continue to meet FCC specifications indefinitely. This is not always true.

A method of measuring envelope delay distortion using only a sine wave generator, a good oscilloscope, a frequency counter and a hand-held calculator will follow. The method relies on the measurement of the change or slope, at intervals, of the phase characteristic of the equipment under test, from which delay can be easily calculated.

In a system free of envelope delay distortion, the phase delay of a sine wave signal, as measured between the input and the output, will be perfectly linear with respect to frequency. As the frequency is increased, the phase delay will increase at a uniform rate. If there is delay distortion present, the phase delay will not increase at a uniform rate. To measure delay distortion, determine the change of phase delay over succeeding intervals and calculate from the result the degree of delay distortion present.

The sine wave oscillator, which should have a range covering 0.05 to 5MHz, is fed into the transmitter at a level so that it modulates at about 50%. The oscilloscope is connected to the transmitter input and the demodulator output as shown in Figure 2. The oscilloscope must have dual time base capability to allow phase comparison between the sine wave input and output. A Tektronix type 7603 with dual trace amplifier type 7A18 and dual time base type 7B53-A plug-ins was used for this article, but comparable oscilloscopes with equivalent capability could also be used.

Phase difference is measured as follows: Using duplicate matched probes, connected as shown in Figure 2 for any given frequency, the lower trace is locked to the input signal. The horizontal sweep is spread, using the variable control, so that the peaks of one sine wave exactly match 7.2 horizontal scale divisions. If each large horizontal division is divided into five small divisions, as is true with most oscilloscope graticules, each small division will correspond to 10 degrees of phase difference. To measure phase difference between the upper and lower traces, move the upper trace peak of the sine wave to the horizontal center line on the graticule and read the number of divisions difference between the two traces. It is easy to estimate phase differences as small as two degrees. Care must be exercised in doing this, and it is best to use as large a verticle deflection as possible to narrow the observational error. See example in Figure 3.

The FCC rule requires averaging the delay as measured between 0.05

As required by FCC rule #73.687(a)5

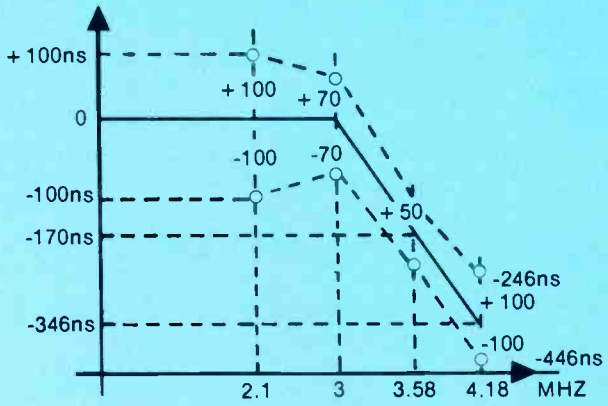

FIG. 1 ENVELOPE DELAY LIMITS
—NAB Engineering Handbook

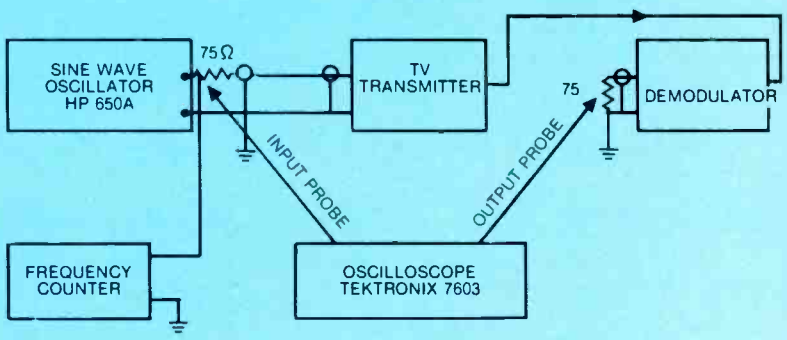

FIG. 2

Beyond ENG

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Ikegami HL-79A

Circle (58) on Reply Card

Envelope delay

and 0.2MHz and use that figure as the reference for frequency intervals above 0.2MHz. To do this, measure the phase difference between 0.05 and 0.10 MHz, then that between 0.10 and 0.15, and finally the phase difference between 0.15 and 0.20MHz. Average these phase differences and calculate the total delay over the interval as follows:

Average delay over the interval $= \frac{\Delta P}{0.36\Delta F}$ ns,

where ΔP = phase difference over the frequency interval and ΔF = frequency interval in megahertz.

For example:

Phase delay at
0.05MHz = 5°
0.010MHz = 87°
0.15MHz = 167°
0.20MHz = 250°

Phase delay difference for:
0.05-0.010MHz = 82°
0.10-0.15MHz = 80°
0.15-0.20MHz = 83°

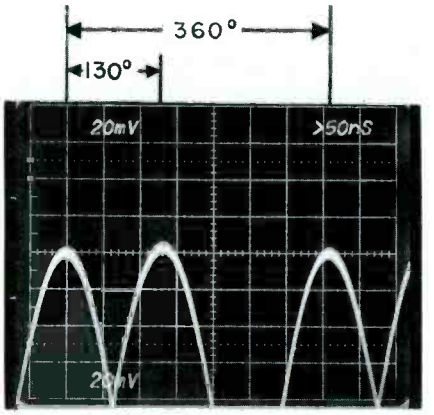
Average difference = 81.6 degrees over the above three 0.05MHz intervals.

Envelope delay over the interval 0.05-0.20MHz is

$\frac{81.6}{0.36 \times 0.05} = 4533$ ns.*

The same equation is used to calculate the delay over any other phase and frequency interval.

Now starting at the frequency, as shown by the frequency counter, where the phase shift through the system is 360 degrees or a multiple of that number, read the frequency in megahertz at intervals of 360 degrees phase shift to three decimal



*This delay is typical of an RCA TT-25, low-band transmitter plus a Scientific Atlanta demodulator.

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varian

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Freq. MHz	ΔF Internal MHz.	Delay n.secs.	Delay relative to that at .05-.20MHz
.05-.20	.05-.200	4533	0
.218	.....	.....	.....
.437	.219	4566	33
.653	.216	4629	96
.867	.214	4673	140
1.085	.218	4587	54
1.305	.220	4545	12
1.524	.219	4566	33
1.744	.220	4545	12
1.964	.220	4545	12
2.184	.220	4545	12
2.402	.218	4587	54
2.617	.215	4651	118
2.834	.217	4608	75
3.051	.217	4608	75
3.268	.217	4608	75
3.485	.217	4608	75
3.707	.222	4505	-28
3.930	.223	4484	-49
4.148	.218	4587	54
4.340	.192	5208	675

Fig. 4 Data taken from RCA TT 25 transmitter plus Scientific Atlanta Demod. before all pass phase corrector networks were adjusted.

Envelope delay

places (or four if total delay is greater than 5000 ns). Record the results as shown in the left-hand column in Figure 4. Then subtract each number in this column from the one immediately below it and record the difference as shown in the second column under *Interval MHz*. Next calculate the delay corresponding to each interval as follows:

$$\text{Delay (ns)} = \frac{360}{0.36\,\Delta F} = \frac{1000}{\Delta F},$$

because each, except the first corresponds to a phase shift of 360°.

These delays in Figure 4 are shown in the third column. To get the delay that would be used in plotting a curve, subtract the delay corresponding to the average over the interval 0.05-0.20MHz from the numbers in the third column. This gives the desired information for plotting. Figure 5 is a plot of the data shown in Figure 4, which was made before phase correcting networks were adjusted for the proper delay characteristics in the system.

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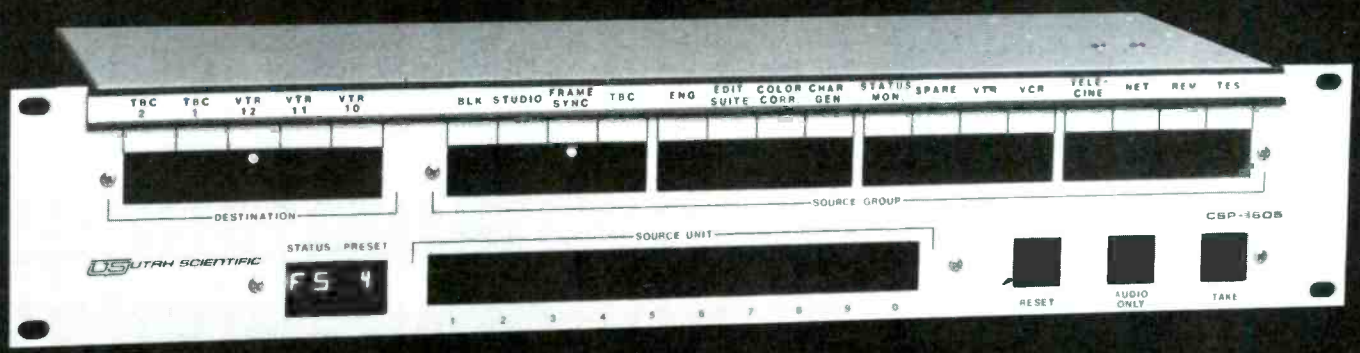

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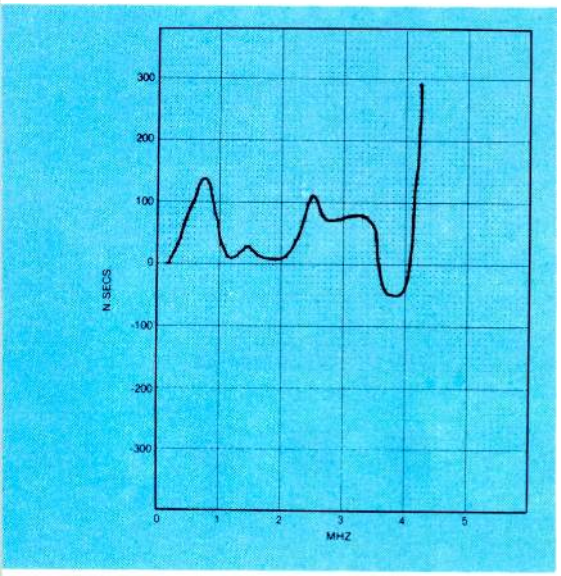
Envelope delay

Intervals of 360° turn out to a be a good number for the average TV transmitter because the total delay is more than 4 μs, and the intervals therefore come close enough to make an informative plot. Wider spacing (720 degrees or more) will smooth the data, but may miss glitches in the overall response. If this method is used to measure the characteristics of individual components, such as low-pass filters or all-pass networks, it may be necessary to take smaller phase intervals in the delay analysis. When small intervals are taken, more care is required in measuring phase and frequency. Any sharp change or kink in frequency characteristics will produce changes in delay such as in the case of a low-pass filter near cutoff, which has not been compensated through the use of all-pass networks.



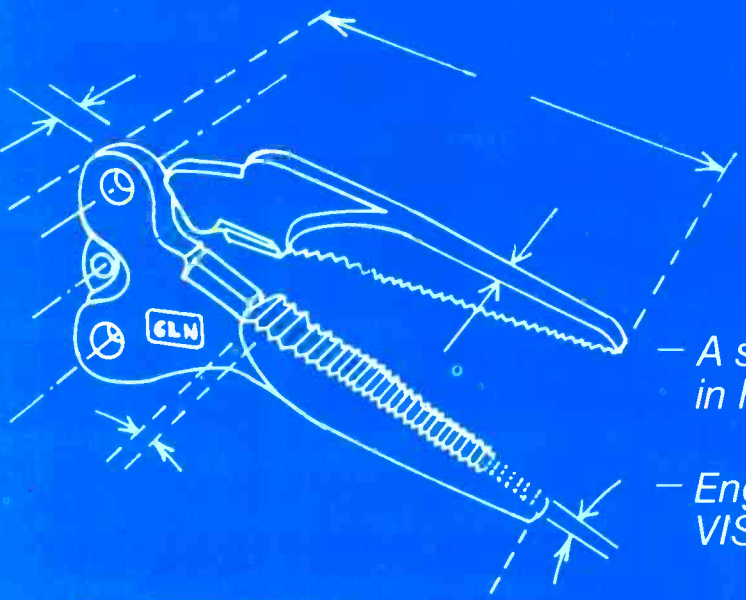
A special case has to do with SAW filters, which are coming into use in TV and other industries. These filters are *transversal* in operation and may produce glitches that are very close in frequency. These irregularities, which are caused by echoes in the SAW device, are down 45 to 50dB, according to one designer. Apparently the noise they cause does not show up in the picture but could show in a detailed analysis of the envelope delay characteristic. A certain amount of data smoothing by sampling over a wider frequency interval will make a better plot, but how much of this is allowable without affecting the result is not known. These filters do not have basic envelope delay distortion and cannot be adjusted in the field.

A Tektronix Model 1450-1 demodulator has been tested individually by the method outlined here, and no spikes were found in the envelope delay characteristic although the instrument uses SAW filters for both the sound trap IN and the sound trap OUT condition. When the sound trap is IN, the high frequency envelope delay closely approximates the delay expected in the *typical* TV receiver.

The FCC curve shown in Figure 1 indicates limits that the TV transmitter system should fall in, but it includes predistortion of delay of the high frequencies to compensate for the delay in the *average* receiver. If a demodulator has a sound trap that cannot be switched out, as is the case with the Scientific Atlanta unit, then the delay should be constant out to approximately 4MHz.

Acknowledgement

The author wishes to thank Charles Burch, chief transmitter engineer, and Phillip Murphree and Robert Powell, engineering department, WSM-TV4, Nashville, TN, for their help in carrying out the tests and for their comments on this article.



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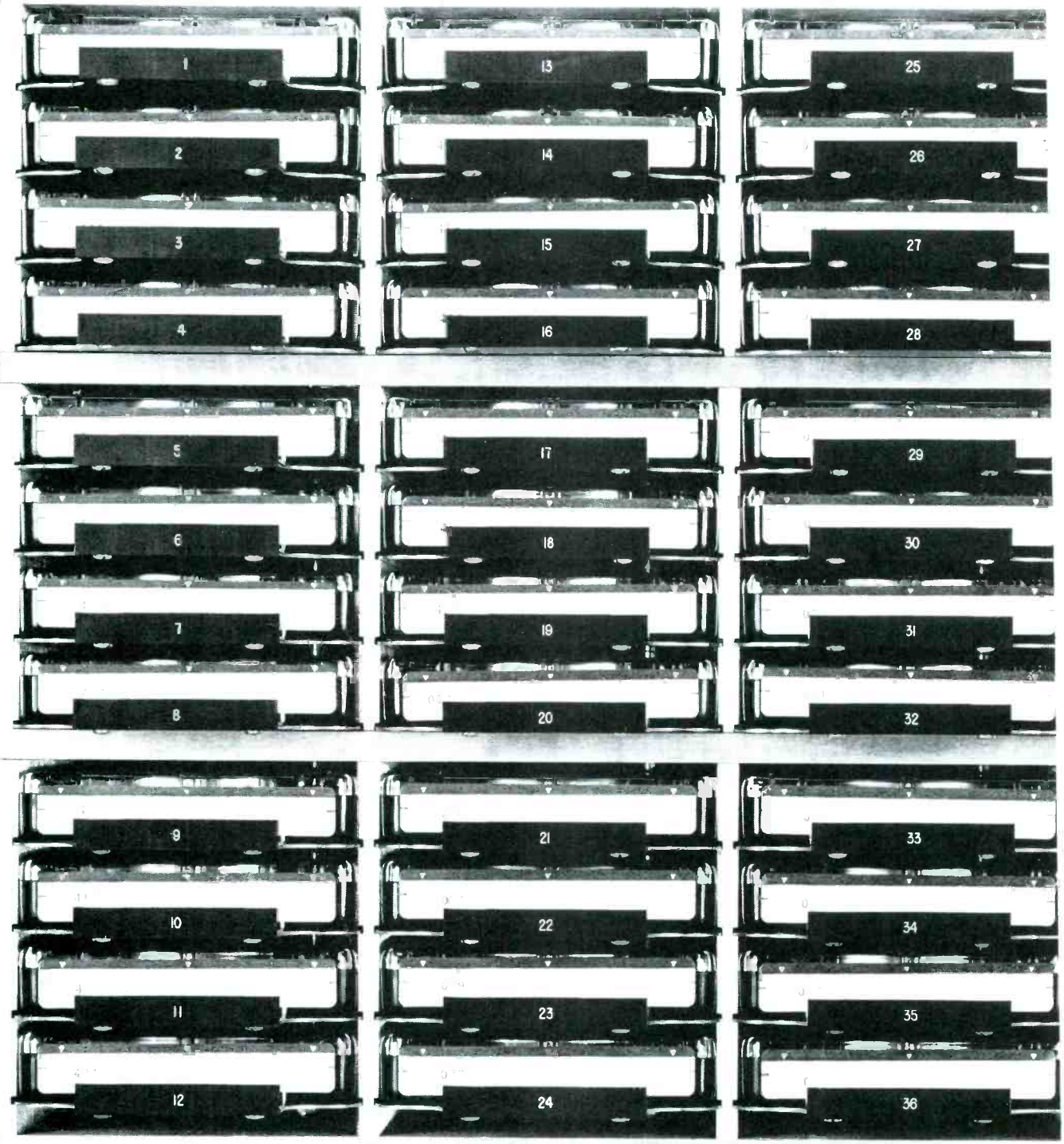

1 — 2 —	13 — 14 —	25 — 26 —	37 — 38 —
3 — 4 —	15 — 16 —	27 — 28 —	39 — 40 —
5 — 6 —	17 — 18 —	29 — 30 —	41 — 42 —
7 — 8 —	19 — 20 —	31 — 32 —	43 — 44 —
9 — 10 —	21 — 22 —	33 — 34 —	45 — 46 —
11 — 12 —	23 — 24 —	35 — 36 —	47 — 48 —

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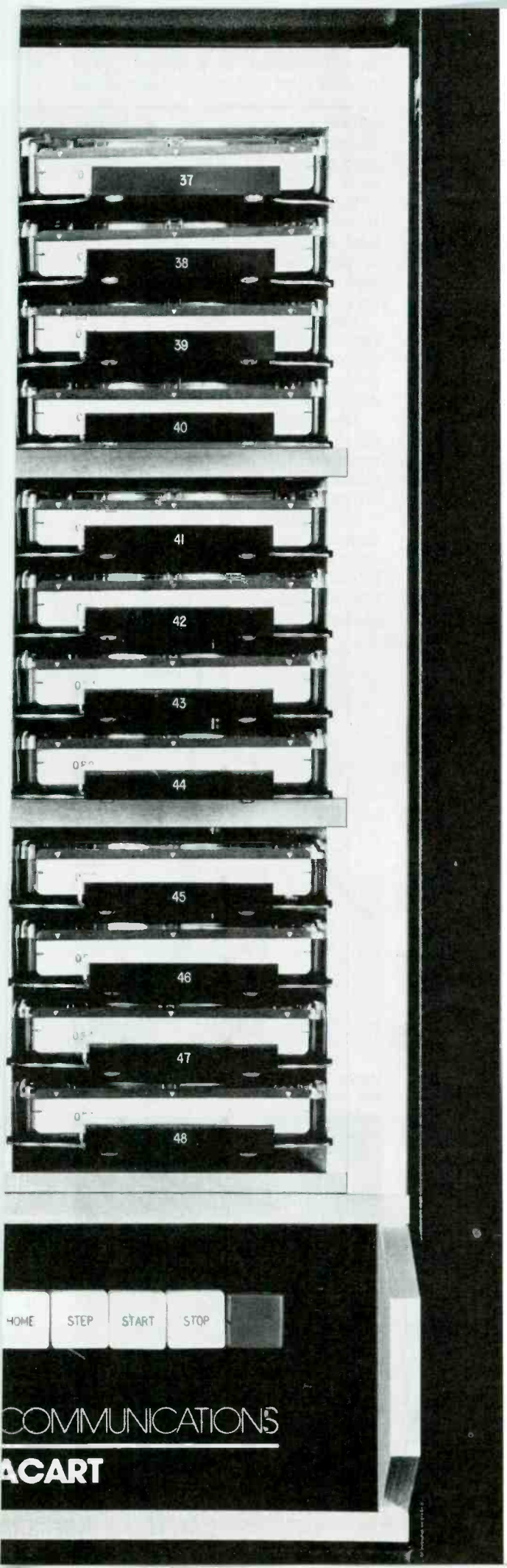

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WFMY-TV gets new transmitting plant

By Larry White, Williams Associates, Lago Vista, TX

On June 18, 1980, WFMY-TV in Greensboro, NC, began telecasting from a new $3.3 million transmitting plant that included an RCA TT-50FL lowband VHF transmitter, a new tall tower 2649 AMSL and a new 4 1/16-inch transmission line connected to an RCA TFV-7A2 circularly polarized Fan Vee antenna.

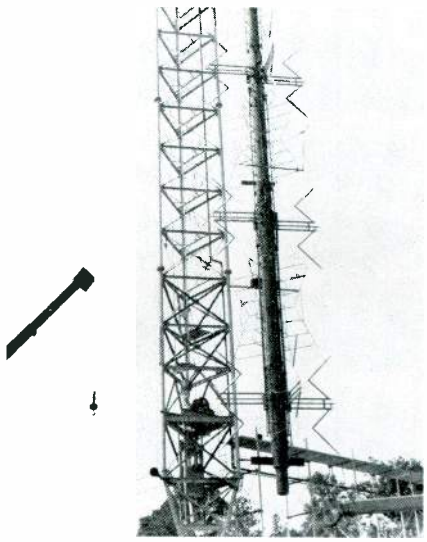
Williams Associates was engaged as project engineer, designing the new building, inside transmission line layout and supervising construction of the new building and tower foundations.

The building was complete and the transmitter installed in fall 1979. The transmitter, as configured, consists of two 25kW transmitters ("A" and "B") combined in the RCA *Opto-Switcher* to produce 50kW peak of sync. Mode switching allows switching to one-half power should either transmitter fail. A 250kW diesel generator assures that the transmitter will continue operating even during a power failure. A 1000A changeover switch senses all three phases incoming to the plant. And should a failure occur on any of the three phases, the generator will automatically start and switch on-line.

The building design is such that the building contents are protected from falling ice on a roof of 12-inch precast prestressed concrete plus 6 inches of reinforced concrete.

The transmitting plant can operate by remote control. However, complete living quarters are provided should a maintenance crew be stranded during snow or ice storms.

Air handling in the building is designed so that a 10,000 CFM fan draws in outside air through vee filters and is ducted to discharge this filtered air over the air intake of the TT-50FL. Another 10,000 CFM



Upper half of Fan Vee antenna leaving the ground.

Construction workers prepare to proof load—one of five anchor cores at Anchor C-2.

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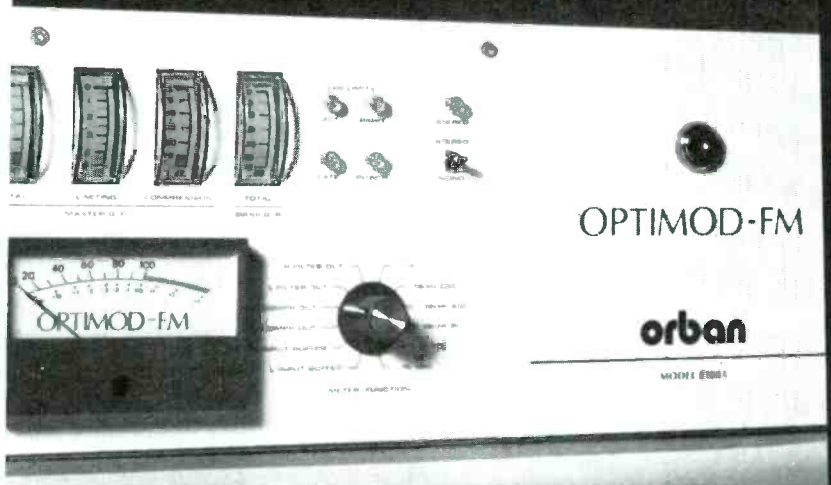

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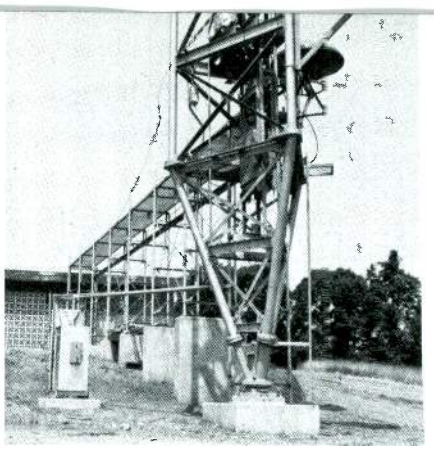
Riggers prepare for arrival of Fan Vee antenna to be inserted in bury section (large pipe in center of tower).



80 ft. horizontal bridge and ice shield.

Anchor A-1 capped with 43.8 cubic yards of concrete completing Anchor A-1.

Left to right: Frank Willis, C.E., WFMY-TV; Larry White, Williams Associates (project supervisor); Lee Brady, assistant C.E., WFMY-TV; Jim Key, WFMY-TV transmitter supervisor; R. M. Williams, president, Williams Associates; Ray McMillan, director of engineering, Harte-Hanks Communications, Inc. Ray McMillan turns on TT-50FL.

WFMY

blower and duct system draws the hot exhaust air from the transmitter and discharges it to the outside. In winter, if building heat is required, transmitter heat is used to maintain building temperature at approximately 70°. By having the exhaust blower slowed down slightly, a positive pressure is maintained in the building so unfiltered air is not drawn into the system around doors, transmission line feedthrough, etc.

Tower foundations consist of three "H" pile anchors and three rock anchors. The "H" pile anchors contain 62 10 x 57 (10-inch wide and 57 pounds/foot) steel piles driven to a depth of approximately 46 feet, then capped with 128.5 cubic yards of reinforced concrete. Rock anchors were attached to bedrock by five 40-foot cores and aircraft cables were inserted into the cores and attached with high yield grout. Each was tested to 10,000 PSI (50,000 PSI per anchor) and then capped with 36 cubic yards of reinforced concrete.

The 1914-foot tower, as designed and built by Stainless, North Wales, PA, will withstand a hurricane-force wind while supporting the Fan-Vee antenna (Channel 2), one UHF panel antenna, two FM antennas and 25

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WFMY

two-way radio antennas, as well as one ENG antenna and two microwave receiver reflectors.

The tower was erected by Tower King, Marietta, GA, in spring 1980. The RCA antenna at 25.3 tons makes it the heaviest circularly polarized antenna at that altitude east of the Mississippi. The antenna was erected in three sections: the bury section, 4.8 tons, the lower half, 13.9 tons, and the top half, 6.6 tons.

The tower is hot-dipped galvanized and has strobe lights, eliminating the need for obstruction painting. All members are solids—no tubular construction—and the largest legs are 7 5/8 inches in diameter. An elevator runs the height of the tower to within 50 feet of the antenna.

The tower contains 1350 tension rods weighing 22 tons (of which the largest is 1 1/4-inch solid steel weighing 59.6 pounds). The smallest tension rod is 3/4-inch solid steel at 19.9 pounds. There were 9550 drive bolts used to put together the tension rods, K braces, X braces and level struts. Another 5425 bolts weighing two tons hold the 58 30-foot sections together. The tower guy lines are held by anchor pins 5 3/4 inches in diameter, weighing 137 pounds each (largest) and 2 5/8 inches in diameter at 25 pounds each (smallest). Strobe lights account for more than one ton of dead weight.

If laid end to end, the 272 tons of tower legs would reach more than one mile, and the three upper guy wires (37.5 tons) would reach over 1 1/4 miles. If all 27 guy wires were laid end to end, they would stretch almost 7.6 miles.

Realizing that after completion of the tall tower FM broadcasters could benefit from increased height, two separate 300-square-foot rooms were built along side of the WFMY-TV operating area to be rented to interested FM stations. This made the complete building 3420 square feet; WFMY-TV occupies 2745 square feet.

Another benefit realized after completion of the tall tower was increased electronic news gathering capability. Making the STL and TSL allows ENG signals from the Winston-Salem area to be relayed back to the studios. An ENG receiving antenna mounted at the 1350-foot level has increased ENG coverage to almost every area within the station's Grade B contour. □

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WESH-TV2

new tower dominates mid-Florida skyline

WESH-TV2, a Cowles Broadcasting station with offices and studios in Daytona Beach and Orlando, FL, has installed a new facilities tower that dominates the mid-Florida skyline. The tip of the new tower, the tallest TV tower aboveground in Florida, is a few feet below that of a hill-mounted tower in northern Florida.*

Steelworkers topped off Florida's tallest structure on June 12 by bolting down a 9-ton antenna whose branches beam the WESH signal to 2 million central Florida viewers.

At 1740 feet above sea level, the tower, in Orange City, midway between Daytona Beach and Orlando, reaches a higher altitude than New York's World Trade Center, Chicago's Sears Tower or San Francisco's TransAmerican Pyramid.

WESH is central Florida's NBC affiliate. Its new tower and transmitter facilities represent an investment of approximately $3 million. John M. Haberlan, president of Cowles Broadcasting Inc., licensee of WESH and Marvin C. Whatmore, chairman and chief executive officer of the station's parent company, Cowles Communications Inc., broke ground at the site, adjacent to Channel 2's previous transmitter, in April 1979.

Besides setting a new height record, Haberlan said, the facility introduces to central Florida circularly polarized TV signals, technology originally developed for the US space program and first used by Apollo 9 astronauts to beam pictures back from the moon. Ordinary TV signals are beamed out in flat, or horizontal planes, but the circularly polarized (CP) signal spirals through the air like a corkscrew so that much more of the signal is picked up by any available receiving surface, Haberlan said. A result, he said, is a much better picture including fewer ghosts, less interference, improved reception on indoor rabbit ear antennas and a lot less fussing to fine-tune outdoor antennas.

"The combination of nearly doubled antenna height over our previous transmitter and the switch to CP will give Channel 2 the opportunity to offer the most modern and dependable television signal available to central Florida viewers," Haberlan said. He said that the new facility not only improves reception for current Channel 2 viewers but that engineering projections indicate it increases the WESH viewing area by nearly 3000 square miles, making the station's programs available to an estimated 330,000 viewers not previously receiving a clear signal. This extends the coverage area of Channel 2 from the Atlantic Ocean to the Gulf of Mexico in a band across the state from roughly St. Augustine in the north to Melbourne in the south.

Nile Hunt, Channel 2 director of engineering, noted that placement of the Harris CP antenna atop the tower completed one of the more unusual construction projects the region has seen. More than 7000 pieces of steel make up the new tower, which was fabricated by North Carolina-based Kline Iron and Steel and assembled by Allied Con-

*Tower owned by WTVY-TV4, Dotham, AL, located in Miller Cross Roads, FL; 1670 foot tower, 1909 feet above sea level.

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WESH

structors, Wichita Falls, TX. The tower base sits on a three-foot square concrete pillar, beneath which are nearly 1000 tons of steel-reinforced high-density concrete. The whole structure is balanced in place with 6½ miles of multi-strand steel guy wires attached to concrete anchors buried more than 25 feet in the soil.

Service on the tower will be performed by engineers who will ride an elevator to the top—a third of a mile trip that takes about 15 minutes. From the top, the Atlantic Ocean is easily visible 18 miles to the east and, on a clear day, it is possible to see the Gulf Coast.

"When we pushed that button, and the station went black, and then came on again, viewers saw substantial picture improvement," he said. "Parts of Orange and Brevard counties could use rabbit-ear viewing for the first time. In Osceola, Citrus, Sumter, Alachua, Putnam and St. Johns counties, reception of our local programming and NBC network presentations was dramatically improved."

The more than $3 million investment by Cowles makes WESH one of only a few dozen stations in the United States to have switched to circular polarization, though more are coming on line rapidly as the equipment becomes available. The new system is the latest in a long list of *firsts* brought to the area by Channel 2. Others include the first use of dual studios to serve the sprawling coverage area, the first hour-long news programs, the first color weather radar, the first mini-cams for improved field photography, the first mobile microwave *Live Eye* units and the first multi-channel video processor for network-quality special effects on a local basis.

The preliminary data from field strength readings indicate that the WESH system is performing fully to expectations; uniformly doubled horizontal component readings were found throughout the viewing area.

"The basic field strength readings do not, of course, reflect the impact of the circular polarization of the signal," noted John Evans, vice president, WESH. "Within the first few weeks of operation we got reports that we were consistently receivable on outdoor antennas in Keystone Heights, in southwest Duval County, within the Jacksonville City Limits, and from South Lakeland in Polk County, immediately adjacent to the Tampa Bay area. □

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CBS leads teletext standards movement

CBS announces its recommendation for a national standard for a broadcast teletext system in the United States, petitions the FCC for rulemaking and urges prompt adoption of teletext standards.

The CBS leadership in research with teletext systems in the United States has been reported extensively in newspapers and in **BE** (November 1979, pp. 62-65). It was speculated that early this year CBS would complete its analysis and, perhaps, have recommendations ready for submission to the FCC at NAB-'80/ Las Vegas in April.

Although earlier speculations were premature, CBS continued its testing and analyses quietly behind the scenes. Then, suddenly, CBS called a press conference in Washington, DC, for the morning of July 29 to present its findings to the FCC. More accurately, the press conference was an invitation to selected members of the news media to witness a petition in which CBS presented the results of its engineering tests, provided its recommendation for a modified version of ANTIOPE (the French teletext system) and urged the prompt adoption of those standards.

The CBS presentation to the FCC was spearheaded by Gene F. Jankowski, president, CBS/Broadcast Group. Technical support was provided by Harry E. Smith, vice president, CBS/Technology, and Joseph Flaherty, vice president, CBS/ Broadcast Engineering.

According to CBS, its recommendation represents a major step toward implementing a broadcast teletext system in the United States capable of providing the home television viewer with a wide range of information services and captioning for the hearing-impaired.

Teletext is a generic term for systems that transmit words and graphics to the home viewer by means of signals transmitted simultaneously with the normal television picture. By use of a receiver equipped with the necessary decoding circuitry, the home viewer has access to an electronic *magazine*, and can select from hundreds of *pages* of information being transmitted by the teletext system—pages for news, sports, stock quotations, weather reports, program schedules, etc.

"After much testing and evaluation we have developed a set of standards that will assure teletext operation in the US broadcast environment," Jankowski said. "We believe broadcast teletext has a bright future in this country, and our considerable efforts to research and adapt this European-developed technology are a good measure of the confidence we have in the future of teletext."

Jankowski also stressed the importance of teletext as the best means of communicating important information services and captioned television programs to the hearing-impaired. "Unlike the so-called Line 21 system which primarily performs captioning," he said, "a teletext system can provide virtually unlimited other services which, because they are visual in nature, are of particular interest to the hearing-impaired."

CBS has been conducting extensive engineering tests on the British CEEFAX and ORACLE teletext systems and the French ANTIOPE system since January 1979 in its laboratories in New York and Stamford, CT. Actual on-air testing began in March 1979 at CBS-owned KMOX-TV, St. Louis, under special temporary authority from the FCC. These tests continued in other cities and on network long lines to develop transmission methods that would ensure reliable service in the United States.

Upon approval of a set of standards by the FCC, broadcasters would be able to acquire the equipment to transmit teletext, and receiver manufacturers could begin mass production of decoders to be used with existing television sets and of television sets with built-in teletext decoding capability.

Supporting Data

The CBS petition for rulemaking was supported by three substantial volumes covering phases I, II and III of the CBS teletext field tests. This careful, detailed research and the presentations by Smith and Flaherty left no doubt that the CBS proposal for teletext standards was based on extensive data and analysis. This work gave additional weight to the CBS recommendation for adoption of a standard by the FCC at the earliest possible time.

The heart of the CBS standards proposal is a software-based, variable format (the so-called *asynchronous* format), a modification of that used in the French ANTIOPE system. In this format the position of the data on the television scanning line is independent of that data on the display. The CBS work indicates that the proposed format, which is at the forefront of today's technology, is sufficiently developed for immediate implementation and that it offers many advantages over fixed format (synchronous) systems.

Teletext will not make current TV receivers obsolete because separate decoders could be added by users—at an estimated cost of, perhaps, $200 in high volume production. In addition, the early adoption of a teletext standard would allow manufacturers the opportunity to integrate decoders into new models as soon as possible.

CBS included in its presentation examples of the type of information services consumers might expect through teletext: news headlines, sports scores, weather, travel schedules, stock market reports, TV programming, gardening tips, horoscopes, entertainment schedules, advertising data, captioning, etc. The list of potential uses of teletext is extensive, but little progress will occur without the establishment of standards to permit progress on broadcast components and decoders.

A question-and-answer session followed the formal CBS presentation. One inquiry concerned CBS's eagerness to push teletext. The reply noted that CBS had typically been at the forefront of new technology (ENG and the loudness meter, for example) and that teletext was just another phase of technology that CBS views as having great potential. CBS is considering production of a syndicated news service for teletext, and this represents the first wave of such information services available to consumers.

But other concerns exist as well. One is that unless the FCC adopts a standard soon, the selection of possible teletext systems will proliferate and cause serious delays in adopting *any* teletext standard.

Flaherty, in describing the evolution of new technology; noted that growth occurs in three stages:

1. The new development is against the Bible; it's immoral;
2. It will never catch on; and
3. I thought of it myself, years ago.

Teletext is in the third stage.

The teletext standard

Based on the extensive field tests, and exhaustive comparative systems analysis studies, the following technical standards were recommended by CBS for the introduction of teletext in the United States:

(1) A variable format system;

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(2) A coding scheme for the introductory version of teletext based on a variation of the ANTIOPE coding structure;
(3) A data bit rate of 5.727272 Mb/s, at a nominal pulse amplitude level of 70 IRE units, with pulse shaping to limit spectral energy to the nominal video baseband;
(4) For the vertical interval application lines 15 and 16 to be authorized initially with provision for the subsequent use of additional lines between 10 and 14 inclusive; and
(5) Provision for the subsequent addition of an adaptive equalizer training pulse in the vertical interval.

Excerpts from the CBS petition for rulemaking

CBS Inc., pursuant to Section 1.401 of the commission's rules, hereby petitions the Federal Communications Commission for the issuance of rules which would allow television broadcast licensees to transmit teletext. Adoption of teletext rules and standards is essential at this time to permit implementation by United States broadcasters, such as CBS, of this major technological advance, already in use in other countries, and to channel the United States development of teletext into practical public service in furtherance of the commission's mandate to "encourage the larger and more effective use of radio in the public interest."

A United States teletext standard

The need for a single standard and prompt adoption: "The public interest will be served by prompt adoption of FCC rules and standards for broadcast teletext. Research, experimentation and field testing in Europe for more than 10 years and in the United States for the past few years have preceded this petition. Although the United States has traditionally been in the forefront of advances in broadcast technology, teletext systems have already been introduced, either on a regular or pilot program basis, in England, Australia, France, Canada, Sweden, Japan and West Germany. Other pilot programs are planned to begin shortly in other countries. CBS believes that it is now appropriate to adopt standards governing transmission of teletext.

"The system proposed herein is highly extensible, thus permitting system growth and innovation as the technology evolves. Moreover, teletext receivers, manufactured pursuant to these standards, can be made compatible with later systems, such as *videotex*—a complementary two-way information system using a telephone set connection.

"The CBS field tests and analyses of the various teletext systems clearly indicate that the software-based, variable format system[1] proposed, a modification of the ANTIOPE system, is sufficiently developed for immediate utilization and offers many inherent advantages over fixed format systems.[2] Moreover, the variable format is at the forefront of current international telecommunications technology. Further, CCITT (the international telecommunications organization) has endorsed software-based telecommunications systems for the proposed Integrated Services Digital Network model currently being planned.[3]

"In the United States, systematic development of teletext requires a common standard, which only the Commission can provide.[4] Delay now will only discourage the substantial investment and coordination needed

[1]In a variable or asynchronous format system, the position of data on the television scanning line is independent of the position of that data on the display.

[2]In a fixed, or synchronous, format system the position of data on the television scanning line bears a direct relationship with the position of the corresponding characters on the television receiver display. This dependence acts as a restraint both on the creative use of the system and its future compatibility with other systems, such as *videotex*.

[3]See, CCITT Study Group III Meeting Report, April 18-24, 1980, Geneva, Document T-28E.

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to launch teletext by encouraging the proliferation of incompatible systems. This will prove wasteful in the long run to broadcasters, viewers, information suppliers and receiver manufacturers alike.

"It is commonly recognized by manufacturers that the major portion of teletext decoder costs is in volume-sensitive integrated circuit chips. Consequently, broadcasters and viewers alike will benefit by prompt adoption of teletext rules and standards. CBS believes that after adoption of the proposed standards, teletext receivers will be made available by manufacturers in sufficiently large quantities to reduce significantly the cost of integrated circuit chips, thus placing teletext within the means of the general public.[5] It can be anticipated, however, that prototype model decoders for field trials and marketing tests will become available almost immediately.

"Convinced of the public benefits to be derived from a carefully thought-out teletext system, CBS has engaged in an extensive program of experiments and testing at CBS laboratories and in the field. Test results are offered with this petition.

Conclusions

"CBS field tests and comprehensive analyses clearly demonstrate that the variable format system possesses unmistakable advantages over the fixed format system for the following reasons:

"**A.** The system is basically a software-based system and, as such, is highly extensible, permitting system growth and innovation as the technology evolves.

"**B.** This technology will afford an extremely high degree of compatibility between broadcast teletext and two-way, *videotex* system decoders.

"**C.** Equally significant, the coding structure proposed herein offers singular versatility. It is not a special, single-purpose language suited only to television broadcast signals. Rather, it may be used without modification for transmission of information over many different types of transmission systems.

"CBS firmly believes that the state-of-the-art of teletext is ripe for rule-making. The benefits of broadcast teletext services are obvious. Through the testing reported herein, issues are now sharply focused. The commission is presented with an opportunity to apply useful learning to practical and worthwhile public service.

"Accordingly, CBS requests expedited consideration of this petition for rulemaking and adoption of the teletext rules and standards proposed.

Proposed rules

In compliance with Section 1.401(c) of the commission's rules, CBS sets forth specifically the following as the substance of the rules proposed:

(a) Section 73.681, which contains the definitions applicable to television technical standards, would be amended by inserting following the definition of "synchronization" the following definition of teletext:

"**Teletext.** A digital data system associated with a broadcast signal for the transmission of information, intended primarily to display pages of text and pictorial material on the screen of suitably equipped receivers."

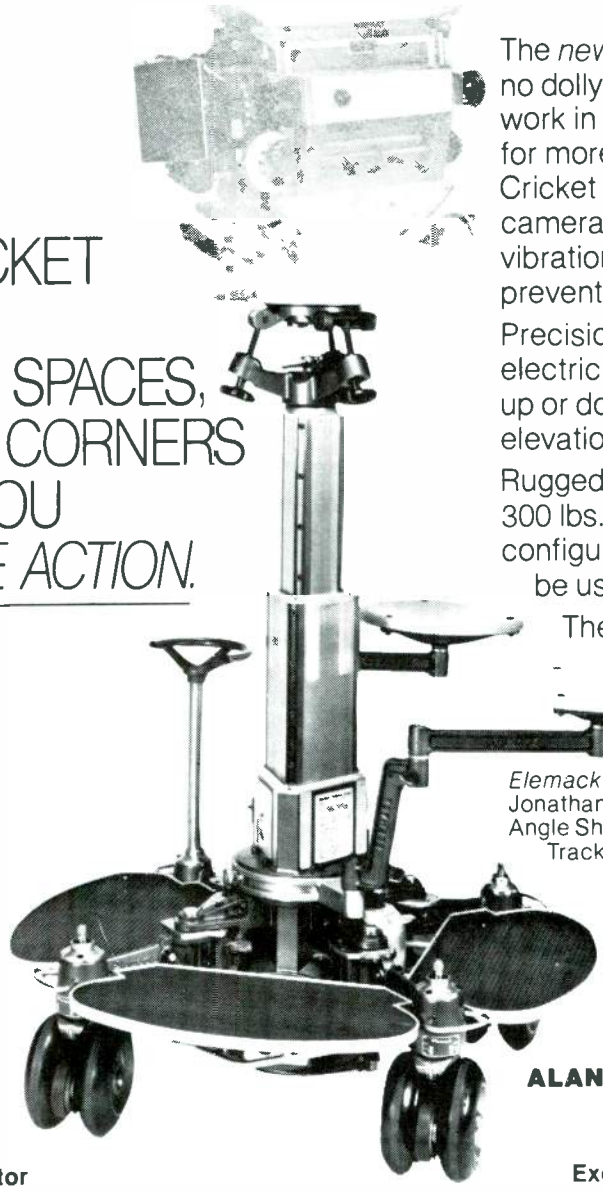
(b) Subsection 73.682(a) (Transmission Standards) should be amended by adding the following new subparagraphs.

"(24)(i) Teletext signals may be

[4]CBS has participated actively in the industry activity currently under way under the aegis of the Broadcast Television Systems Committee, Subcommittee on Teletext, which is being sponsored by EIA, looking towards a recommendation to the commission of a single teletext standard. The subcommittee has been very active and productive during the past year and a half of its existence, but is much behind schedule. The subcommittee was to have completed its task by the first of January to arrive at a single teletext "standard." CBS is concerned that unless a positive step is taken now, teletext may be denied to the American public for a long time to come.

[5]TELIDON, the other variable format system, is more complex. However, the system proposed herein allows for future incorporation of new features, such as those included in TELIDON, and can do so without making early teletext equipment obsolete. Indeed, the introduction of a practical teletext system will undoubtedly fuel consumer demand for increasing sophistication.

Shooting in a Tight Spot?



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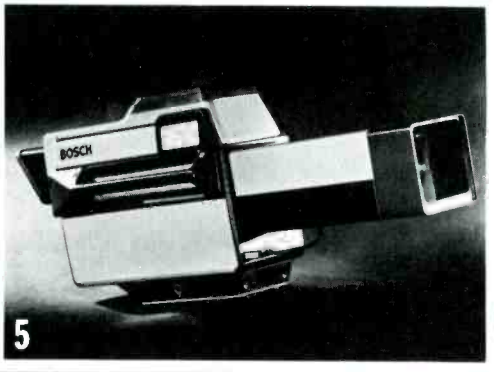

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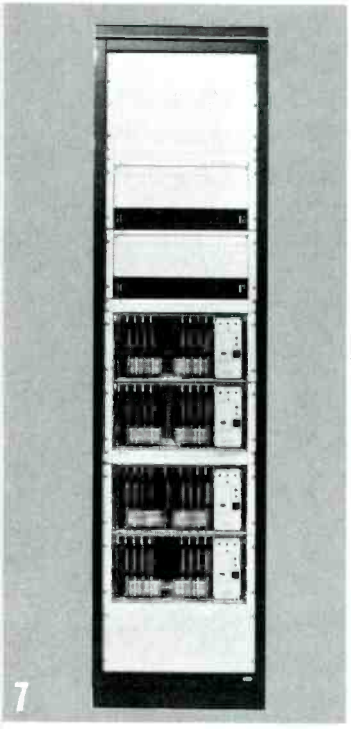
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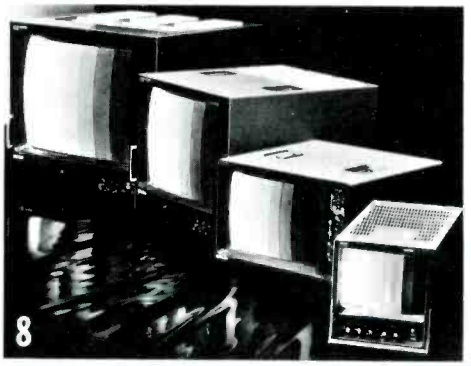
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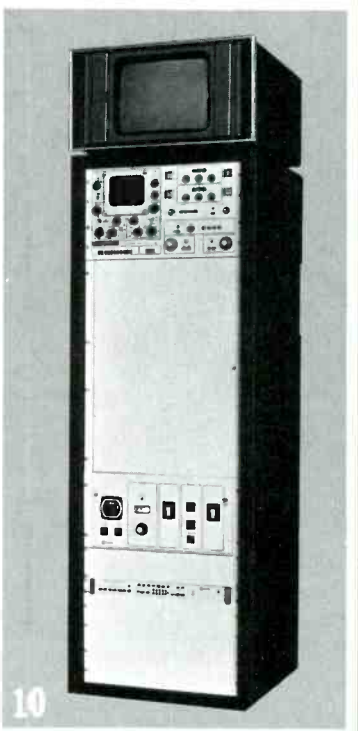
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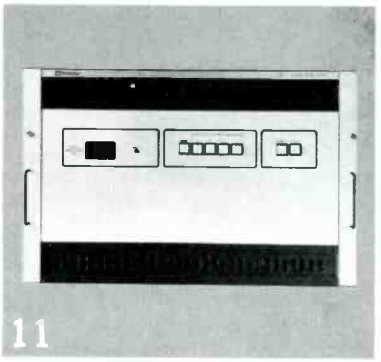
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Teletext

transmitted on specific scanning lines in the vertical blanking interval or on all active picture scanning lines.

"(24)(ii) Lines 10 through 16 of the vertical blanking interval may be used for the transmission of teletext. Lines 10-14 may be used for the transmission of teletext upon an affirmative showing that, based on relevant facts, including pulse amplitude level, no significant degradation will be caused to the program signal as viewed on home receivers.

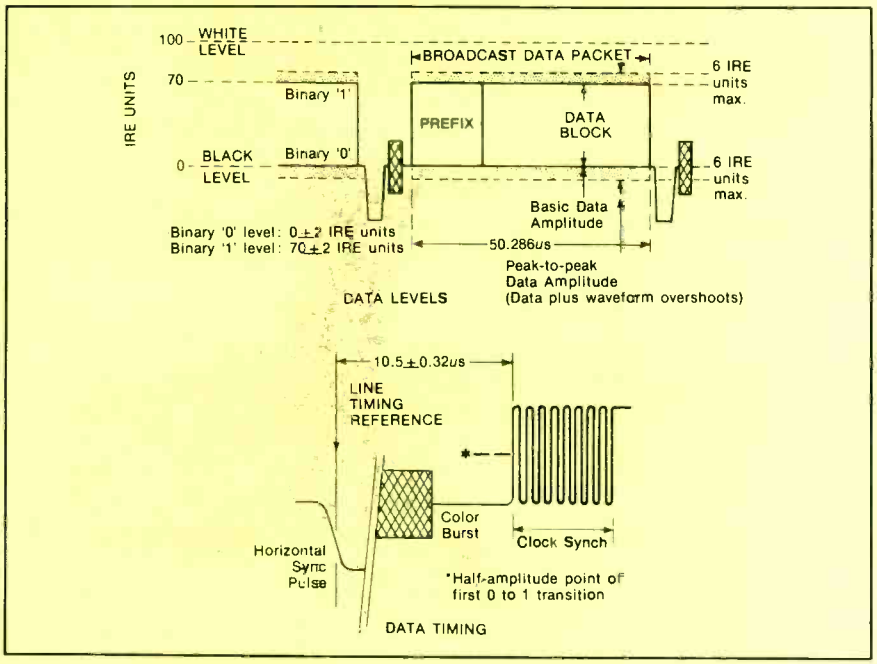
"(24)(iii) Teletext signals shall conform to Figure 18 of Section 73.699. The system shall be a variable format, asynchronous system. The data bit rate for transmission shall be 5.727272 Mb/s (364 times line frequency, 8/5 times color subcarrier frequency). The transmitted data shall be in the form of a data packet consisting of 36, 8-bit bytes arranged into a prefix and data block. The prefix may consist either of 5 bytes for vertical blanking interval applications or 8 bytes for full field teletext transmission applications. A code signifying the end of one display row and the start of another row may appear within the data block.

"(24)(iv) A reference pulse for a decoder-associated adaptive equalizer filter, designed to improve the decoding of teletext signals, may be inserted in the vertical interval in conformance with Note 10 associated with Figure 18.

"(24)(v) Teletext signals shall cause no significant degradation to any portion of the visual or aural signals nor produce emissions outside of the authorized television channel.

"(24)(vi) Transmission of visual emergency messages pursuant to Section 73.1250 shall take precedence and shall be cause for interrupting teletext transmission."

(c) Section 73.699 (engineering charts) should be amended by adding as Figure 18:



Note:

1. The structure shown above related to a variable format or asynchronous system, wherein a code signifying the end of one display row and the start of another row may appear within the data block.
2. The data bit rate is 5.727272 Mb/s (364xH, 8/5 x S.C.) ±16 b/s.
3. The teletext signal consists of 288 binary bits (pulse or no pulse) per television scanning line.
4. The data signal is coded using non-return-to-zero (NRZ) format.
5. The broadcast data packet consists of 36 8-bit bytes arranged into: a prefix and a data block.
6. The prefix has two options:
   short prefix of 5 bytes: CS CS BI P1 P2
   long prefix of 8 bytes: CS CS B2 P1 P2 P3 CI PL
   For vertical interval applications the short prefix is used.
   P, CI and PL represent packet address, continuity index and packet length.
7. The clock run-in signal (CS) is specified as 10101010.
8. The framing code is specified as follows:
   when used with short prefix:
   (B1) 00100001
   when used with long prefix:
   (B2) 11100111
9. The pulses are shaped to limit spectral energy to the nominal video baseband.
10. A special pulse designed as a training signal for an adaptive equalizer in a receiver may be transmitted on an otherwise unused line between 10-14 inclusive. The pulse is shaped to limit spectral energy to the nominal video baseband. □

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Part I

By R. M. Unetich and D. D. Harbert, RCA, Meadow Lands, PA

The introduction of high-power, solid-state RF devices has resulted in the development of broadband linear amplifiers with more than 1kW of RF output for use in television transmitters. In unattended, remote-controlled systems in which the maximum in reliability is required, these devices can greatly enhance reliability and reduce maintenance costs and downtime through the elimination of vacuum tube stages. However, this goal will only be achieved if these transistorized amplifiers are properly protected. This article describes the protection system developed by RCA for the new TTG Series of television transmitters, which uses solid-state RF amplifiers up to the final tube stage.

System description

The TTG Series transmitter is a vacuum tube output stage following a high-power, solid-state amplifier, which is driven by a heterodyne upconverter and IF modulator. In the high-power version, illustrated in Figure 1, the drive consists of four parallel 400W solid-state amplifiers with a combined output power capability of 1600W peak of sync. The output array is driven by a predriver with an output capability of 200W.

In the IF portion of the exciter, two pin diode attenuators are used to provide continuously adjustable level control and to allow the proper distribution of operating levels for the linearity corrector and output mixer.

The output from attenuator A is controlled by the primary automatic level control system (ALC). Attenuator B is normally held at a fixed level of attenuation but is used as a backup control element in case of a failure in the primary ALC loop. The

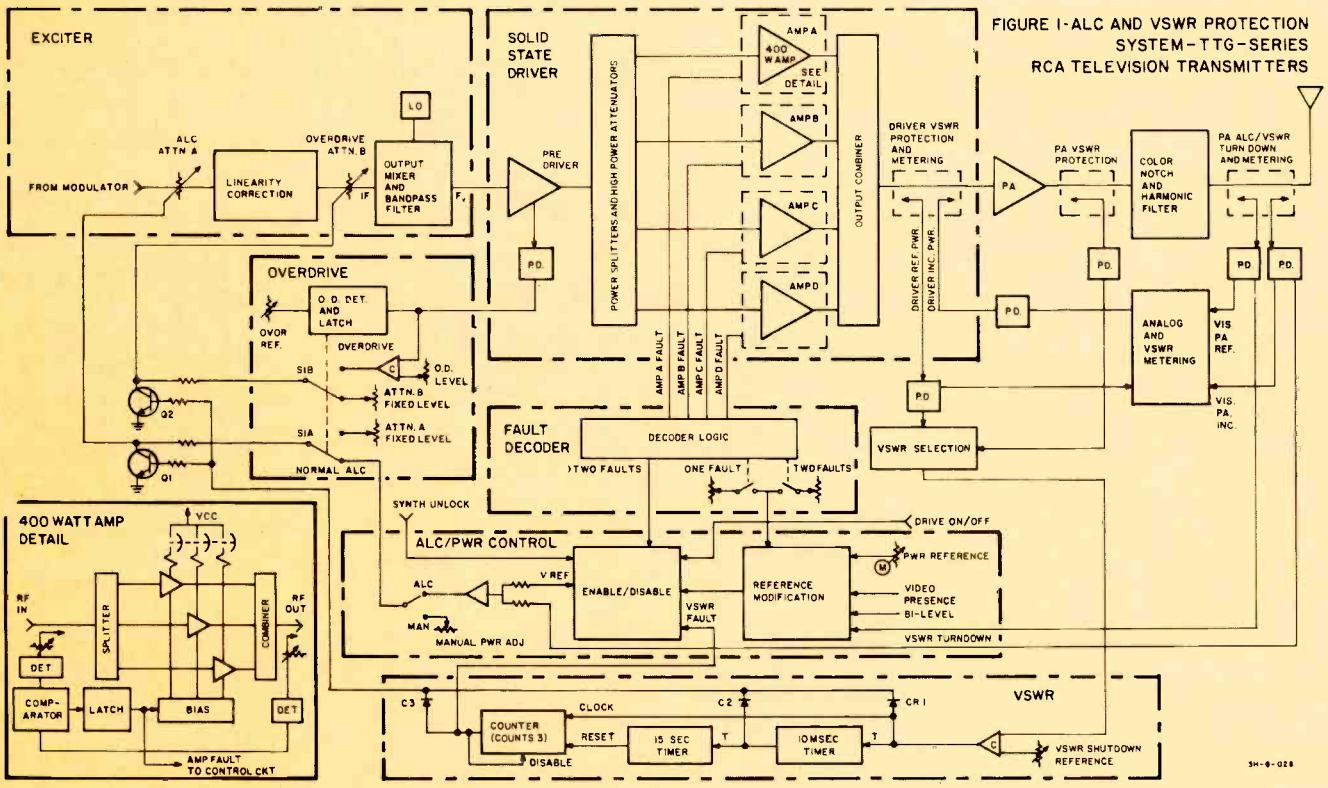
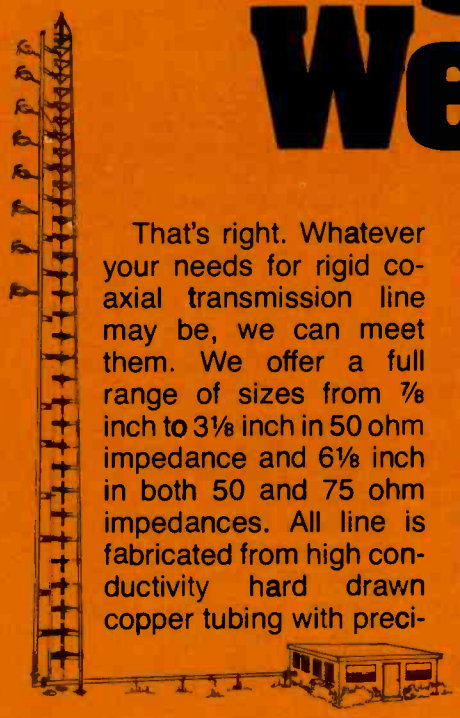


FIGURE 1-ALC AND VSWR PROTECTION SYSTEM-TTG-SERIES RCA TELEVISION TRANSMITTERS

Rigid line? We have it.



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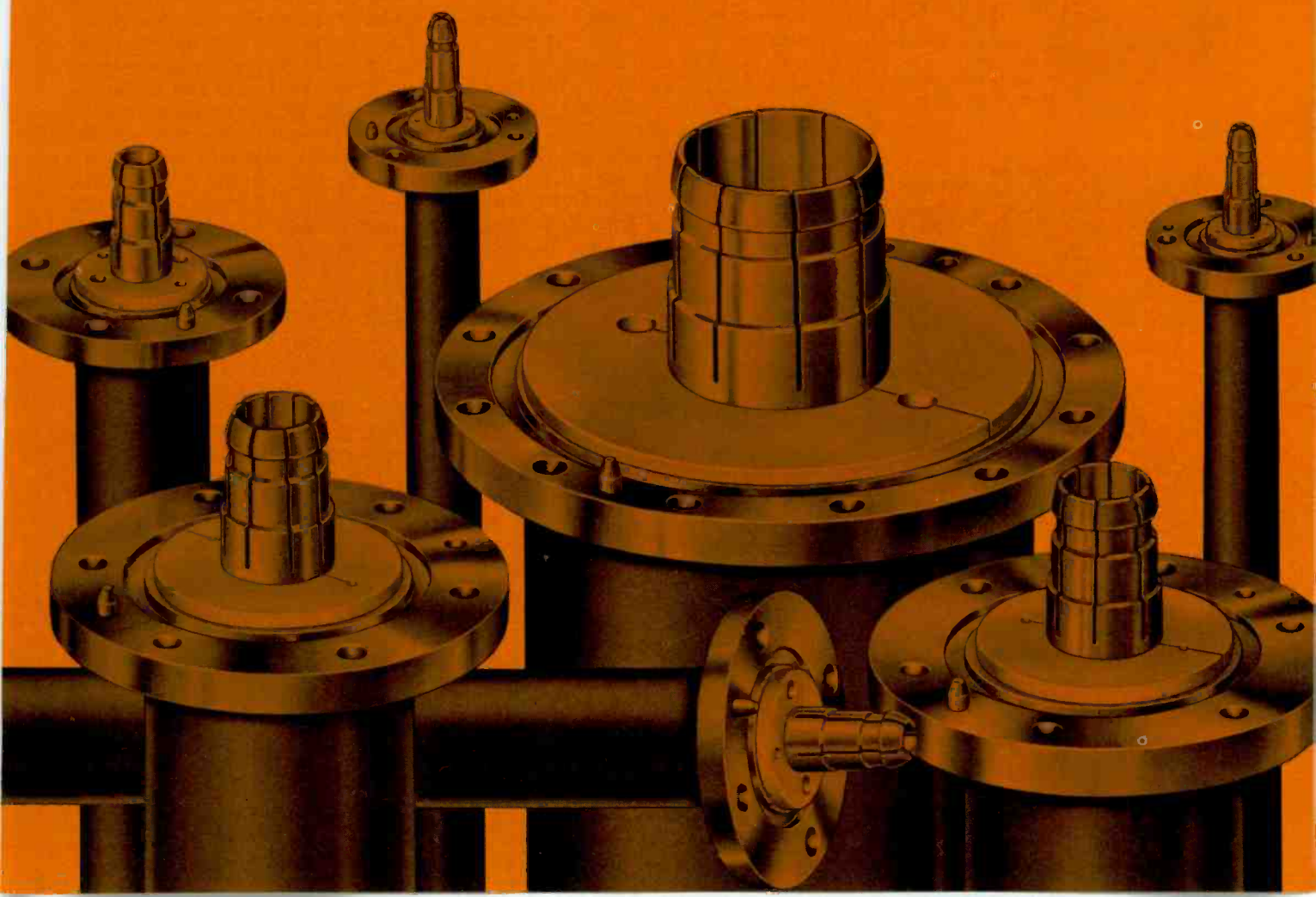

pin diode attenuators are integrated circuits with a flat frequency response, excellent signal linearity, a wide dynamic range and the ability to change attenuation from minimum to maximum within 5 to 10μs. This ability of the attenuators to act as an extremely fast RF switch is the key to the VSWR protection system.

The remainder of the circuits in Figure 1 depict the power control, driver protection and metering systems unique to the TTG Series transmitters.

Automatic level control

The primary function of the ALC system is to maintain the peak-of-sync power into the load element at a fixed level. This is accomplished with a straightforward, closed-loop control system that compares a detected sample of the incident wave to a reference voltage, amplifies any error voltage existing between the two inputs and applies this correction signal to the control input of the pin diode attenuator in the exciter. The loop gain and bandwidth are controlled at the correction voltage amplifier. The peak detectors used throughout the transmitter are identical.

An adjustable gain allows the outputs of each detector to be normalized to 10V for 100% power, which simplifies the control circuit setup. Because the peak detectors are also used in the VSWR system, where extremely fast response time is required, they were designed to have an attack time of less than 4 μs and a sag between horizontal pulses less than 15m V out of 10V.

The reference voltage is obtained from a stable voltage source and a motor-driven potentiometer is used to adjust the reference input to the ALC operational amplifier to the value necessary to achieve the desired output power. The reference voltage can be modified to reduce the RF power by a prescribed amount under certain operational or fault conditions by applying an input to the reference modification portion of the control circuitry. These conditions include: one amplifier module failure, two amplifier module failures, loss of video, high VSWR, bi-level operation parallel systems and excessive RF drive.

The RF power can be turned on or off by applying the appropriate input to the enable/disable portion of the control circuitry. These inputs are: drive on/off (from transmitter control), VSWR fault shut down, more than two amplifier module failures, shutdown and synthesizer unlocked.

During initial setup or upon a failure, the primary ALC loop can be opened and a manual level control used to set the output power level. This allows each function to be checked and to be properly adjusted separately before going into full ALC operation.

It should be noted that the power control and VSWR protection system in the aural portion of the transmitter is identical to that of the visual.

Transistor failure modes

Transistor failure mechanisms are a complicated subject because the failure mode is influenced by a number of factors such as transistor construction, operating temperature and collector voltage. A complete treatment of the failure mechanisms would be too lengthy for this article; however, in general, sustained operation outside the safe operating area of the particular transistor in use will lead to failures. A typical safe operating curve is shown in Figure 2.

Region I is bounded by the maximum allowable current rating of the transistor. The boundary of Region III is defined by the voltage breakdown ratings of the transistor and Region II is determined by the maximum power dissipation capability and the second breakdown rating of the transistor. Operation above Region III can destroy a transistor within a few microseconds because the failure is primarily caused by the voltage breakdown mechanism.

Operating outside of Region I and II will also quickly destroy a transistor, although the failure does not occur as rapidly as for an overvoltage condition because the failure mechanism in these regions is primarily caused by localized hot spots on the transistor pellets.

In a properly designed amplifier, the load line is situated well within the safe operating area of the transistor; however, under certain fault conditions, the load line can be shifted.

These fault conditions are:

1. Exceeding the maximum allowable collector voltage. This can occur because of a malfunctioning power supply.

2. Shifting load line because of a high load VSWR. Because the re-

flected wave can appear at the collectors at any phase angle relative to the incident wave, the collectors can see any load line from a short circuit to an open circuit. Because it is possible for the maximum safe collector voltage to be exceeded, the transistors must be protected by removing the RF drive as quickly as possible (within 100 to 200 μs for many types of RF devices). The VSWR protection system to be described will remove drive within 20 to 30 μs after the occurrence of a fault.

3. Applying excessive drive causes the average collector current to exceed the maximum allowable. In the RCA amplifiers, the load line is situated so that this does not occur, and circuit breakers are used to remove the collector voltage when the average current exceeds approximately 125% of the black picture current at maximum output power.

This article will be concluded as Part II in the October issue.

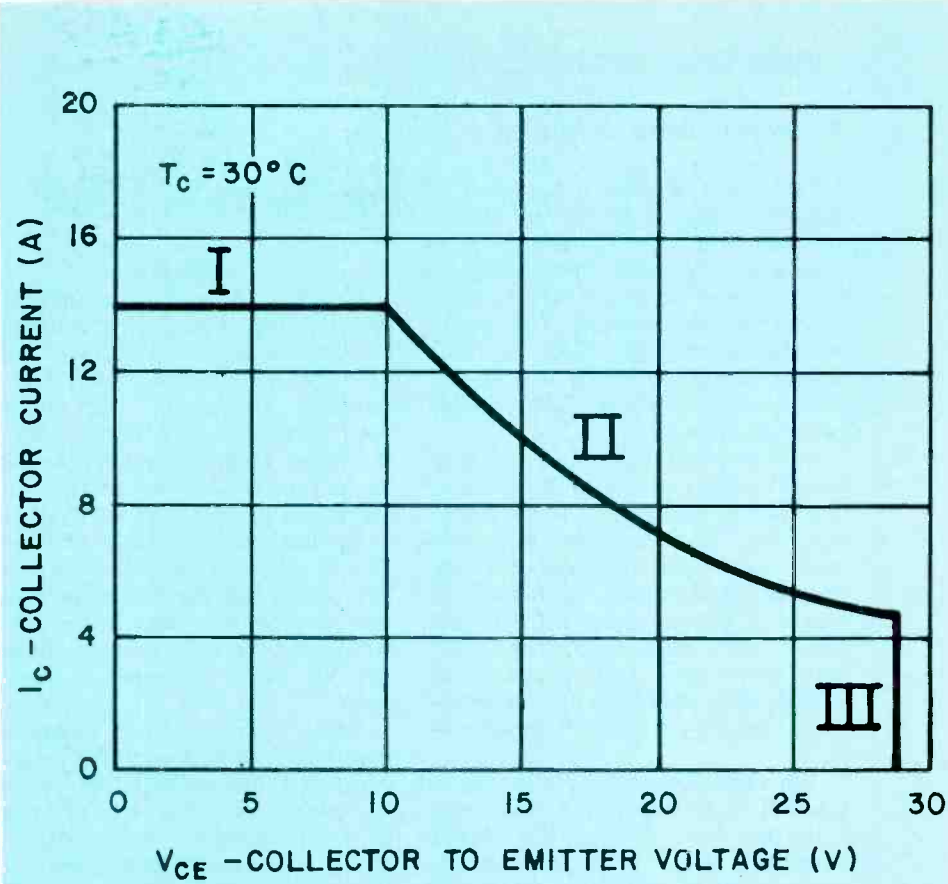

Figure 2. Safe operating area of a typical RF transistor.

Level-monitoring meters for broadcast services

By James L. Tonne, Goleta, CA

Two types of meters are used to monitor program levels in broadcasting: One, the VU meter, is a simple ac voltmeter responding to the effective value of an applied waveform; the second, the peak-reading meter (also called the PPM, or peak program meter) is a simple peak-reading (technically a quasi-peak) ac voltmeter.

In theory the VU meter is highly standardized in meter ballistics, impedance, sensitivity, scale marking, etc., but in practice it has many variations. Although the supposedly standardized VU meter is a simple effective-responding ac voltmeter, such things as pointer ballistics (rise and fall times, and overshoot or damping) and sensitivity are left to the meter manufacturer.

The PPM, less standardized than the VU meter, contains electronic circuitry that allows the meter movement itself to respond to the peak value of the program waveform. Because the PPM is an electronically augmented movement, the options exist to add frequency-consciousness (weighting), to have a long dB scale or to change the meter ballistics.

Ballistics

The VU meter has, supposedly, clearly defined ballistics. But these are not alterable by the end user. The PPM usually has a rise time or damping adjustment, but its fall time is considerably longer than its rise time. This is probably the most important factor in making that meter easier to read. An electronically augmented meter movement that is effective or RMS-responding (but which has the controlled ballistics as in peak-reading meter circuitry) would probably be preferable to the VU meter because of reading ease.

Slight reading errors caused by poor ballistics in a particular meter, when at the console output point in the broadcast chain, will not really affect transmitter modulation. It shows ignorance of broadcast practice to say that allowing a 20% program overshoot (caused by an over-damped meter movement) will cause overmodulation. Broadcasters have long used limiting amplifiers to help prevent overmodulation.

However, a meter that overshoots easily (and so results in a slightly lower program level) will not, in practice, cause undermodulation. This is also caused by the commonplace audio gain-riding amplifiers or limiting amplifiers used in broadcasting.

Peaks and pre-emphasis

Some studio-to-transmitting interconnecting links contain pre-emphasis in their transmitting portions. If ordinary program material is applied to such a link, the treble boost will allow overmodulation or overdriving of that link, even if the audio level entering link is carefully controlled.

This is an instance in which the ordinary VU meter has two handicaps. One is that these links offer a relatively limited dynamic range; overload to noise-floor ratios as low as 70-75dB are common. The audio level applied to the link must crowd the system; the average must be kept relatively high as measured the same way the link overloads—on a peak-sensitive basis. Because a VU meter cannot measure the peak value of the complex program waveforms, it cannot monitor satisfactorily the audio levels applied to one of these links. The other problem is

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caused by pre-emphasis contained in the link. The VU meter will not respond to this pre-emphasis.

The meter used to measure the modulation (program level) applied to such a link must respond to the peak value of the pre-emphasized modulating waveform. The VU meter is a noncontender in monitoring audio levels into such a link because it is not peak-sensitive and does not reflect the pre-emphasis used in the link transmitter.

Tape recorders, because of their tendency to overload at some level and their pre-emphasis, are subject to the same problems as the studio-to-transmitting link. The VU meter is a contender in the tape machine record deck only because the overload is neither sharply defined nor regulated.

Complex waves

When program material is applied to a frequency-division multiplex system, as is commonly used in telephone company program conveyance, and complex waveforms applied to such a link are measured with a VU meter, that VU meter's reading can easily be duplicated by another VU meter at the receiving end of the link.

In practice, however, the program link will have envelope delay distortion. This will alter the complex program waveform. Because of this, waveform peak values may be noticeably altered in passing through the link, and a receiving-end peak-reading meter may give different readings from a peak-reading meter at the sending end. At the same time, a receiving-end VU meter will agree with the sending-end VU meter.

The program link must have negligible nonlinear (for example, harmonic) distortion and the frequency response must be satisfactorily flat for this to happen. It is assumed that the meter ballistics for a given meter type are essentially identical at each end of the link, in which case meter ballistics are relatively inconsequential.

In such a situation, both VU and PPM meters are telling their version of the truth about the waveforms to which they are responding. If it is the object of a meter to monitor energy or loudness through a program system containing envelope delay distortion, then the VU meter (or other effective or preferably RMS meter) is probably the best choice. If it is the object of a meter to monitor that system for overload (caused by a complex waveform and/or perhaps limited headroom), then a peak-reading meter is the only possible choice.

Scales

The scale on the VU meter is supposedly standardized, but the PPM scale is not. It is common practice for the PPM scale to be linear for decibels and to be linear in that manner for at least a 20dB range. Wide dynamic range scales are possible with the PPM, but if the object is to increase gain in a broadcast environment, such a scale is inappropriate.

In broadcast practice only the upper 20dB of scale is used often. Expanded scales, to 30-50dB, force the operator to generally confine the meter pointer to the top few centimeters of scale length; the rest of the scale is wasted. It is satisfactory to use a VU meter type of scale (20 or 23dB of range, linear voltage) on a peak-reading meter. This would probably encourage use of the PPM.

Distortion

Because the VU meter has no

significant amount of buffering between the rectifier circuitry and the signal source and because the rectifier is nonlinear, the VU meter will add distortion to the circuit being monitored. The only way to circumvent this is to add an amplifier between the program circuit and the meter itself. The amount of distortion otherwise added to a typical circuit (without the buffer amplifier) by a VU meter is about 0.2—0.3%. In modern program circuits, this essentially controls the system distortion.

The PPM adds no easily measurable degradation to the circuit under test because of the electronic buffering required for its operation. Power is required to operate the PPM, but this is a matter of a few milliamperes, generally bipolar and easily provided.

Modulation

The broadcast program signal will eventually arrive at a point at which it must be controlled on a peak-sensitive basis. In an AM transmitter, this is at the audio input to the transmitter. In TV, it is at the audio input port on the aural exciter. Similarly, in FM, it is at the inputs to the stereo generator or exciter. The use of the *composite* STL does not significantly alter this discussion.

In any of these cases the final control of modulation is normally done at that point in the broadcast system electronically and automatically by a peak limiter. In practice, a nondistorting but fast-acting AGC system is most often used. In any event, the modulation will be controlled on a peak-sensitive basis. Even if a smooth audio flow is provided to the peak limiter, by using whatever type of meter chosen, that audio will be regulated on a peak-sensitive basis.

Manual gain-riding procedures in Europe appear to be different from those in North America. European facilities commonly use the peak-reading meter and generally use far less audio processing. If audio levels (as perceived on a radio receiver) vary more in Europe than in North America, it is probably not because of the use of the peak-reading meter; it is more likely caused by the small amount of audio processing (AGC and limiting) they use. Minor level fluctuations, whatever the cause, will be more apparent when an electronic audio gain rider is absent from the program chain or when minimal limiting is used.

The peak-reading meter was first introduced to broadcasting transmission equipment in 1966. The item was a subcarrier *all solid-state* generator. Such peak-reading monitoring is now standard on all the leading FM broadcast exciters and other transmission equipment manufactured in the US.

The choice

The question of which meter type to use (VU or peak-reading) at a given point in the broadcast chain should be decided by remembering two points:

- If the object of using a meter is to monitor loudness, then the VU meter or other effective or RMS meter is possibly the best choice;
- If the object of using a meter is to monitor modulation or to predict overload, the peak-reading meter is the only possible choice.

These statements are not modified by such factors as the scale color or by whether the scale is linear by voltage or linear by decibels or by whether the meter has any particular ballistics.

The effective value of a program waveform should be measured when loudness is the only item of concern. The best way to do this is possibly with an RMS or other effective-responding meter such as the VU meter.

Level monitoring

The peak value of a program waveform must be measured when the system overload point (or some legal limit) is of concern. The only way to do this is with a peak-reading meter.

A suggestion

Bear in mind the precautions outlined so far, and remember that, except for the modulation monitor, there is no single meter that will simultaneously do all that could be asked of it. The following is a set of recommendations for a level-monitoring meter for broadcast service:

1. The scale should resemble the present VU meter; it should be at least approximately linear in voltage. This should help its acceptance by not introducing a *new* kind of scale. The existing 20 or 23dB of VU meter range is adequate;

2. The electronics should be peak-sensitive for a full wave. This will enable program monitoring when overload is of concern. Being full-wave sensitive will make the meter blind to asymmetric waveforms; the highest peak will activate the meter. Program amplifiers are invariably set up for a symmetrical overload;

3. The peak-detector storage capacitor rise time should be to 90% in 10ms. This will prevent brief nonloudness-causing items (such as a crack in a record) from *pinning* the meter;

4. The pointer rise time should be to 90% in 200 ms. This is slightly faster than the present VU meter but is not disturbingly rapid;

5. The pointer overshoot should be about 0.5dB or about 5%, corresponding to a damping factor of 20. This rise time has been found to give a more accurate indication for typical program material than critical damping or the 1.5% overshoot supposedly allowed on the present VU meter; and

6. The pointer fall time (controlled largely by the storage capacitor and associated circuitry) should be about 1.5 seconds, yielding an easy-to-follow movement.

If the storage capacitor rise time of 10 ms (item 3), can be reduced to 10 *micro*seconds, that charging circuit would qualify for use in a modulation monitor; for true peak monitoring a fast capacitor-charging circuit must be used. If the storage capacitor is charged at a slow rate, the circuit will not be truly peak-sensitive. Ultimately it becomes an effective-responding circuit.

The rectifier circuit can be made to be peak-sensitive (by using a fast charging rate) or it can be made effective (by never letting the capacitor really get up to the peak value), or it can be made to be an intermediate or transitional circuit simply by changing the capacitor charge rate. In practice, a single resistor will determine the charge rate and the circuit characteristics. For level-monitoring service in broadcast applications, a 10 ms storage capacitor rise time seems appropriate.

Summary

The meter proposed should be useful for mixing at the initial stages of program production, as well as for predicting system overload and what the peak limiter will see. The moderate pointer rise and especially the slow fall time (untouchable by the VU meter) allows low-fatigue monitoring of program levels.

This meter will not be a cure-all. It should, however, do a better job than the present VU meter, especially when headroom (dynamic range) is limited.Because of the *standard* scale, it should receive better acceptance than any known proposed PPM. □

people in the news

Clifford E. Hall Jr. has been appointed to the new post of director of membership activities for the National Association of Educational Broadcasters (NAEB). As part of his work in membership activities, Hall was also named senior planner in the Public Telecommunications Institute with direct responsibility for planning and executing the NAEB Annual Conference.

Willard J. [Bill] Wilmot and **William F. Donahoe** have been assigned increased responsibilities in the sales and marketing organization of Belden's Electronic Division. Wilmot has been appointed director of sales and marketing; Donahoe became general sales manager.

Herbert J. Mayer has been appointed vice president and general manager of the Cord Products Division.

Dennis Doyle has been appointed chief engineer at WEDU Channel 3, the community-owned Public Broadcasting Service (PBS) affiliate in the Tampa/St. Petersburg market.

Robert E. Borum of Tampa has assumed the position of engineering supervisor at WEDU.

Arclite Systems announced the addition of **Bridget Beier** to its sales staff. The company represents leading international theatrical, television and architectural lighting and dimming control manufacturers.

Judith Hodges is the new assistant engineer at WNCN, 104.3 FM in New York. She is responsible for audio production and equipment maintenance.

Herbert J. Mendelsohn has been appointed vice president, marketing, CBS Video Enterprises.

Microtime announced the appointment of **Alan Kartes** as central regional sales manager. Kartes replaces **William Baird**, who was promoted to southeast regional manager last fall.

Henry Pessah has been appointed manager of engineering for Cablewave Systems. In this position Pessah will be responsible for product design and the technical direction of Cablewave.

Roy D. Bright, former commercial manager and later head of the British Post Office's PRESTEL International Division, has been named managing director of INTELMATIQUE, the international marketing arm of France's Telematique program.

Irwin Segelstein has been appointed president, NBC Television. Segelstein will coordinate all of the major groups currently involved in television activity, both network and owned stations.

Paolo Zaccarian has been appointed director, engineering and development—Europe, for the CBS Television Network.

Nadler & Larimer announced the appointment of **Jo Ann Harvard** as vice president in charge of broadcast activities.

People in the news

George G. Elsaessar has been appointed vice president, marketing at Arvin/Echo. Elsaessar will be responsible for the development and direction of all marketing activities relating to the company's line of magnetic recording products.

Electro-voice named the following regional sales managers: **Ferd Boyce, Chuck Gring**, and **Tony Satariano** as western, southern and central regional managers respectively. Jim Loppnow will be responsible for advertising, customer service, marketing services and related projects at Tapco.

Jane LeFevre is the new marketing manager for Makamichi. LeFevre will lead marketing and advertising efforts. Prior to accepting her responsibilities at Makamichi, LeFevre served as western advertising manager for *Stereo Review*.

Frank Smith, former director of operations for Vital Industries, has joined Datatron's video systems division as eastern regional sales manager. In his new post, Smith will be responsible for direct sales and distributor support of Datatron's video systems product lines in the East.

McMartin Industries has announced the appointment of **David Kelly** as district sales manager for a territory covering several of the New England and Atlantic states as well as New York City.

Altec Lansing has announced the appointment of **Ted Uzzle** as manager, market development. Uzzle will be working primarily in the area of theater and cinema audio, training and consulting on installations with Altec Lansing sound contractors.

Shure Brothers has announced that **William P. Finnegan** has joined the company as vice president of marketing. Finnegan comes to Shure from Quasar, where he was director of marketing.

After 23 years of employment, **Carroll Amos**, a transmitter technical engineer, has retired from KOOL Radio-Television Inc. Amos has been with KOOL's engineering department since 1957.

Gerald M. Land, assistant chief engineer at KQV/WDVE Radio, has been promoted to chief engineer. Land has been with the station since 1961.

Jack P. McCarthy has been named vice president and general manager of WIIC-TV, Pittsburgh, transferring from the same position at WHIO-TV in Dayton. **Neil Pugh** succeeds McCarthy as vice president of Miami Valley Broadcasting Corporation, assuming full responsibilities as station manager of WHIO-TV. **Merritt S. Rose, Jr.**, has been named to the newly created position of director of marketing projects for the broadcasting division of Cox Broadcasting. He will remain in Pittsburgh, where he has served as station manager of WIIC-TV.

William A. Blockie has been named vice president, marketing, at Videomagnetics. He previously was with National Semiconductor, where he held product management positions.

hardware report

Automation: combined industries aid broadcasters

The products of different industries, especially from electronics and computer technologies, are helping broadcasters on all fronts. Radio automation is an area with those benefits. Automation aids radio stations in preparing records, newscasts, public service announcements and advertisements. They must log everything aired to meet FCC requirements, and to bill advertising time properly.

For many radio stations, the Texas Instruments OMNI 800 model 820 Receive-Only (RO) Printer has eliminated the need for hand-logging the day's programming schedule. The TI system is a part of the Harris Broadcast Products Division's 9000 Series of Automated Program Control Systems.

Along with the TI printer, the Harris program control systems use minicomputers and a Video Display Terminal (VDT) to pre-record radio programs and automatically play commercials, songs, and announcements during live broadcasts. The VDTs display programming information and interface with the TI printers when a hard copy printout is needed for files or reference.

Some radio stations have found that they occasionally want to input directly onto the log sheet without using the VDT. For these customers, Harris supplies a TI 820 Keyboard Send Receive (KSR) Data Terminal. The KSR has the same features as the receive-only printer, but also has a typewriter-like keyboard.

The TI820 RO printer plays several roles in the Harris 9000 systems. It automatically records and prints an accurate log of each programming segment or advertisement for use in the station's regular reporting to the FCC, and to document advertising time. It also lists the date, time, and length of each advertisement aired to assure proper invoicing to the customer.

In addition to its primary logging functions, the 820 RO can print any information stored in Harris 9000 system's minicomputer. Traffic directors plan future programming by having the printer list the names of upcoming segments, their running time, and the items that are scheduled around them. Similarly, advertising managers use the printout to plan ad time. By reading the programming printout for a certain day, they can easily determine how much ad time is available for sale.

According to Kevin Mostyn, director of engineering, KYA radio, San Francisco, "The printers save our announcers time because the need to log each programming sement manually is eliminated. This means more time can be devoted to creative programming ideas. Also, our secretaries don't have to spend time typing handwritten log sheets that are often hard to read. The printers have definitely increased KYA's operating efficiency."

Printing speed was one of the many reasons Harris chose the TI 820 RO printer for the 9000 Series. The 820 prints at 150 characters per second (cps). "A logging printer has to be able to handle a wide variety of program formats," explained Mitch Montgomery, manager, Harris Radio Sales, Eastern US. "Our customers range from talk-show stations to fast-paced, 'lots-of-music, lots-of-talk' stations. The 820 RO easily handles the speed required for any format.

"Also, the printer's forms and print adjustment features make it work well with the Harris 9000 systems," Montgomery continued. "Within any station's basic format, there are endless minor variations—from 30-second announcements to three-minute songs. Harris customers need a printer that can accommodate a variety of invoices and forms with different columnar and print sizes, and the 820 RO gives them the flexibility they need. With the 820's ability to print multiple copies, we can send a copy straight off the printer to the customer as a bill. Or, our salesmen can take a copy to a prospective customer to show what airtime is left for the month."

The TI printer's reliability and compatibility with other hardware also made it a logical choice for the Harris 9000 systems. "We work the printer constantly," said Montgomery, "and it continues to perform beautifully, even when unattended on 24-hour radio stations. It was also simple to tie it into the 9000 systems because it interfaced so easily with our existing computer and VDT equipment."

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meetings, events, & seminars

September 26—The Society of Broadcast Engineers *8th Annual Upstate New York Regional Convention* will take place at the Syracuse Hilton Inn. More than 30 exhibitors are expected to display the latest state-of-the-art equipment for radio and television broadcasters. Additional information is available from Hugh Cleland, convention chairman, WCNY TV/FM, Liverpool, NY; (315) 457-0440.

October 27-29—Scientific-Atlanta's *6th Satellite Earth Station Symposium* is to be held in Atlanta, GA. There will be a $95 registration fee for the symposium to help cover the cost of meals and conference material. For more information contact H. Allen Ecker, or Jay Levergood, Scientific-Atlanta, Dept. BE, 3845 Pleasantdale Road, Atlanta, GA 30340.

November 29—The Chicago Section of SMPTE's *Fifth Annual Chairman's Reception/Symposium/Awards Banquet*, is being held at Ramada—The O'Hare Inn, Chicago, IL. For information contact: Ken Knaus, Dept. BE, Eastman Kodak Company, 1901 West 22nd Street, Oak Brook, IL 60521; (312) 654-5338.

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- *Product section begins on page 116.*
- *Manufacturers' addresses section begins on page 178.*
- *Dealer/distributor section begins on page 200.*

Since our first edition of the Buyers' Guide 12 years ago, the broadcasting industry has grown tremendously in complexity of equipment and completeness of broadcast services. Just as the industry has responded to the use of new technologies—most notably the microprocessor in all phases of automation—the Buyers' Guide has responded by providing the most complete directory possible for engineers, managers, and purchasing agents requiring broadcasting equipment or services. Reflecting the current healthy state of our industry, this year's Buyers' Guide has nearly 724 product categories, lists more than 875 manufacturers, and contains more than 214 advertisers. It's the result of a dedicated staff effort to make it our finest tool for purchasing the industry's hardware, software and services.

Each year, **Broadcast Engineering** mails extensive questionnaire forms to suppliers around the world. They are asked to identify, by special code number, every product they currently market. In the process, scores of new products and companies are added, while lines that have been phased out—and firms that have left the field—are deleted. Once amassed and assembled, these new data are processed through a unique computer operation, programmed to "read" the code numbers and assign company names and Red Listings to appropriate product headings.

Advertisers in this issue are listed in red under each appropriate product heading. These Red Listings include the ad page location to serve as a direct reference to the product information you are seeking.

Broadcast Product Dealer/Distributors are listed separately in the section beginning on page 200, followed by the states they serve and the products/services they provide. If they are advertisers, their ad appears either on the page of their listing or on the facing page. A full explanation of this section appears on page 200.

Broadcast Product Manufacturers' Addresses begins on page 178. There, you will find a complete, alphabetized index of mailing addresses for all of the companies listed in the Product Directory. Additional information appears under the index listing for advertisers in this issue: the name and telephone number of the home office sales manager, followed by, in many cases, a roster of regional sales contacts for that firm.

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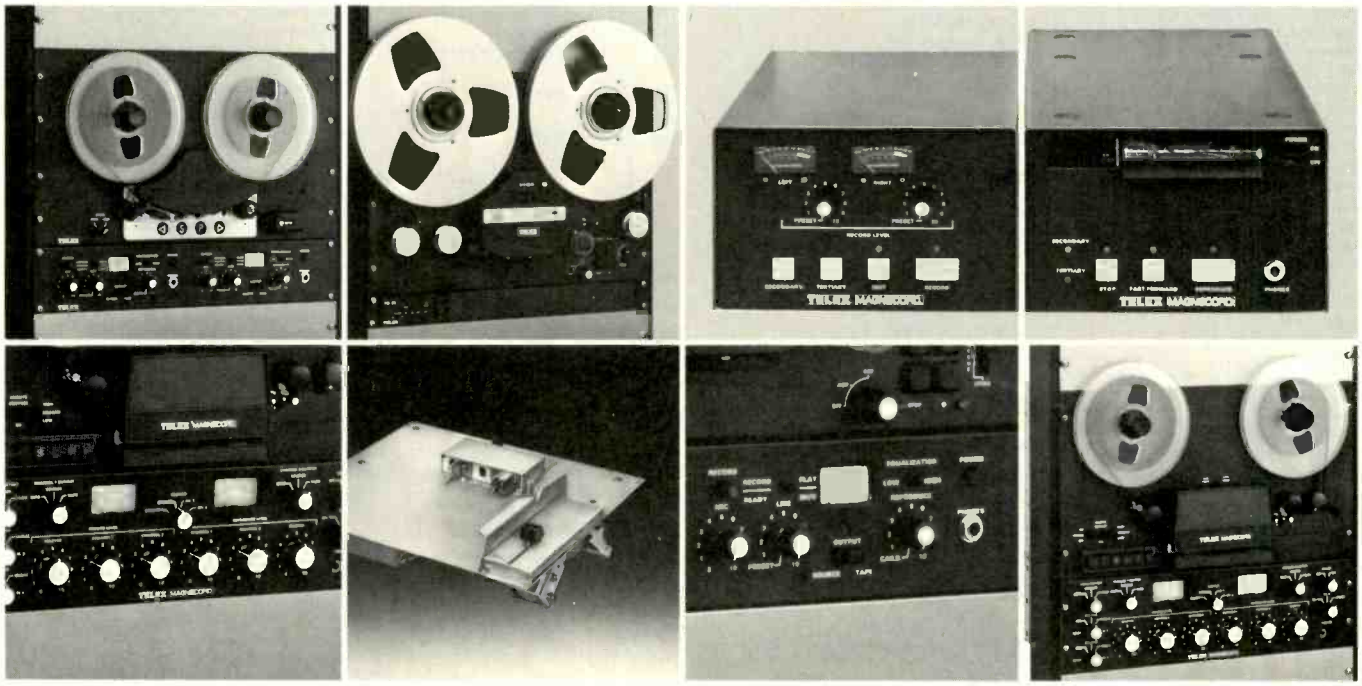

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Jensen Transformers
Modular Audio Products Unit of Modular Devices, Inc.
Motorola Semiconductor Products Inc.
Opamp Labs, Inc.
Pacific Recorders & Eng. Corp.
ProTech Audio Corp.
Quad-Eight Electronics
Richmond Sound Design, Ltd.
Spectra Sonics
Sphere Electronics
Tektronix Inc.
United Research Lab Corp.

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ATI-Audio Technologies Inc.
AVAB America Inc.
Acrodyne Industries Inc.
Altec Lansing Sound Products
American Data Corp. A North American Philips Co.
Arrakis Sytems Inc.
Audionics, Inc.
Audisar
BGW Systems Inc.
Belar Electronics Lab., Inc.
Bell Audio Systems, Inc.
Bogen Div. Lear Siegler, Inc.
Broadcast Electronics, Inc.
California Instruments
Comark Communications, Inc.
Continental Electronics Mfg. Co.
Crown International, Inc.
DYMA Engineering, Inc.
Edcor
Eumig USA, Inc. 225 Community Dr.
Farinon Video
Harris Corp. Broadcast Products Div.
Harris Corp. PRD Electronics Div.
International Nuclear Corp.
James B. Lansing Sound, Inc.
Logitek Electronic Systems, Inc.
McMartin Industries, Inc.
Micro-Trak Corp.
Microwave Associates Communications Co.
Modular Audio Products Unit of Modular Devices, Inc.
Moseley Associates, Inc.
Motorola Semiconductor Products Inc.
Nagra Magnetic Recorders, Inc.
Opamp Labs, Inc.
Orange County Elec. Int'l., Inc.
Panasonic Company
Panasonic Co. Professional Audio Div.
Paso Sound Products Inc.
ProTech Audio Corp.
QSC Audio Products Inc.
Quad-Eight Electronics
RTS Systems, Inc.
Ramko Research Inc.
Sansui Electronics Corp.
Scientific Systems, Inc.
Sescom, Inc.
Spectra Sonics
Studer Revox America
Superscope Inc.
TEAC Corp of America
Tayburn Electronics, Inc.
Telectro Systems Corp.
Telex Communications, Inc.
Tri Tec Systems Inc.
Tweed Audio USA Inc.
UMC Electronics Co. Broadcast Products Div.
Ultra Audio Pixtec
United Recording Electronics Industries
Varian Associates, Inc. Electron Device Group
Ward-Beck Systems, Ltd.
Wilkinson Electronics, Inc.
Yamaha International Corp.

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ATI-Audio Technologies Inc.
Altec Lansing Sound Products
Applied Technology Corp.
Arrakis Sytems Inc.
Audio & Design Recording

Beyer. We make the best broadcast mics, too.

MCE 5

In recording studios, concert halls and theatres worldwide, Beyer is the premier name in microphones. Loved by performers and respected by engineers.

Now that same Beyer quality is available in a full line of innovative broadcast microphones, to meet every need and solve every problem.

The Beyer MCE 5 is the world's smallest electret condenser and provides true broadcast-quality audio from a 7 x 23 mm. cylinder weighing just 6.5 grams. It has wide frequency response, but is immune to most body noises. And you can hide it almost anywhere and connect it to a cable or a wireless transmitter.

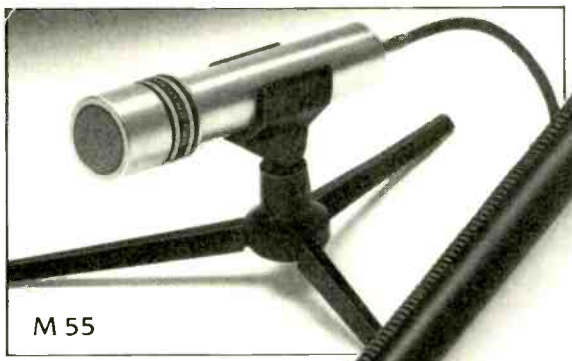
If you can't get the mic near the sound source, try our Beyer MC 717 shotgun. It has a directional gain of at least 20 dB and a 40-20K frequency response.

The MC 717 is part of a modular condenser mic system consisting of six different transducer capsules plus amplifiers and phantom power supplies that can be perfectly tailored for a wide range of broadcast situations. They're all ruggedly built to handle ENG as well as studio work and can accept temperatures up to 160° and 99% humidity.

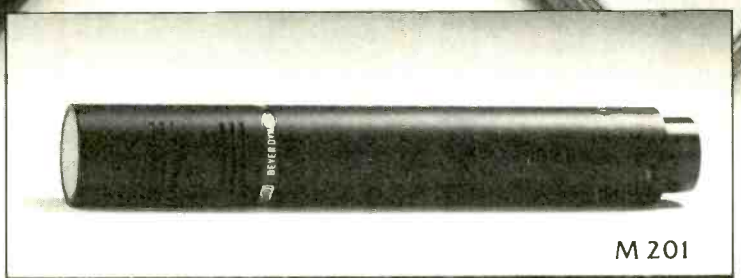
Other mics include: the M 55 – an omni-directional dynamic mic that is especially suited for reporters and field interviews; the M 69 – a uni-directional hypercardioid dynamic mic that is perfect for announcers on TV and a studio mic in radio stations; the M 88 – a uni-directional cardioid dynamic mic with warm and full bass response that is ideal for booth or radio announce. This is easily one of the best mics in the business – with a special suspension that eliminates transmitted noise if hand held. Our M 201 is another microphone with excellent vocal characteristics that is favored by singers and reporters alike.

There are many more mics in the Beyer line, plus stands, booms, headsets and accessories. Visit your local Beyer distributor for more information and specs.

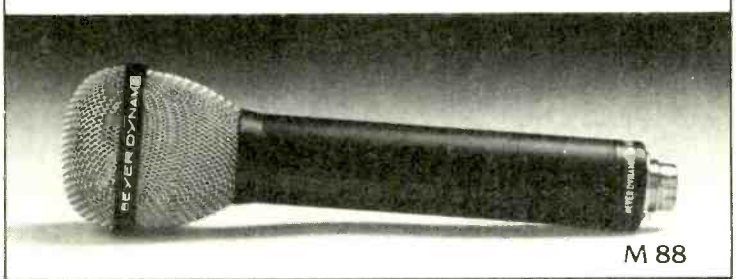
MC 717



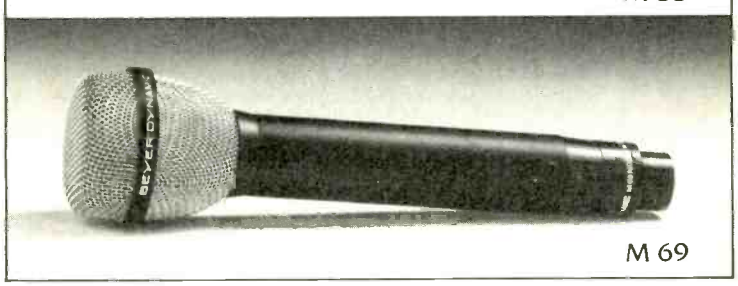
M 55



M 201



M 88



M 69

Beyer Dynamic

BEYER DYNAMIC, INC.
5-05 Burns Avenue, Hicksville, NY 11801 • (516) 935-8000
In Canada, H. Roy Gray, Ltd.

Circle (106) on Reply Card

Circuit Research Labs, Inc.
dbx, Inc.
Delta Electronics Inc. (Va.)
DYMA Engineering, Inc.
Elcom Engineering Co.
Elcom Specialty Products, Inc.
Fernseh Inc.
Gregg Laboratories
Inovonics Inc.
Kahn Communications, Inc.
MICMIX Audio Products, Inc.
Modular Audio Products Unit of Modular Devices, Inc.
Moseley Associates, Inc.
Orange County Elec. Int'l., Inc.
Orban Assoc. Inc.
Pacific Recorders & Eng. Corp.
ProTech Audio Corp.
Pyramid Loudspeaker Corp.
Scantex Labs Inc.
Sontec Electronics
Spectra Sonics
Telectro Systems Corp.
United Recording Electronics Industries
Wang Voice Comm. Inc.

Amplifiers, Processing Video

Automation Techniques, Inc.
Robert Bosch GmbH
Broadcast Video Systems, Ltd.
Central Dynamics Corp.
Dynasciences Div. Whittaker Corp.
Fernseh Inc.
GTE Products Corp. Sylvania CATV Div.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Industrial Sciences, Inc. (ISI)
International Nuclear Corp.
LeCroy Fiberoptic Systems
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Marconi Electronics Inc. Broadcast & Communication Div.
Microtime, Inc.
Siegel Electronics
Sigma Electronics, Inc.
Tektronix Inc.
3M Co. Mincom Div.
Versa Count Engineering
Vital Industries Inc.

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Fernseh Inc. 94-95

American Data Corp. A North American Philips Co.
Robert Bosch GmbH
Broadcast Video Systems, Ltd.
Central Dynamics Corp.
Cohu, Inc. Electronics Div.
Datatek Corp.
Di-Tech Inc.
Dynair Electronics, Inc.
Dynasciences Div. Whittaker Corp.
EIMAC Div. of Varian
Fernseh Inc.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Hughes Elec. Devices Corp. (HEDCO)
Industrial Sciences, Inc. (ISI)
International Nuclear Corp.
LeCroy Fiberoptic Systems
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Microwave Power Devices, Inc.
Panasonic Company
RHG Electronics Laboratory, Inc.
Shintron Co. Inc.
Sigma Electronics, Inc.
Tektronix Inc.
Telemet Div. A Geotel, Co.
3M Co. Mincom Div.
Varian Associates, Inc. Electron Device Group
Video Aids of Colorado
Vital Industries Inc.

Amplifiers, Pulse Delay

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Dynair Electronics, Inc. 221

American Data Corp. A North American Philips Co.
Robert Bosch GmbH
Broadcast Video Systems, Ltd.
Central Dynamics Corp.
Di-Tech Inc.
Dynair Electronics, Inc.
Fernseh Inc.
Grass Valley Group, Inc.
Industrial Sciences, Inc. (ISI)
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Sigma Electronics, Inc.

Amplifiers, Remote

ATI-Audio Technologies Inc.
Arrakis Sytems Inc.
Belar Electronics Lab., Inc.
Broadcast Electronics, Inc.
Cetec Broadcast Group
DYMA Engineering, Inc.
Harris Corp. Broadcast Products Div.
McMartin Industries, Inc.
Micro-Trak Corp.
Richmond Sound Design, Ltd.
Spectra Sonics
Tayburn Electronics, Inc.
Transist-O-Sound Inc.
Ultra Audio Pixtec
Wide Band Engineering Co., Inc.
Wilkinson Electronics, Inc.

Amplifiers, RF General Purpose

Amperex Electronic Corp. Slatersville Div.
Anderson Scientific
CCA Electronics Corp.
CSI Electronics, Inc.
Comark Communications, Inc.
Continental Electronics Mfg. Co.
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
Harris Corp. Broadcast Products Div.
Harris Corp. PRD Electronics Div.
International Microwave Corp.
McMartin Industries, Inc.
Merill Cable Equipment Corp.
Microwave Power Devices, Inc.
Motorola Semiconductor Products Inc.
Mu-Del Electronics, Inc.
The Narda Microwave Corp.
RHG Electronics Laboratory, Inc.
Sencore, Inc.
Television Technology Corp.
Wide Band Engineering Co., Inc.
Wilkinson Electronics, Inc.

Amplifiers, RF Peak Limiting

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Inovonics Inc. 220

Harris Corp. Broadcast Products Div.
Inovonics Inc.
Moseley Associates, Inc.
The Narda Microwave Corp.
RHG Electronics Laboratory, Inc.

Amplifiers, RF Power

Acrodyne Industries Inc.
Anderson Scientific
Belar Electronics Lab., Inc.
CSI Electronics, Inc.
Comark Communications, Inc.
Continental Electronics Mfg. Co.
EEV, Inc.
EIMAC Div. of Varian
EMCEE Broadcast Products
English Electric Valve Co. Ltd.
Harris Corp. Broadcast Products Div.
Harris Corp. PRD Electronics Div.
Howe-Yin Research Co. Inc.
International Microwave Corp.
LPB Inc.
Marconi Communication Systems Ltd.
McMartin Industries, Inc.
Microwave Power Devices, Inc.
Moseley Associates, Inc.
Motorola Semiconductor Products Inc.
Mu-Del Electronics, Inc.
QEI Corp.
Rohde & Schwarz Sales Co.
Scientific Radio Systems, Inc.
Sintronic Corp.
Television Technology Corp.
Townsend Associates, Inc.
Triple Crown Electronics, Inc.
Varian Associates, Inc. Electron Device Group
Wilkinson Electronics, Inc.

Amplifiers, Stereo Booster

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ATI-Audio Technologies Inc.
Bogen Div. Lear Siegler, Inc.
Modular Audio Products Unit of Modular Devices, Inc.
Orange County Elec. Int'l., Inc.
Paso Sound Products Inc.
ProTech Audio Corp.
Spectra Sonics

Amplifiers, Stereo Limiter

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Applied Technology Corp.
Audicon, Inc.
Audio & Design Recording
BGW Systems Inc.
Broadcast Electronics, Inc.
Cetec Broadcast Group
Circuit Research Labs, Inc.
dbx, Inc.
DYMA Engineering, Inc.
EMT-FRANZ GMBH
Elcom Engineering Co.
Elcom Specialty Products, Inc.
Gotham Audio Corp.
Gregg Laboratories
Harris Corp. Broadcast Products Div.
Inovonics Inc.
Moseley Associates, Inc.
Rupert Neve, Inc.
Orange County Elec. Int'l., Inc.
Orban Assoc. Inc.
Pyramid Loudspeaker Corp.
QEI Corp.
Sontec Electronics
Spectra Sonics
Thomson-CSF Broadcast, Inc.
United Recording Electronics Industries
Wilkinson Electronics, Inc.

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AVA Electronics
Advanced Analog Systems
Broadcast Video Systems, Ltd.
Dage-MTI, Inc.
Datatek Corp.
Delta Electronics Inc. (N.C.)
Dynasciences Div. Whittaker Corp.
GBC Closed Circuit TV Corp.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Howe-Yin Research Co. Inc.
Hughes Elec. Devices Corp. (HEDCO)
International Nuclear Corp.
Javelin Electronics A Subs. of Kidde, Inc.
LeCroy Fiberoptic Systems
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Motorola Semiconductor Products Inc.
Opamp Labs, Inc.
Siegel Electronics
Tayburn Electronics, Inc.
Tektronix Inc.
Telemet Div. A Geotel, Co.
Texscan Corp.
3M Co. Mincom Div.
Varian Associates, Inc. Electron Device Group
Video Aids of Colorado

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Bald Mountain Lab
Crown International, Inc.
DYMA Engineering, Inc.
Inovonics Inc.
Leader Instruments Corp.
Neutrik Products
Potomac Instruments, Inc.
Radiometer Elec. U.S. Inc.
Rockland Systems Corp. See Wavetek Rockland, Inc.
The Ken Schaffer Group, Inc.
United Recording Electronics Industries
Wavetek Rockland, Inc.

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Amber Electro Design, Ltd.
Audicon, Inc.
Broadcast Electronics, Inc.
Bruel & Kjaer Instruments, Inc.
Crown International, Inc.
DYMA Engineering, Inc.
Frequency Devices Inc.
Harris Corp. Broadcast Products Div.
Leader Instruments Corp.
Leasametric
Marconi Instruments Div. of Marconi Electronics Inc.
Neutrik Products
Potomac Instruments, Inc.
Radiometer Elec. U.S. Inc.
Rohde & Schwarz Sales Co.
Sound Technology
TM Systems, Inc.
Tektronix Inc.
Wavetek Rockland, Inc.

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Amber Electro Design, Ltd.
Audicon, Inc.
Bruel & Kjaer Instruments, Inc.
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
Harris Corp. Broadcast Products Div.
Ivie Electronics, Inc.
Kay Elemetrics Corp.
Leader Instruments Corp.
Marconi Instruments Div. of Marconi Electronics Inc.
Neutrik Products
Potomac Instruments, Inc.
Rohde & Schwarz Sales Co.
Sound Technology
Tektronix Inc.
Wavetek Rockland, Inc.

Analyzers, Insertion Signal

Cezar International, Ltd.
Marconi Instruments Div. of Marconi Electronics Inc.
Wavetek Rockland, Inc.

Analyzers, Intermodulation

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Amber Electro Design, Ltd.
Bruel & Kjaer Instruments, Inc.
Crown International, Inc.
Marconi Instruments Div. of Marconi Electronics Inc.
Neutrik Products
Potomac Instruments, Inc.
Rohde & Schwarz Sales Co.
Sound Technology
Tektronix Inc.
Triple Crown Electronics, Inc.
Wavetek Rockland, Inc.

Analyzers, Power Line Disturbance

Dranetz Engineering Labs., Inc.

Analyzers, RF Network

Alford Mfg. Co.
Delta Electronics Inc. (Va.)
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
Harris Corp. PRD Electronics Div.
Leasametric
Rohde & Schwarz Sales Co.
Scientific-Atlanta, Inc.
Soll, Inc.
Tektronix Inc.
Tennaplex Systems Ltd.
Wide Band Engineering Co., Inc.

Analyzers, Sideband

Glentronix (1977) Ltd.
Kahn Communications, Inc.
Marconi Instruments Div. of Marconi Electronics Inc.
Rohde & Schwarz Sales Co.
Tektronix Inc.
Telemet Div. A Geotel, Co.
Wavetek Rockland, Inc.

Analyzers, Spectrum

AVAB America Inc.
Amber Electro Design, Ltd.
Anderson Scientific
Applied Technology Corp.
Audicon, Inc.
Bruel & Kjaer Instruments, Inc.
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
Eventide Clock Works Inc.
Harris Corp. Broadcast Products Div.
Ivie Electronics, Inc.
Kahn Communications, Inc.
Kay Elemetrics Corp.
Leasametric
Marconi Instruments Div. of Marconi Electronics Inc.
Mid State Communications, Inc.
QEI Corp.
Rohde & Schwarz Sales Co.
The Ken Schaffer Group, Inc.
Spectrum Instruments, Inc.
Tektronix Inc.
Telemet Div. A Geotel, Co.
Texscan Corp.
Wavetek Rockland, Inc.

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Philips Broadcast Equip Corp. 85

Amtron Corp.
Colorado Video Inc.
Eastman Kodak Co.
Imero Fiorentino Associates, Inc.
Harris Corp. Broadcast Products Div.
Marconi Instruments Div. of Marconi Electronics Inc.
Philips Broadcast Equip Corp.
Rohde & Schwarz Sales Co.
Sencore, Inc.
Tektronix Inc.
Telemet Div. A Geotel, Co.

Animation Equipment

Arvin/Echo Science Corp.
Convergence Corp.
Dolphin Productions, Inc.
Interand Corp. Telestrator Div.
MPB Technologies Inc.

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World Tower Co. Inc. 235

Advance Industries
Gabriel Electronics, Inc.
Innovative Television Equipment, Inc.
Leasametric
LeBlanc & Royle Comm. Towers Ltd.
Micro Communications, Inc.
Microwave Associates Communications Co.
Power-Optics, Inc.
Scientific-Atlanta, Inc.
Texscan Corp.
World Tower Co. Inc.

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Cortland Line Co. Advanced Products Div.
DHV, Inc.
G C Electronics Div. Wallace Murray
Harris Corp. Broadcast Products Div.
High-Lite Corp.
LeBlanc & Royle Comm. Towers Ltd.
Microflect Co., Inc.
Fred A. Nudd Corp.
Allen Osborne Associates
Philadelphia Resins Corp.
Stainless, Inc.
Swager Tower Corp.
Tri-Ex Tower Corp.
Unarco-Rohn Div. of Unarco Ind., Inc.
Utility Tower Co.
World Tower Co. Inc.

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EMCEE Broadcast Products
Fort Worth Tower Co.
Gabriel Electronics, Inc.
Global Communications & Eng., Inc.
Harris Corp. Broadcast Products Div.
High-Lite Corp.
LeBlanc & Royle Comm. Towers Ltd.
Marconi Communication Systems Ltd.
Micro Communications, Inc.
Microwave Associates Communications Co.
Fred A. Nudd Corp.
Nurad, Inc.
Prodelin Inc.
Soll, Inc.
Stainless, Inc.
Swager Tower Corp.
Tri-Ex Tower Corp.
Unarco-Rohn Div. of Unarco Ind., Inc.
Utility Tower Co.
World Tower Co. Inc.

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Electro Impulse, Inc. 227

AVA Electronics
Anderson Scientific
DHV, Inc.
Dielectric Communications A Unit of General Signal
Electro Impulse, Inc.
North Hills Electronics, Inc.
Phelps Dodge Communications Co.
Potomac Instruments, Inc.
Scala Electronic Corp.
Wilkinson Electronics, Inc.

Antenna Dummy Loads

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AVA Electronics
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Bird Electronic Corp.
CSP Inc.
Continental Electronics Mfg. Co.
Dielectric Communications A Unit of General Signal
Electro Impulse, Inc.
Harris Corp. Broadcast Products Div.
Kappa Networks, Inc.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Maury Microwave Corp.
Micro Communications, Inc.
Rex Rheostat & Co., Inc.
Scientific Radio Systems, Inc.
Shively Laboratories, Inc.
Wilkinson Electronics, Inc.

Antenna Heater Controls

Cetec Broadcast Group
Shively Laboratories, Inc.
Valad Electric Heating Corp.

Antenna Ice Warning Systems

Harris Corp. Broadcast Products Div.

Antenna Remote Indicators

Dielectric Communications A Unit of General Signal
Harris Corp. Broadcast Products Div.
Microwave Associates Communications Co.
Moseley Associates, Inc.
Nurad, Inc.
Scientific-Atlanta, Inc.

Antenna RF Current Controllers

Delta Electronics Inc. (Va.)
Harris Corp. Broadcast Products Div.

Antenna Sampling Systems

CSP Inc.
Cablewave Systems Inc.
Cetec Broadcast Group
Delta Electronics Inc. (Va.)
Elcom Engineering Co.
Geleco Electronics Ltd.
Harris Corp. Broadcast Products Div.
Moseley Associates, Inc.
Tennaplex Systems Ltd.

Antenna Systems

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Alford Mfg. Co.
Andrew Corp.
Anixter-Mark
Bogner Broadcast Equipment Corp.
CSP Inc.
Cablewave Systems Inc.
Cetec Broadcast Group
Continental Electronics Mfg. Co.
Delta Electronics Inc. (Va.)
Dielectric Communications A Unit of General Signal
The Finney Co.
G C Electronics Div. Wallace Murray
Gabriel Electronics, Inc.
Geleco Electronics Ltd.
Harris Corp. Broadcast Products Div.
High-Lite Corp.
Marconi Communication Systems Ltd.
Micro Communications, Inc.
Microwave Associates Communications Co.
Nurad, Inc.
Phelps Dodge Communications Co.
Prodelin Inc.
RCA Broadcast Systems
Rohde & Schwarz Sales Co.
Shively Laboratories, Inc.
Tayburn Electronics, Inc.
Tennaplex Systems Ltd.

Antenna Tuning Units

CSI Electronics, Inc.
CSP Inc.
Cetec Broadcast Group
DHV, Inc.
Dielectric Communications A Unit of General Signal
G C Electronics Div. Wallace Murray
Geleco Electronics Ltd.
Harris Corp. Broadcast Products Div.
Maury Microwave Corp.
Micro Communications, Inc.
Scientific Radio Systems, Inc.
Texscan Corp.
Wilkinson Electronics, Inc.

Antenna VSWR Indicators

Bird Electronic Corp.
CSI Electronics, Inc.
Cetec Broadcast Group
Comark Industries Inc.
Dielectric Communications A Unit of General Signal
DYMA Engineering, Inc.
Harris Corp. Broadcast Products Div.
Micro Communications, Inc.
Moseley Associates, Inc.
Sencore, Inc.
Texscan Corp.

Antennas, Directional System

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World Tower Co. Inc. 235

Alford Mfg. Co.
Bogner Broadcast Equipment Corp.
CSI Electronics, Inc.
CSP Inc.
Cetec Broadcast Group
Continental Electronics Mfg. Co.
DHV, Inc.
Dielectric Communications A Unit of General Signal
The Finney Co.
Gabriel Electronics, Inc.
Geleco Electronics Ltd.
Harris Corp. Broadcast Products Div.
Harrison Systems Ltd.
Innovative Television Equipment, Inc.
Micro Communications, Inc.
Microwave Associates Communications Co.
Nurad, Inc.
RCA Broadcast Systems
Rohde & Schwarz Sales Co.
Shively Laboratories, Inc.
Tayburn Electronics, Inc.
World Tower Co. Inc.

Antennas, Receiving FM

Anderson Scientific
Anixter-Mark
Belar Electronics Lab., Inc.
Catel Div. United Scientific Corp.
The Finney Co.
G C Electronics Div. Wallace Murray

Harris Corp. Broadcast Products Div.
Johnson Electronics Inc.
McMartin Industries, Inc.
Micro Communications, Inc.
Robins Industries Corp.
Rohde & Schwarz Sales Co.
Scala Electronic Corp.
Scientific-Atlanta, Inc.
Swintek Enterprises, Inc.
Tennaplex Systems Ltd.

Antennas, Receiving LF

Anixter-Mark
Elcom Engineering Co.
McKay Dymek Co.
Rohde & Schwarz Sales Co.
Tennaplex Systems Ltd.

Antennas, Receiving MF

Anixter-Mark
Belar Electronics Lab., Inc.
Elcom Engineering Co.
McKay Dymek Co.
Rohde & Schwarz Sales Co.

Antennas, Receiving UHF/VHF

Anderson Scientific
Anixter-Mark
The Finney Co.
G C Electronics Div. Wallace Murray
Micro Communications, Inc.
Moseley Associates, Inc.
Phelps Dodge Communications Co.
Prodelin Inc.
RCA Distributor & Special Products Div.
Rohde & Schwarz Sales Co.
Scala Electronic Corp.
Scientific-Atlanta, Inc.
Tennaplex Systems Ltd.

Antennas, Receiving Microwave

Andrew Corp.
Anixter-Mark
Bogner Broadcast Equipment Corp.
Cablewave Systems Inc.
Engineering Associates
Farinon Video
Gabriel Electronics, Inc.
Harris Corp. Broadcast Products Div.
Maury Microwave Corp.
Micro Communications, Inc.
Microwave Associates Communications Co.
NEC America, Inc. Broadcast Equip. Div.
Nurad, Inc.
Prodelin Inc.
Scientific-Atlanta, Inc.
Tayburn Electronics, Inc.
Tennaplex Systems Ltd.
TerraCom Loral Corp.

Antennas, Remote Pickup

Andrew Corp.
Anixter-Mark
Belar Electronics Lab., Inc.
Cetec Broadcast Group
Farinon Video
Harris Corp. Broadcast Products Div.
High-Lite Corp.
McMartin Industries, Inc.
Micro Communications, Inc.
Moseley Associates, Inc.
Motorola Communications and Electronics Inc.
Nurad, Inc.
Scala Electronic Corp.
Scientific-Atlanta, Inc.
Tayburn Electronics, Inc.
Tennaplex Systems Ltd.
Tri-Ex Tower Corp.

Antennas, Remote Transmitting, Radio

Anixter-Mark
Cetec Broadcast Group
Dielectric Communications A Unit of General Signal
Farinon Video
Harris Corp. Broadcast Products Div.
High-Lite Corp.
Microwave Associates Communications Co.
Moseley Associates, Inc.
Scala Electronic Corp.
Tennaplex Systems Ltd.
Tri-Ex Tower Corp.

Antennas, STL

Andrew Corp.
Anixter-Mark
Cablewave Systems Inc.
Cetec Broadcast Group
Contel Mfg.
Dielectric Communications A Unit of General Signal
Gabriel Electronics, Inc.
Harris Corp. Broadcast Products Div.
Micro Control Associates, Inc.
Microwave Associates Communications Co.
Moseley Associates, Inc.
Nurad, Inc.
Prodelin Inc.
Scala Electronic Corp.
Swager Tower Corp.
TerraCom Loral Corp.
Utility Tower Co.

Antennas, Transmitting FM

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Phelps Dodge Communications Co. 99

Alford Mfg. Co.
Anderson Scientific
Bogner Broadcast Equipment Corp.
Cetec Broadcast Group
Comark Communications, Inc.
Comark Industries Inc.
Dielectric Communications A Unit of General Signal
Harris Corp. Broadcast Products Div.
Marconi Communication Systems Ltd.
McMartin Industries, Inc.
Micro Communications, Inc.
Phelps Dodge Communications Co.
RCA Broadcast Systems
Scala Electronic Corp.
Shively Laboratories, Inc.
Swintek Enterprises, Inc.
Tennaplex Systems Ltd.

Antennas, Transmitting HF

Comark Communications, Inc.
DHV, Inc.
Delta Electronics Inc. (Va.)
Tennaplex Systems Ltd.

Antennas, Transmitting LF

Cetec Broadcast Group
Comark Communications, Inc.
Continental Electronics Mfg. Co.
Dielectric Communications A Unit of General Signal
Harris Corp. Broadcast Products Div.
Marconi Communication Systems Ltd.
Micro Communications, Inc.
Stainless, Inc.

Antennas, Transmitting MF

Cetec Broadcast Group
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Marconi Electronics Inc. Broadcast & Communication Div.
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Dielectric Communications A Unit of General Signal
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Marconi Electronics Inc. Broadcast & Communication Div.
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Nurad, Inc.
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Prodelin Inc.
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Nurad, Inc.
RCA Broadcast Systems
SWR Inc.
Tennaplex Systems Ltd.
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Antennas, Transmitting Microwave

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Anixter-Mark
Bogner Broadcast Equipment Corp.
Cablewave Systems Inc.
ENG Helicopter Satellites, Ltd.
Farinon Video
Gabriel Electronics, Inc.
Harris Corp. Broadcast Products Div.
Marconi Communication Systems Ltd.
Micro Communications, Inc.
Micro Control Associates, Inc.
Microwave Associates Communications Co.
Nurad, Inc.
Prodelin Inc.
Rohde & Schwarz Sales Co.
Scientific-Atlanta, Inc.
Tayburn Electronics, Inc.
Tennaplex Systems Ltd.
TerraCom Loral Corp.

Antennas, TV Earth Station

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Andrew Corp.
Anixter-Mark
Farinon Video
Fort Worth Tower Co.
Gabriel Electronics, Inc.
Gardiner Communications Corp.
Harris Corp. Broadcast Products Div.
Hughes Aircraft Co. Microwave Communications Products
Marconi Communication Systems Ltd.
Microdyne Corp.
Microwave Associates Communications Co.
Pinzone Communications Products Inc.
Prodelin Inc.
Schudel, Inc.
Scientific-Atlanta, Inc.
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Western Tele-Communications, Inc.

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Analog Devices, Inc.
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Auditronics, Inc.
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Duncan Electronics, Inc.
DYMA Engineering, Inc.
Gerard Tech
Gotham Audio Corp.
Harris Corp. Broadcast Products Div.
ITI Electronics, Inc.
Kay Elemetrics Corp.
Kings Electronics Co., Inc.
Leader Instruments Corp.
Marconi Instruments Div. of Marconi Electronics Inc.
Orange County Elec. Int'l., Inc.
Potomac Instruments, Inc.
ProTech Audio Corp.
Richmond Sound Design, Ltd.
Rohde & Schwarz Sales Co.
Sescom, Inc.
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Texscan Corp.
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Gerard Tech
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Harris Corp. PRD Electronics Div.
ITI Electronics, Inc.
Kay Elemetrics Corp.
Kings Electronics Co., Inc.
Maury Microwave Corp.
Merill Cable Equipment Corp.
Mu-Del Electronics, Inc.
The Narda Microwave Corp.
Rohde & Schwarz Sales Co.
Shallco, Inc.
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Kay Elemetrics Corp.
Maury Microwave Corp.
Merill Cable Equipment Corp.
Mu-Del Electronics, Inc.
The Narda Microwave Corp.
Potomac Instruments, Inc.
Rohde & Schwarz Sales Co.
Shallco, Inc.
Tech Laboratories Inc.
Tektronix Inc.
Texscan Corp.

Attenuators, Microwave

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Harris Corp. PRD Electronics Div.
Kay Elemetrics Corp.
Kings Electronics Co., Inc.
Maury Microwave Corp.
Mu-Del Electronics, Inc.
The Narda Microwave Corp.
Rohde & Schwarz Sales Co.
Tech Laboratories Inc.
Tektronix Inc.
Texscan Corp.
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Harris Corp. PRD Electronics Div.
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Audio Technology
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Logitek Electronic Systems, Inc.
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Moseley Associates, Inc.
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QEI Corp.
Sharepoint Systems Inc.
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Rupert Neve, Inc.

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Computer Business Systems, Inc.
Computer Concepts Corp.
Consolidated Electronic Industries
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Sharepoint Systems Inc.
Soll, Inc.
Sono-Mag Corp.
Tape-Athon Corp. Cavox Stereo Productions
Time & Frequency Tech., Inc.
Torpey Controls & Eng. Ltd.

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Time & Frequency Tech., Inc.
Torpey Controls & Eng. Ltd.
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Automation, Lighting Control

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Strand Century, Inc.
Theatre Techniques Inc.
Thorn Lighting, Inc.

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McInnis, Skinner & Associates
TVNS

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Kaman Sciences/BCS
The Management
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PWH Electronics Ltd.
Quad-Eight Electronics
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Tape-Athon Corp. Cavox Stereo Productions
Tektronix Inc.
Telex Communications, Inc.
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Channelmatic, Inc.
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Computer Business Systems, Inc.
Computer Concepts Corp.
Computer Management Systems, Inc.
Custom Business Systems, Inc.
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Kaman Sciences/BCS
The Management
Matrix Systems Inc.
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Automation, Tape Control, Cartridge

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IGM Communications
Kaman Sciences/BCS
Microprobe Electronics, Inc.
PWH Electronics Ltd.
Sharepoint Systems Inc.
Sono-Mag Corp.
Telex Communications, Inc.
UMC Electronics Co. Broadcast Products Div.

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Control Video Corp.
Harris Corp. Broadcast Products Div.
IGM Communications
Microprobe Electronics, Inc.
Otari Corp.
PWH Electronics Ltd.
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Sharepoint Systems Inc.
Soll, Inc.
Sono-Mag Corp.
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Automation, Video Display Terminals

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Teknekron Controls, Inc.
Time & Frequency Tech., Inc.
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Equipto Electronics Corp.
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Pacific Recorders & Eng. Corp.
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Marshall Electronics
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Andrew Corp.
Audicon, Inc.
Audio-Technica U.S., Inc.
Belden Corp.
Boston Insulated Wire & Cable Co.
Brand-Rex Co.
CCS Hatfield Communications Products
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Comm/Scope Co.
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Gabriel Electronics, Inc.
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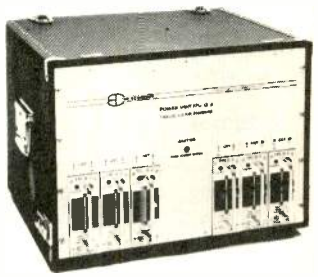

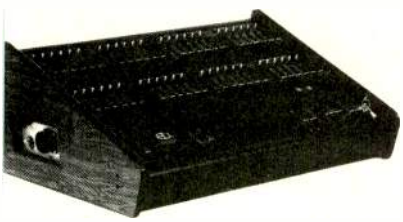

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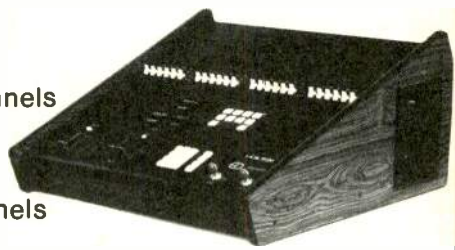

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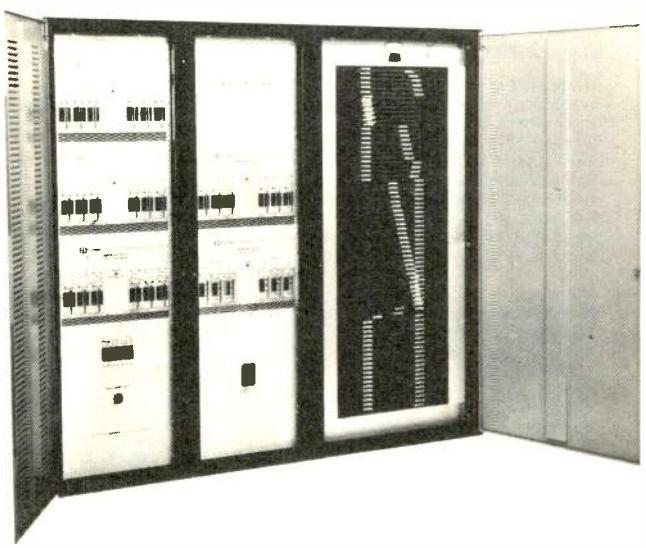

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Alan Gordon Enterprises Inc.
Gruber Products Co.
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Panasonic Company
Quick-Set Inc.
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Triple S Mfg. Corp.

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Asaca Corp. of America
Bogen Photo Corp.
Cohu, Inc. Electronics Div.
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Alan Gordon Enterprises Inc.
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Javelin Electronics A Subs. of Kidde, Inc.
Matthews Studio Equipment, Inc.
Miller Professional Equipment, Inc.
O'Connor Eng. Labs. Inc.
Panasonic Company
Power-Optics, Inc.
Quick-Set Inc.
Tele-Cine Inc.
Television Products Co. Inc.

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EEV, Inc.
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English Electric Valve Co. Ltd.
Fernseh Inc.
GBC Closed Circuit TV Corp.
Harris Corp. Broadcast Products Div.
Ikegami Electronics (USA) Inc.
NEC America, Inc. Broadcast Equip. Div.
Panasonic Co. Video Systems Div.
RCA Distributor & Special Products Div.
RCA Electro Optics and Devices
Teknekron Controls, Inc.
Westinghouse Electric Corp. Ind. & Govt't Tube Div.

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Dage-MTI, Inc.
Fernseh Inc.
GBC Closed Circuit TV Corp.
Harris Corp. Broadcast Products Div.
Hitachi Denshi America, Ltd.
Ikegami Electronics (USA) Inc.
Innovative Television Equipment, Inc.
Javelin Electronics A Subs. of Kidde, Inc.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Panasonic Company
Philips Broadcast Equip Corp.
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Quick-Set Inc.
RCA Broadcast Systems
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Cine 60, Inc.
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GBC Closed Circuit TV Corp.
Gruber Products Co.
Harris Corp. Broadcast Products Div.
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K & H Products, Ltd.
Lee-Ray Industries, Inc.
Sfena Corp.
Sony Corp. of America
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Hitachi Denshi America, Ltd.
Ikegami Electronics (USA) Inc.
Marconi Electronics Inc. Broadcast & Communication Div.
Philips Broadcast Equip Corp.
RCA Broadcast Systems
Sharp Electronics Corp.

Cameras, Film Cine

AATON Cameras, Inc.
Arriflex Corp.
Bolex (U.S.A.), Inc.
Canon USA, Inc. Optics Div.
Cinema Products Corp.
Frezzolini Electronics, Inc.
Alan Gordon Enterprises Inc.
Harris Corp. Broadcast Products Div.
Karl Heitz, Inc.
Soremec Eclair USA, Inc.

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Alan Gordon Enterprises Inc.
Harris Corp. Broadcast Products Div.
Hitachi Denshi America, Ltd.
Ikegami Electronics (USA) Inc.
International Video Corp.
Link Electronics Ltd.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Media Concepts, Inc.
NEC America, Inc. Broadcast Equip. Div.
Panasonic Company
Panasonic Co. Video Systems Div.
Philips Broadcast Equip Corp.
RCA Broadcast Systems
Sharp Electronics Corp.
Sony Corp. of America
Thomson-CSF Broadcast, Inc.
Toshiba Int'l. Corp. Broadcast Electronic Systems
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Hitachi Denshi America, Ltd.
Ikegami Electronics (USA) Inc.
Image Resource Corp.
International Video Corp.
Link Electronics Ltd.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
NEC America, Inc. Broadcast Equip. Div.
Panasonic Company
Panasonic Co. Video Systems Div.
Philips Broadcast Equip Corp.
RCA Broadcast Systems
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Harris Corp. Broadcast Products Div.
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Inmark Corp.
KD Components, Inc.
Surcom Associates
T T E, Inc.

Captioning Systems

Robert Bosch GmbH
Fernseh Inc.
MPB Technologies Inc.
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Broadcast Electronics, Inc.
Cetec Broadcast Group
Fidelipac Corp.
Harris Corp. Broadcast Products Div.
Nortronics Co., Inc. Recorder Care Div.
Taber Mfg. & Eng. Co.
Telex Communications, Inc.

Cartridge Machine Rebuilding Services

Broadcast Electronics, Inc.

Cartridge Machines, Dual Deck

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D-B Electronics, Inc.
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International Electro-Magnetics
McCurdy Radio Ind. Inc.
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Audi-Cord Corp.
Broadcast Controls Div. Of Automated Broadcast Controls
Broadcast Electronics, Inc.
Cetec Broadcast Group
Consolidated Electronic Industries
D-B Electronics, Inc.
Harris Corp. Broadcast Products Div.
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International Electro-Magnetics
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Harris Corp. Broadcast Products Div.
IGM Communications
International Electro-Magnetics
International Tapetronics Corp.
McCurdy Radio Ind. Inc.
Micro-Trak Corp.
Pacific Recorders & Eng. Corp.
Ramko Research Inc.
Sono-Mag Corp.
Telex Communications, Inc.
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Broadcast Electronics, Inc.
Cetec Broadcast Group
D-B Electronics, Inc.
EMT-FRANZ GMBH
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IGM Communications
International Tapetronics Corp.
Micro-Trak Corp.
Pacific Recorders & Eng. Corp.
Ramko Research Inc.
Telex Communications, Inc.
UMC Electronics Co. Broadcast Products Div.

Cartridge Reconditioning Services

Broadcast Electronics, Inc.
Harris Corp. Broadcast Products Div.
Re-Play Video Cartridge Service

Cartridge Recording Services

Media Concepts, Inc.
Tape-Athon Corp. Cavox Stereo Productions

Cartridge Reloading Services, Audio

Aristocart Div. Western Broadcasting, Ltd.
Audico, Inc.
Broadcast Electronics, Inc.

Cartridge Reloading Services, Video

Audico, Inc.
Re-Play Video Cartridge Service

Cartridge Splice Finder

Ampro Broadcasting
Broadcast Electronics, Inc.
Cetec Broadcast Group
Harris Corp. Broadcast Products Div.
IGM Communications
International Tapetronics Corp.
UMC Electronics Co. Broadcast Products Div.

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Contel Mfg.
EMT-FRANZ GMBH
Fidelipac Corp.
Fuji Photo Film USA, Inc. Magnetic Tape Div.
Harris Corp. Broadcast Products Div.
IGM Communications
Maxell Corp. of America
Memorex Corp. Professional Products Group
Procart
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McCurdy Radio Ind. Inc.
Micro-Trak Corp.
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IGM Communications
Micro-Trak Corp.
Osawa & Co. (USA), Inc.
Procart
QRK Broadcast Electronics
Shure Brothers Inc.
Sono-Mag Corp.
Stanton Magnetics Inc.
Telex Communications, Inc.
UMC Electronics Co. Broadcast Products Div.

Cartridges, Videotape

Cinema Products Corp.
Fuji Photo Film USA, Inc. Magnetic Tape Div.
Maxell Corp. of America
Memorex Corp. Professional Products Group
Panasonic Co. Video Systems Div.
RCA Broadcast Systems
Re-Play Video Cartridge Service
Schuessler Case Co., Inc.
Sony Corp. of America
3M Co. Magnetic Audio/Video Prod. Div.

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Broadcast Electronics, Inc.
Impact Case Sales Ltd.
K & H Products, Ltd.
Lee-Ray Industries, Inc.
Lyon Metal Products, Inc.
Neumade Products Corp.
Storeel Corp.
Winsted Corp.

Cases, Film and Tape, Carrying and Shipping

A & S Case Co.
Anvil Cases, Inc.
Cases Inc.
Fiberbilt
Hollywood Film Co.
Ikelheimer-Ernst, Inc. Fiberbilt
Impact Case Sales Ltd.
Lowenthal Mfg.
Maxell Corp. of America
Neumade Products Corp.
Parsons Mfg. Corp.
Plastic Reel Corp. of America
Reliance Plastics & Packaging Div.
Research Technology, Inc.
Schuessler Case Co., Inc.
Star Case Mfg. Co. Inc.
Thermodyne International Ltd.
3M Co. Magnetic Audio/Video Prod. Div.
Vulcan Binder & Cover
WIDL Video
Winsted Corp.

Cases, Video Equipment Transit

A & S Case Co.
Anvil Cases, Inc.
Cases Inc.
Comprehensive Video Supply Corp.
Fiberbilt
Ikelheimer-Ernst, Inc. Fiberbilt
Impact Case Sales Ltd.
K & H Products, Ltd.
Lowenthal Mfg.
Multiplier Industries Corp.
Panasonic Co. Video Systems Div.
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Pentagon Industries, Inc.
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Eumig USA, Inc. 225 Community Dr.
Foundation Elec. Instruments Inc.
Neal Ferrograph U.S.A., Inc.
Panasonic Company
Ramko Research Inc.
Sansui Electronics Corp.
TEAC Corp of America
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EECO Inc.
EEG Enterprises, Inc.
Fernseh Inc.
Harris Corp. Broadcast Products Div.
Interand Corp. Telestrator Div.
Kaitronics Corp.
Knox Video Products
Laird Telemedia Inc.
MPB Technologies Inc.
MSI Television
Motorola Semiconductor Products Inc.
Panasonic Company
Portac Inc.
QSI Systems, Inc.
Shintron Co. Inc.
System Concepts Inc.
Tektronix Inc.
Thomson-CSF Broadcast, Inc.
3M Co. Mincom Div.
Unitel
Video Data Systems
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Character Generators, Wire Service Memory System

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Video Data Systems 82

"The Image System can make any 3/4" VTR look like 1", automatically!"

A strong statement for a strong system. The Image System™ is the most comprehensive system ever invented to correct predictable deficiencies in color under video tape formats and the first to do it automatically.

The Image System – Record 1 and Playback 1 – a bold new idea from Faroudja Laboratories, for ten years the pioneer and leader in processing technology for better television pictures.

Traditionally, image improvement systems have attempted to recover and rebuild information already lost or degraded in production and post-production stages. Further, these attempts have been based upon an operator's subjective judgements about picture quality on a particular, and not necessarily accurate, playback monitor.

The Image System is different. It consists of a pre-processor called Record 1™ and post-processor called Playback 1.™

Record 1 boosts small details which will be predictably degraded or lost in all color under VTR formats. Further, Record 1 encodes the original video signal with a non visible, fully compatible pilot signal which will later control Playback 1 to set detail levels *automatically* without operator error based upon monitor performance.

Portable RECORD 1

Playback 1, the second part of the Image System, is utilized just before time base correction for broadcast. It reduces noise and ringing, eliminates chroma/luminance delay and sharpens details; *automatically*. The resulting picture does not have the cartoon effect or plastic appearance of color under formats – it looks as if it comes from a more expensive VTR.

FAROUDJA Laboratories

Circle (111) on Reply Card

Faroudja Laboratories Inc.
946 Benicia Avenue
Sunnyvale, California 94086
Telephone 408/245-1492

BEI-Beston Electronics, Inc.
Robert Bosch GmbH
Fernseh Inc.
MSI Television
Unitel
Video Data Systems

Choppers

Tektronix Inc.
Townsend Associates, Inc.

Chroma Key Background Movement Devices

Marconi Communication Systems Ltd.
NEC America, Inc. Broadcast Equip. Div.
Panoak Lighting Systems
Power-Optics, Inc.

Chroma Keyer-Decoders

Broadcast Video Systems, Ltd.
Central Dynamics Corp.
Dynasciences Div. Whittaker Corp.
Grass Valley Group, Inc.
Industrial Sciences, Inc. (ISI)
International Nuclear Corp.
Marconi Communication Systems Ltd.
Siegel Electronics
Telemet Div. A Geotel, Co.

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Central Dynamics Corp.
Crosspoint Latch Corp.
Dynasciences Div. Whittaker Corp.
Grass Valley Group, Inc.
Industrial Sciences, Inc. (ISI)
International Nuclear Corp.
Marconi Communication Systems Ltd.
Panasonic Company
Panasonic Co. Video Systems Div.
RCA Broadcast Systems
Shintron Co. Inc.
Telemet Div. A Geotel, Co.
3M Co. Mincom Div.
Vital Industries Inc.

Cleaner, Magnetic Tape Head

Allsop, Inc.
Ampex Corp.
Audio Magnetics Corp.
Broadcast Electronics, Inc.
Comprehensive Video Supply Corp.
Fidelipac Corp.
G C Electronics Div. Wallace Murray
Memorex Corp. Professional Products Group
N.O.V.A. Corp.
Nortronics Co., Inc. Recorder Care Div.
Pentagon Industries, Inc.
Robins Industries Corp.
Sono-Mag Corp.
TEAC Corp of America
Telectro Systems Corp.
The Texwipe, Co.
3M Co. Magnetic Audio/Video Prod. Div.
United Recording Electronics Industries

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Broadcast Electronics, Inc.
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Glentronix (1977) Ltd.
Harris Corp. Broadcast Products Div.
Harwood Mfg. Co. Subs. Elgin Nat'l. Industries, Inc.
Leitch Video Ltd.
Sono-Mag Corp.
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Broadcast Aids, Inc.
Broadcast Controls Div. Of Automated Broadcast Controls
Broadcast Electronics, Inc.
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Datatron, Inc.
EECO Inc.
ESE
Glentronix (1977) Ltd.
Global Specialties Corp.
Gray Engineering Labs
Harris Corp. Broadcast Products Div.
Image Video Ltd.
Kaitronics Corp.
Leitch Video Ltd.
Logitek Electronic Systems, Inc.
Motorola Semiconductor Products Inc.
PWH Electronics Ltd.
Pacific Recorders & Eng. Corp.
QRK Broadcast Electronics
QSI Systems, Inc.
Ramko Research Inc.
Telectro Systems Corp.
Torpey Controls & Eng. Ltd.

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Datametrics Inc.
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Kaitronics Corp.
Leitch Video Ltd.
PWH Electronics Ltd.
QSI Systems, Inc.
Sono-Mag Corp.
Torpey Controls & Eng. Ltd.

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Ramko Research Inc.

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Faroudja Labs
Fernseh Inc.
Harris Corp. Broadcast Products Div.
Ikegami Electronics (USA) Inc.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Microtime, Inc.
Photo Research Div. of Kollmorgen Corp.
Power-Optics, Inc.
RCA Broadcast Systems
Siegel Electronics
Tektronix Inc.
Television Equipment Associates
Thomson-CSF Broadcast, Inc.

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Combiners, Power

CSP Inc.
Cetec Broadcast Group
Comark Industries Inc.
Continental Electronics Mfg. Co.
Dielectric Communications A Unit of General Signal
Geleco Electronics Ltd.
Harris Corp. Broadcast Products Div.
Marconi Electronics Inc. Broadcast & Communication Div.
Micro Communications, Inc.
Mu-Del Electronics, Inc.
The Narda Microwave Corp.
North Hills Electronics, Inc.
Shively Laboratories, Inc.
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Bayly Engineering Ltd. Member of AEG-Telefunken Group
Centro Corp.
Compucan, Inc.
DYMA Engineering, Inc.
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
The Gerstenslager Co.
Global Communications & Eng., Inc.
Harris Corp. Broadcast Products Div.
International Microwave Corp.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Microwave Associates Communications Co.
Motorola Communications and Electronics Inc.
Multiplier Industries Corp.
Paso Sound Products Inc.
Pennbeth Marketing Inc.
Phelps Dodge Communications Co.
RCA Broadcast Systems
Regency Electronics, Inc.
Swintek Enterprises, Inc.
Tennaplex Systems Ltd.
Tri-Ex Tower Corp.

Communication Systems, Microwave

Anderson Scientific
Atlantic Research Corp.
Cablewave Systems Inc.
California Microwave
Coastcom
Comark Industries Inc.
Compucan, Inc.
Comsearch, Inc.
DYMA Engineering, Inc.
Gabriel Electronics, Inc.
Harris Corp. Broadcast Products Div.
Hughes Aircraft Co. Microwave Communications Products
International Microwave Corp.
LNR Communications, Inc.
Marconi Communication Systems Ltd.
Microwave Associates Communications Co.
Moseley Associates, Inc.
Motorola Communications and Electronics Inc.
NEC America, Inc. Broadcast Equip. Div.
RHG Electronics Laboratory, Inc.
Rockwell Int'l. Collins Broadcast Products
Tepco Corp.
TerraCom Loral Corp.
Tri-Ex Tower Corp.
Varian Associates, Inc. Electron Device Group
Western Tele-Communications, Inc.

Communication Systems, Multiplex

Atlantic Research Corp.
Catel Div. United Scientific Corp.
David Clark Co., Inc.
Coastcom
Farinon Video
IGM Communications
International Microwave Corp.
Johnson Electronics Inc.
Kaitronics Corp.
LeCroy Fiberoptic Systems
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Microwave Associates Communications Co.
Moseley Associates, Inc.
Motorola Communications and Electronics Inc.
Rockwell Int'l. Collins Broadcast Products
The Ken Schaffer Group, Inc.
Tennaplex Systems Ltd.
TerraCom Loral Corp.
Times Fiber Communications, Inc. Div. Times Wire & Cable
Western Tele-Communications, Inc.

Communication Systems, STL

Bayly Engineering Ltd. Member of AEG-Telefunken Group
Cablewave Systems Inc.
Cetec Broadcast Group
Comark Industries Inc.
Compucan, Inc.
Comsearch, Inc.
Custom Audio Elec., Inc.
DYMA Engineering, Inc.
Farinon Video
Harris Corp. Broadcast Products Div.
Hughes Aircraft Co. Microwave Communications Products
International Microwave Corp.
LeCroy Fiberoptic Systems
Marti Electronics
Micro Control Associates, Inc.
Microwave Associates Communications Co.
Moseley Associates, Inc.
NEC America, Inc. Broadcast Equip. Div.
Nurad, Inc.
RHG Electronics Laboratory, Inc.
Tepco Corp.
TerraCom Loral Corp.
Time & Frequency Tech., Inc.

Communication Systems, Teleprinter

Johnson Electronics Inc.
Moseley Associates, Inc.

Comparators, Video

Leitch Video Ltd.
Television Equipment Associates

Compensators, Dropout

Digital Video Systems Inc.
Merlin Engineering Works, Inc.
Microtime, Inc.
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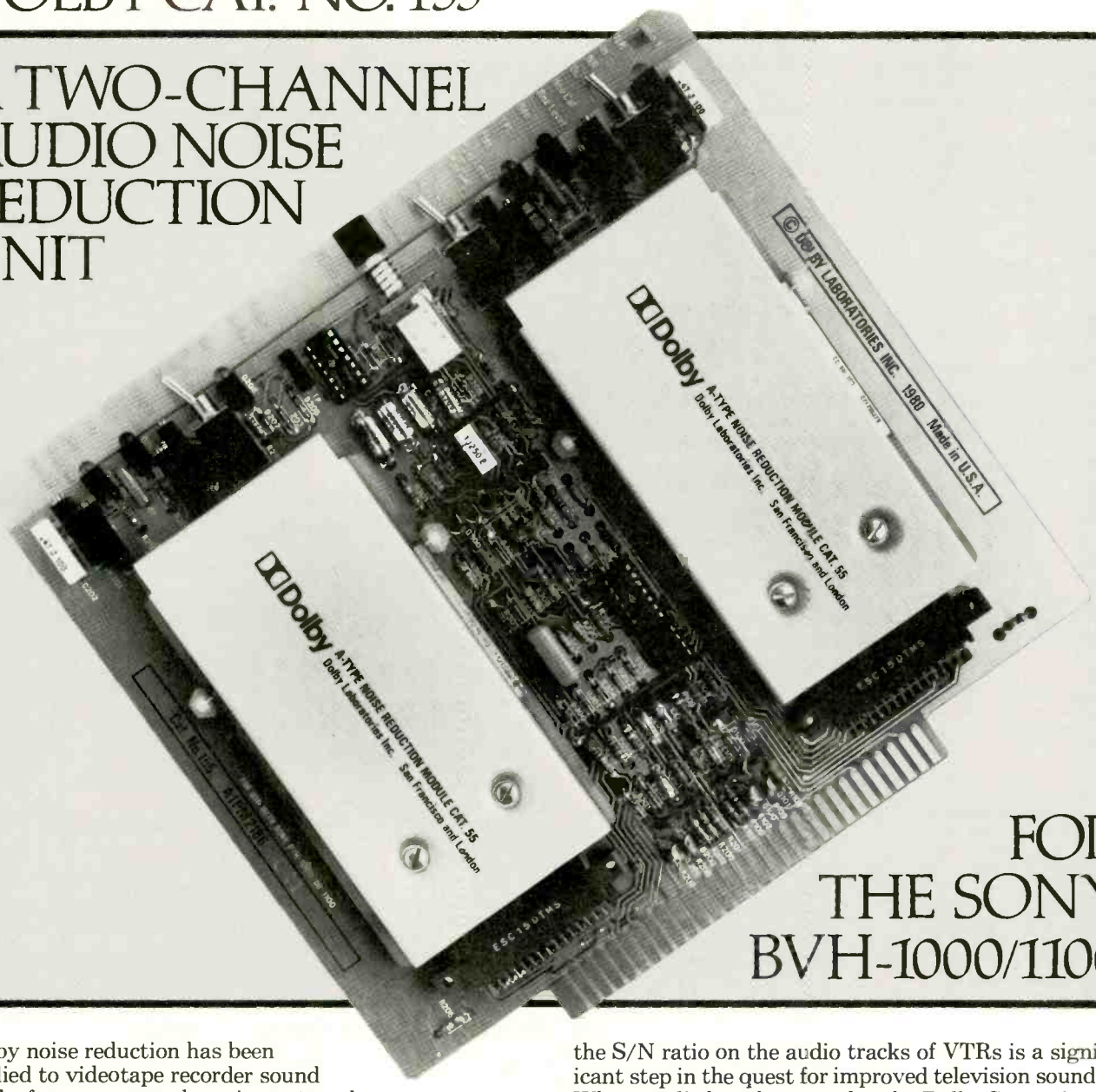
AMP Inc.
AVA Electronics
Belden Communications, Inc.
Boston Insulated Wire & Cable Co.
Cambridge Products
Ercona Corp.

DOLBY CAT. NO. 155

A TWO-CHANNEL AUDIO NOISE REDUCTION UNIT



FOR THE SONY BVH-1000/1100

Dolby noise reduction has been applied to videotape recorder sound tracks for many years by using external noise reduction units, such as the highly successful Dolby Laboratories' 360 series. The new Cat. No. 155 has been designed specifically to incorporate Dolby A-type noise reduction within the Sony BVH-1000/1100 videotape recorder. Like other professional Dolby noise reduction units, it provides 10 dB of noise reduction, from 20 Hz upwards, rising to 15 dB at 9kHz and above.

Two fully independent channels are provided in the Cat. No. 155, which plugs into an existing unused circuit card location in the BVH-1000/1100, with minor changes to the backplane. The front panel meters and gain controls on the BVH-1000/1100 are used in the normal manner; a bypass switch allows for instant removal of the noise reduction card from the signal path, restoring the videotape recorder to its unmodified state.

Today, with wide audio bandwidth and low noise becoming the norm in many parts of the television origination/transmission chain, the improvement in the S/N ratio on the audio tracks of VTRs is a significant step in the quest for improved television sound. When applied to those tracks, the Dolby System's 10 dB of noise reduction results in VTR audio performance which is in line with professional audio tape recorders. The Dolby system uses a complementary technique which applies compression and expansion to low level signals only, in four independent bands. The result is noise reduction with none of the audible side effects, such as noise modulation and overshoot distortion, associated with more conventional noise reduction techniques. Since its introduction in 1966, the Dolby system of noise reduction has become widely accepted throughout the world for high quality tape recording and in other audio transmission and storage media. The new Dolby Cat. No. 155 brings the benefits of the Dolby system to television audio in a form particularly suited to the purpose.

The Cat. No. 155 is now in quantity production and will be displayed at SMPTE by Dolby Laboratories in booth 120-121.

DOLBY LABORATORIES, INC., 731 Sansome Street, San Francisco CA 94111, Phone (415) 392-0300, Telex 34409 • 346 Clapham Road, London SW9, Phone 01-720 1111, Telex 919109.

Dolby®

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S80/2469/2880

Fesco Inc.
The Finney Co.
G C Electronics Div. Wallace Murray
Harris Corp. Broadcast Products Div.
Javelin Electronics A Subs. of Kidde, Inc.
Lemo USA Inc.
Magnavox CATV Systems, Inc.
Marshall Electronics
Matthews Studio Equipment, Inc.
Maury Microwave Corp.
Micro Communications, Inc.
Neutrik Products
Paladin Corp.
Phelps Dodge Communications Co.
Rex Rheostat & Co., Inc.
Sono-Mag Corp.
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BSM Systems
Bayly Engineering Ltd. Member of AEG-Telefunken Group
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Central Dynamics Corp.
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Custom Audio Elec., Inc.
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Harrison Systems Inc.
Industrial Sciences, Inc. (ISI)
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International Nuclear Corp.
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Electro & Optical Systems Ltd.
Johnson Electronics Inc.
MCI/Quantel
Motorola Semiconductor Products Inc.
TRW, LSI Products
Tektronix Inc.

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The Finney Co.
LNR Communications, Inc.
Marconi Electronics Inc. Broadcast & Communication Div.
Motorola Semiconductor Products Inc.
Mu-Del Electronics, Inc.
North Hills Electronics, Inc.
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Kaitronics Corp.
Lectrotech Inc.
Logitek Electronic Systems, Inc.
Motorola Semiconductor Products Inc.
Multi-Track Magnetics, Inc.
PWH Electronics Ltd.
Pacific Recorders & Eng. Corp.
Philips Test & Measuring Instruments, Inc.
QRK Broadcast Electronics
QSI Systems, Inc.
Ramko Research Inc.
Sharepoint Systems Inc.
Tektronix Inc.
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B & K Precision Dynascan Corp.
Bright Electronics Corp.
DSI Instruments, Inc.
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Image Video Ltd.
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Rupert Neve, Inc.
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PWH Electronics Ltd.
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ProTech Audio Corp.
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Cetec Vega
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Alford Mfg. Co.
Dielectric Communications A Unit of General Signal
EEV Canada Ltd.
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
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Colorado Video Inc.
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Central Dynamics Corp.
Computer Labs Div. of Analog Devices, Inc.
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Tektronix Inc.

Diplexers

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Coastcom
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Continental Electronics Mfg. Co.
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Harris Corp. Broadcast Products Div.
Laird Telemedia Inc.
Micro Communications, Inc.
Mu-Del Electronics, Inc.
North Hills Electronics, Inc.
Nurad, Inc.
Phelps Dodge Communications Co.
SWR Inc.
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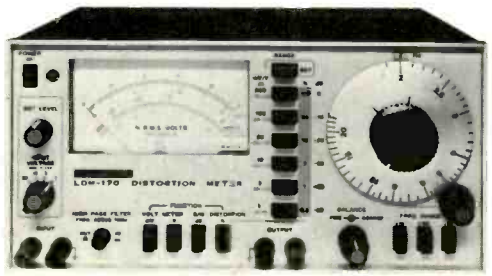

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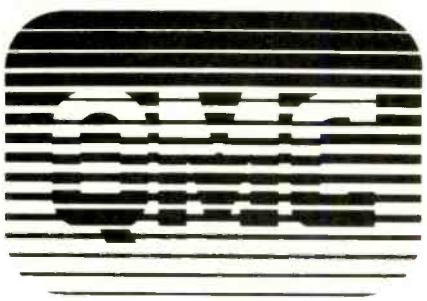

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Oktel Corp.

Frame Synchronizers --See Synchronizers

Framers, Color

A. F. Associates, Inc.
Central Dynamics Corp.

Frequency Standards

John Fluke Mfg. Co., Inc.
Global Specialties Corp.
Maury Microwave Corp.
Rohde & Schwarz Sales Co.
Tracor Inc.

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Potomac Instruments, Inc. 30

Amber Electro Design, Ltd.
Audisar
B & K Precision Dynascan Corp.

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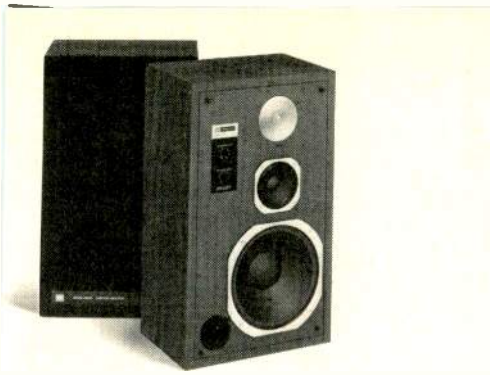


Cherokee Studios, Hollywood, California.

JBL 4313 Studio Monitor.
It flattens the competition.

JBL

Introducing the 4313.

Flat frequency response. It means accuracy. Naturalness. Reality.

JBL gives it to you without the bigger box that you'd expect along with it, since the 4313 only measures about 23" x 14"x10"!

This new, compact professional monitor produces deep, distortion-free bass. And does it with a newly developed 10" driver. Its massive magnet structure and voice coil are equivalent to most 12" or 15" speakers. Yet it delivers heavy-duty power handling and a smoother transition to the midrange than most larger-cone speakers.

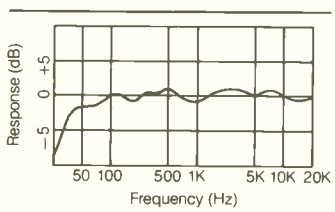
The 4313's edge-wound voice coil midrange accurately reproduces strong, natural vocals and powerful transients.

Up top, a dome radiator provides high acoustic output with extreme clarity and wide dispersion. A large 1" voice coil gives it the ruggedness needed in professional use.

Working together, these precision matched speakers offer superb stereo imaging, powerful sound levels and wide dynamic range.

Audition the 4313 soon.

We think you'll agree that its combination of flat response, power and moderate size flattens the competition.



On-axis frequency response. 4313 monitor.

James B. Lansing Sound, Inc.,
8500 Balboa Blvd.,
Northridge, California 91329.

Circle (116) on Reply Card

JBL First with the pros.

Bald Mountain Lab
Broadcast Electronics, Inc.
DYMA Engineering, Inc.
Exact Electronics, Inc.
Frequency Devices Inc.
Global Specialties Corp.
Harris Corp. Broadcast Products Div.
Hickok Elec. Inst. Co.
ITT Instruments & Components Metrix Div.
Leasametric
Marconi Instruments Div. of Marconi Electronics Inc.
Modular Audio Products Unit of Modular Devices, Inc.
Opamp Labs, Inc.
Potomac Instruments, Inc.
Quad-Eight Electronics
Rohde & Schwarz Sales Co.
Sencore, Inc.
Sescom, Inc.
Sound Technology
Spectra Sonics
Tektronix Inc.
Tri Tec Systems Inc.
VIZ Mfg. Co.
Wang Voice Comm. Inc.

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Leader Instruments Corp.
Leasametric
Marconi Instruments Div. of Marconi Electronics Inc.
Rohde & Schwarz Sales Co.
Tektronix Inc.
United Recording Electronics Industries

Generators, Background Color

American Data Corp. A North American Philips Co.
Automation Techniques, Inc.
Beaveronics, Inc.
Robert Bosch GmbH
Broadcast Video Systems, Ltd.
Central Dynamics Corp.
Crosspoint Latch Corp.
Fernseh Inc.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Industrial Sciences, Inc. (ISI)
Lenco Inc. Electronics Div.
MSI Television
Marconi Electronics Inc. Broadcast & Communication Div.
Philips Test & Measuring Instruments, Inc.
Shintron Co. Inc.
Tektronix Inc.
Video Data Systems

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Crosspoint Latch Corp.
Datatek Corp.
Dynair Electronics, Inc.
Fernseh Inc.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Industrial Sciences, Inc. (ISI)
International Nuclear Corp.
Jatex, Inc.
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
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Tektronix Inc.
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Broadcast Video Systems, Ltd.
Cohu, Inc. Electronics Div.
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Echolab
Harris Corp. Broadcast Products Div.
Hickok Elec. Inst. Co.
ITT Instruments & Components Metrix Div.
Industrial Sciences, Inc. (ISI)
Jatex, Inc.
Leader Instruments Corp.
Leasametric
Lectrotech Inc.
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Panasonic Company
Panasonic Co. Video Systems Div.
Philips Test & Measuring Instruments, Inc.
QSI Systems, Inc.
Sencore, Inc.
Shintron Co. Inc.
Sigma Electronics, Inc.
Tektronix Inc.
Telaudio Centre
Telemet Div. A Geotel, Co.
3M Co. Mincom Div.
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Dynasciences Div. Whittaker Corp.
Fernseh Inc.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Industrial Sciences, Inc. (ISI)
Leasametric
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marconi Communication Systems Ltd.
Panasonic Company
Panasonic Co. Video Systems Div.
Philips Test & Measuring Instruments, Inc.
QSI Systems, Inc.
Rohde & Schwarz Sales Co.
Sencore, Inc.
Sharp Electronics Corp.
Shintron Co. Inc.
Sigma Electronics, Inc.
Tektronix Inc.
Telaudio Centre
Telemet Div. A Geotel, Co.
Video Aids of Colorado
Video Data Systems
Viscount Industries Ltd.
Vital Industries Inc.
World Video Inc.

Generators, Convergence

Broadcast Video Systems, Ltd.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
ITT Instruments & Components Metrix Div.
Leader Instruments Corp.
Lectrotech Inc.
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Philips Test & Measuring Instruments, Inc.
Sencore, Inc.
Sigma Electronics, Inc.
Tektronix Inc.
Telaudio Centre

Generators, Cross Pulse

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Harris Corp. Broadcast Products Div.
Lenco Inc. Electronics Div.
Siegel Electronics
Tektronix Inc.
3M Co. Mincom Div.
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Video Data Systems

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Skotel Corp.
United Recording Electronics Industries

Generators, Digital Sync

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Robert Bosch GmbH
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Central Dynamics Corp.
Crosspoint Latch Corp.
Dynair Electronics, Inc.
Fernseh Inc.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Industrial Sciences, Inc. (ISI)
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Rohde & Schwarz Sales Co.
Sigma Electronics, Inc.
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ADDA Corp.
Central Dynamics Corp.
Crosspoint Latch Corp.
Electro & Optical Systems Ltd.
Fernseh Inc.
Grass Valley Group, Inc.
Industrial Sciences, Inc. (ISI)
MCI/Quantel
MPB Technologies Inc.
MSI Television
NEC America, Inc. Broadcast Equip. Div.

Generators, FM Subcarrier

CSI Electronics, Inc.
Catel Div. United Scientific Corp.
Cetec Broadcast Group
Coastcom
Harris Corp. Broadcast Products Div.
Marti Electronics
McMartin Industries, Inc.
Moseley Associates, Inc.
QEI Corp.
Solid Electronics Labs
Tektronix Inc.
Times Fiber Communications, Inc. Div. Times Wire & Cable
Wilkinson Electronics, Inc.

Generators, Monoscope

Telemet Div. A Geotel, Co.

Generators, NTSC Signal Test/Pattern

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Asaca Corp. of America
B & K Precision Dynascan Corp.
Broadcast Video Systems, Ltd.
Harris Corp. Broadcast Products Div.
Leader Instruments Corp.
Leasametric
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Marconi Electronics Inc. Broadcast & Communication Div.
Marconi Instruments Div. of Marconi Electronics Inc.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
Sigma Electronics, Inc.
Tektronix Inc.
Telaudio Centre
Telemet Div. A Geotel, Co.
VIZ Mfg. Co.
World Video Inc.

Generators, Powered (Electric Motor)

Dynamote Corp.
Harris Corp. Broadcast Products Div.
Lampkin Lab. Inc.
North Wind Power Co.

Generators, Powered (Gasoline Engine)

Belden Communications, Inc.
Centro Corp.
E-N-G Corp.
Harris Corp. Broadcast Products Div.
Lampkin Lab. Inc.
Onan Corp.

Generators Powered (Solar Energy)

North Wind Power Co.
Teledyne Energy Systems

Generators, SCA

CSI Electronics, Inc.
Cetec Broadcast Group
Harris Corp. Broadcast Products Div.
Leader Instruments Corp.
Marti Electronics
McMartin Industries, Inc.
Micro Control Associates, Inc.
Moseley Associates, Inc.
QEI Corp.
Sencore, Inc.
Solid Electronics Labs
Tektronix Inc.
Time & Frequency Tech., Inc.
Versa Count Engineering
Wilkinson Electronics, Inc.

Generators, Safe Area

Broadcast Video Systems, Ltd.
Gray Engineering Labs

Generators, Signal AF

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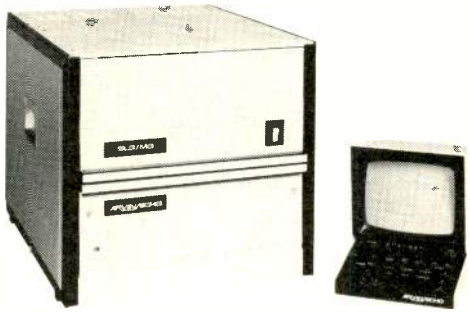
Amber Electro Design, Ltd.
Audisar

ARVIN/ECHO: Innovation in Intelligent Video Production Equipment.

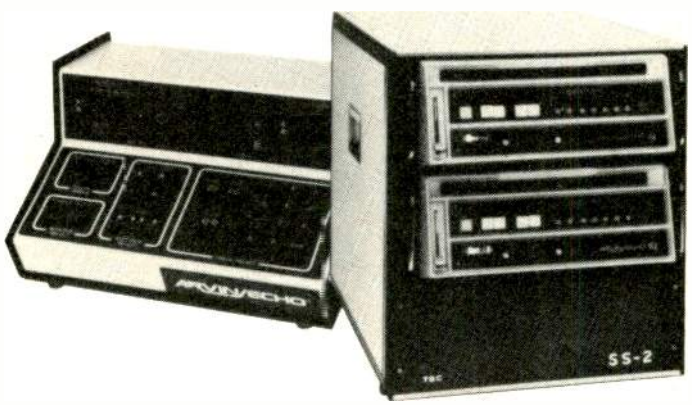
Arvin/Echo is a division of the Arvin Applied Technology Group, one of the most comprehensive and prestigious private research and development companies in the world. As a technological leader, Arvin/Echo has built its reputation on producing rugged, reliable broadcast production equipment.

EFS-1A: The EFS-1A offers the industry an extraordinary Frame-Stor™ Recorder in a small package (38 pounds). It is also available in PAL/SECAM. The relative low cost of the EFS-1A enables broadcasters to install a system in news, production or wherever the capability is required. The unit uses Arvin's unique, flexible Discassette® which electronically stores 400 slides (200 per side), is virtually indestructable, and is interchangeable with any EFS-1A System in the world. Remote random access to the EFS-1A System is also available with an optional interface to character generators.

SLO/MO™-1: Another use for the Arvin/Echo Discassette principle is the capability to provide the instant replays which are expected by sports fans. The SLO/MO-1 is a versatile production tool which is light weight, rugged, transportable and sells for a reasonable price. The system gives broadcasters capabilities such as slow motion, freeze/frame select and time saving editing. SLO/MO's usefulness in sports, news and commercials is enhanced by its High Band Color, Digital Comb Filter, Digital Time Base Correction and Digital Field Storage.



SS-2 Slide-Stor™ System: The SS-2 System is replacing 35mm slides as the medium for still presentations because it greatly simplifies the production and storage of graphics. All graphics can be preprogrammed on disc for instant call-up during broadcast. The SS-2 System frees a camera during the show, and eliminates the need for expensive tele-cine chains. Vertical/interval switching for on air use from one disc to another is built in. At the heart of the SS-2 System are two EFS-1A Broadcast color Discassette Frame-Stor Recorders which together will store up to 400 NTSC, or 200 PAL/SECAM high quality television frames—on line. Add more Discassettes for access to unlimited images.



THE IMAGE MAKER (EFS-2)®: All the advantages of our EFS-1A and much, much more. The Image Maker is a compact, versatile, programmable unit which delivers random access to 500 images on line with our exclusive Discassette. Preview and program outputs are built in. It also has the capability to do sequences and motion loops from 16 frames to 500 frames. Record and playback in single frame, real time, or anything in between for exciting animation effects. Serial digital interface is standard.

THE SQUEEZER™: A unique and highly affordable production tool which can reduce images to four discrete sizes ($^1/_4$, $^1/_9$, $^1/_{16}$, and $^1/_{25}$ of original) with complete positioning capabilities. Squeeze stills or live video. Border the image with full color which can be adjusted for width, saturation and hue. Then use the border to crop from one of the four sizes to infinity. Or, leave the border off entirely. It's your choice. The Squeezer can also insert one image into itself or key it over another. Signals for down stream keying are provided. And, it can be preset to four positions before air time.

Contact Dennis Shelton, Marketing Director at

ARVIN/ECHO™ 485 E. Middlefield Road, Mountain View, California, 94043
Telephone: (415) 961-7145, TWX: (910) 379-6499

APPLIED TECHNOLOGY GROUP ARVIN

Circle (117) on Reply Card

B & K Precision Dynascan Corp.
Bald Mountain Lab
Delta Electronics Inc. (N.C.)
Exact Electronics, Inc.
Frequency Devices Inc.
Global Specialties Corp.
Hickok Elec. Inst. Co.
ITT Instruments & Components Metrix Div.
Ivie Electronics, Inc.
Lampkin Lab. Inc.
Leader Instruments Corp.
Opamp Labs, Inc.
Potomac Instruments, Inc.
Rohde & Schwarz Sales Co.
Sencore, Inc.
Spectra Sonics
Tektronix Inc.
VIZ Mfg. Co.

Generators, Signal Dot Bar

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Asaca Corp. of America
B & K Precision Dynascan Corp.
Robert Bosch GmbH
Broadcast Video Systems, Ltd.
Cohu, Inc. Electronics Div.
Colorado Video Inc.
Fernseh Inc.
Grass Valley Group, Inc.
Hickok Elec. Inst. Co.
ITT Instruments & Components Metrix Div.
Leader Instruments Corp.
Lectrotech Inc.
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Philips Test & Measuring Instruments, Inc.
Sencore, Inc.
Tektronix Inc.
Telemet Div. A Geotel, Co.
VIZ Mfg. Co.

Generators, Signal Marker

B & K Precision Dynascan Corp.
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
ITT Instruments & Components Metrix Div.
Lectrotech Inc.
Sencore, Inc.
Tektronix Inc.
United Recording Electronics Industries
VIZ Mfg. Co.

Generators, Signal Pulse

B & K Precision Dynascan Corp.
Global Specialties Corp.
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Marconi Electronics Inc. Broadcast & Communication Div.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
TM Systems, Inc.
Tektronix Inc.
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B & K Precision Dynascan Corp.
Boonton Electronics
Delta Electronics Inc. (Va.)
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
Engineering Associates
John Fluke Mfg. Co., Inc.
Harris Corp. PRD Electronics Div.
ITT Instruments & Components Metrix Div.
Lampkin Lab. Inc.
Leader Instruments Corp.
Marconi Instruments Div. of Marconi Electronics Inc.
Microdyne Corp.
Mid State Communications, Inc.
Motorola Communications and Electronics Inc.
The Narda Microwave Corp.
Philips Test & Measuring Instruments, Inc.
Potomac Instruments, Inc.
Radiometer Elec. U.S. Inc.
Rohde & Schwarz Sales Co.
Sadelco, Inc.
Scientific-Atlanta, Inc.
Sencore, Inc.
Tektronix Inc.
Texscan Corp.
VIZ Mfg. Co.

Generators, Signal Square Wave

Amber Electro Design, Ltd.
Audisar
B & K Precision Dynascan Corp.
Exact Electronics, Inc.
Global Specialties Corp.
Hickok Elec. Inst. Co.
ITT Instruments & Components Metrix Div.
Leitch Video Ltd.
Philips Test & Measuring Instruments, Inc.
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Dynair Electronics, Inc.
Dynasciences Div. Whittaker Corp.
Echolab
Fernseh Inc.
Grass Valley Group, Inc.
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
Sencore, Inc.
Siegel Electronics
Sigma Electronics, Inc.
Tektronix Inc.
Telaudio Centre
Telemet Div. A Geotel, Co.
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Beaveronics, Inc.
Broadcast Video Systems, Ltd.
Central Dynamics Corp.
Colorado Video Inc.
Convergence Corp.
Crosspoint Latch Corp.
Dage-MTI, Inc.
Dynair Electronics, Inc.
Dynasciences Div. Whittaker Corp.
Echolab
Ikegami Electronics (USA) Inc.
Industrial Sciences, Inc. (ISI)
Interand Corp. Telestrator Div.
International Nuclear Corp.
Knox Video Products
MCI/Quantel
Marconi Communication Systems Ltd.
Panasonic Company
Panasonic Co. Video Systems Div.
Sharp Electronics Corp.
Shintron Co. Inc.
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Leasametric
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
Sigma Electronics, Inc.
Tektronix Inc.
Telemet Div. A Geotel, Co.
VIZ Mfg. Co.

Generators, Stereo

Bayly Engineering Ltd. Member of AEG-Telefunken Group
Boonton Electronics
CSI Electronics, Inc.
Catel Div. United Scientific Corp.
Cetec Broadcast Group
Harris Corp. Broadcast Products Div.
Kahn Communications, Inc.
Leader Instruments Corp.
McMartin Industries, Inc.
Moseley Associates, Inc.
Orban Assoc. Inc.
Pyramid Loudspeaker Corp.
QEI Corp.
Radiometer Elec. U.S. Inc.
Rohde & Schwarz Sales Co.
Sencore, Inc.
Solid Electronics Labs
Sound Technology
Wilkinson Electronics, Inc.

Generators, Subcarrier

Robert Bosch GmbH
Broadcast Video Systems, Ltd.
CSI Electronics, Inc.
Cetec Broadcast Group
Coastcom
Crosspoint Latch Corp.
Fernseh Inc.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Industrial Sciences, Inc. (ISI)
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marti Electronics
McMartin Industries, Inc.
Merill Cable Equipment Corp.
Micro Control Associates, Inc.
Moseley Associates, Inc.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
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Sigma Electronics, Inc.
Solid Electronics Labs

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Crosspoint Latch Corp.
Dynair Electronics, Inc.
Dynasciences Div. Whittaker Corp.
Echolab
Fernseh Inc.
Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Ikegami Electronics (USA) Inc.
Industrial Sciences, Inc. (ISI)
Leitch Video Ltd.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Nagra Magnetic Recorders, Inc.
Panasonic Co. Video Systems Div.
Philips Broadcast Equip Corp.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
Sencore, Inc.
Sharp Electronics Corp.
Shintron Co. Inc.
Siegel Electronics
Sigma Electronics, Inc.
Tektronix Inc.
Telemet Div. A Geotel, Co.
3M Co. Mincom Div.
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Teledyne Energy Systems

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The BTX Corp.
Broadcast Video Systems, Ltd.
CMX/Orrox Div. of Orrox Corp.
Central Dynamics Corp.
Control Video Corp.
Convergence Corp.
Datametrics Inc.
Datatron, Inc.
EECO Inc.
ESE
Electro & Optical Systems Ltd.
Glentronix (1977) Ltd.
Gray Engineering Labs
Kaitronics Corp.
Laird Telemedia Inc.
Multi-Track Magnetics, Inc.
Rupert Neve, Inc.
Philips Broadcast Equip Corp.
Quintek Inc.
Recortec, Inc.
Shintron Co. Inc.
Skotel Corp.
Tektronix Inc.
Telcom Research

STARTING OCT. 1

A NEW STRENGTH IN RADIO BROADCASTING EQUIPMENT

BROAD PRODUCT LINES OF AM AND FM TRANSMITTERS

Starting October first, Continental Electronics will offer broadcasters a complete line of high quality AM and FM radio transmitters, stereo studio consoles, antenna systems and related equipment.

The transmitter product line will include AM and FM transmitters 1 kW thru 50 kW.

This expansion is brought about in part by Continental's recent purchase of Collins Broadcast Products Group from Rockwell International Corporation.

NEW FACILITIES

New manufacturing facilities have been completed at Continental's plant in Dallas, to handle the additional product lines.

MARKETING AND FIELD ENGINEERING

Continental broadcast equipment, and existing Collins radio transmitters, will be serviced by a world-wide Continental field support and marketing group headquartered in Dallas.

This group has been expanded to meet customer requirements in a professional manner.

PIONEER AND LEADER IN HIGH-POWER RF SYSTEMS

Since its founding in 1946, Continental Electronics has pioneered many advances in high-power rf transmitter and systems technology at power levels from kilowatts to megawatts; for communications, radio broadcast, radar and scientific research applications.

Continental medium wave and short wave broadcast transmitters have achieved a world-wide reputation for quality components and construction; circuit innovations and unique, simple-to-operate designs which produce superior performance.

STRENGTH YOU CAN DEPEND ON

Whatever your radio broadcast needs may be, Continental offers quality equipment and competent marketing and engineering support.

For information on Continental broadcast equipment, call (214) 381-7161 or contact Broadcast Marketing Department, Continental Electronics Mfg. Co., P. O. Box 270879, Dallas, Texas 75227 Telex: 73-398

See us at the NRBA, booth 405 & 406.

Continental Electronics

Circle (118) on Reply Card

United Media, Inc.

Generators, Tone

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Altec Lansing Sound Products
Amber Electro Design, Ltd.
Autogram Corp.
Bald Mountain Lab
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Broadcast Controls Div. Of Automated Broadcast Controls
Broadcast Electronics, Inc.
Channelmatic, Inc.
Consolidated Electronic Industries
Di-Tech Inc.
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
Elcom Engineering Co.
Exact Electronics, Inc.
Frequency Devices Inc.
Gorman-Redlich Mfg. Co.
IGM Communications
Ivie Electronics, Inc.
Motorola Communications and Electronics Inc.
Opamp Labs, Inc.
Spectra Sonics
Wang Voice Comm. Inc.

Generators, Tone, EBS

Bald Mountain Lab
Broadcast Electronics, Inc.
ESE
Elcom Engineering Co.
Gorman-Redlich Mfg. Co.
International Nuclear Corp.
Logitek Electronic Systems, Inc.
McMartin Industries, Inc.
Time & Frequency Tech., Inc.

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Portac Inc.
Video Aids of Colorado

Generators, VTR Head Signal

Adcom Communications Inc.

Generators, Video Carrier

Merill Cable Equipment Corp.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
Sencore, Inc.
Tektronix Inc.

Generators, Video Sweep

Asaca Corp. of America
B & K Precision Dynascan Corp.
Datatek Corp.
Harris Corp. Broadcast Products Div.
ITT Instruments & Components Metrix Div.
Leader Instruments Corp.
Lectrotech Inc.
Lenco Inc. Electronics Div.
Link Electronics Ltd.
Marconi Instruments Div. of Marconi Electronics Inc.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
Sencore, Inc.
Tektronix Inc.
Telemet Div. A Geotel, Co.
Texscan Corp.
VIZ Mfg. Co.

Hand Trucks, ENG Equipment

Coherent Communications
E-N-G Corp.
Impact Case Sales Ltd.
K & H Products, Ltd.
Lee-Ray Industries, Inc.

Head Alignment Gauges

Ampro Broadcasting
Broadcast Electronics, Inc.
Fidelipac Corp.
Harris Corp. Broadcast Products Div.
Merlin Engineering Works, Inc.
Multi-Track Magnetics, Inc.
Nagra Magnetic Recorders, Inc.
Pentagon Industries, Inc.
Videomagnetics, Inc.

Head Cleaning Products, Video

Comprehensive Video Supply Corp.
Fuji Photo Film USA, Inc. Magnetic Tape Div.
Nortronics Co., Inc. Recorder Care Div.
Sony Corp. of America
3M Co. Magnetic Audio/Video Prod. Div.

Head Covers, Videotape

Merlin Engineering Works, Inc.
Videomagnetics, Inc.

Head Nest Rebuilding Services

International Electro-Magnetics
Lipps, Inc.
Minneapolis Magnetics
Taber Mfg. & Eng. Co.
United Research Lab Corp.

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Audio-Technica U.S., Inc.
Audiosears Corp.
Bell & Howell Audio Visual Div.
Beyer Dynamic, Inc.
Broadcast Electronics, Inc.
Cetec Broadcast Group
David Clark Co., Inc.
Ercona Corp.
G C Electronics Div. Wallace Murray
Harris Corp. Broadcast Products Div.
Integrated Sound Systems Inc.
Micro-Trak Corp.
Miles Associates Div. Miles Products Ltd.
Nagra Magnetic Recorders, Inc.
Neal Ferrograph U.S.A., Inc.
Orange County Elec. Int'l., Inc.
Panasonic Company
R-Columbia Products Co., Inc.
Robins Industries Corp.
Setcom Corp.
Stanton Magnetics Inc.
Television Equipment Associates
Telex Communications, Inc.
Vidaire Electronics Mfg. Corp.

Headphones, Announcers Earpiece

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Beyer Dynamic, Inc.
Broadcast Electronics, Inc.
Cetec Broadcast Group
Clear-Com Intercom Systems
DYMA Engineering, Inc.
Electro-Voice Inc.
Ercona Corp.
Harris Corp. Broadcast Products Div.
Orange County Elec. Int'l., Inc.
R-Columbia Products Co., Inc.
Sennheiser Electronic
Setcom Corp.
Television Equipment Associates
Telex Communications, Inc.

Headphones, Broadcast Monitoring

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Beyer Dynamic, Inc.
Broadcast Electronics, Inc.
David Clark Co., Inc.
Clear-Com Intercom Systems
Ercona Corp.
Harris Corp. Broadcast Products Div.
Micro-Trak Corp.
Miles Associates Div. Miles Products Ltd.
Orange County Elec. Int'l., Inc.
Panasonic Company
R-Columbia Products Co., Inc.
Sennheiser Electronic
Setcom Corp.
Studer Revox America
Television Equipment Associates
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Headphones with Announcers Microphone

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Audiosears Corp.
Beyer Dynamic, Inc.
Broadcast Electronics, Inc.
Cetec Broadcast Group
David Clark Co., Inc.
DYMA Engineering, Inc.
Electro-Voice Inc.
Ercona Corp.
Harris Corp. Broadcast Products Div.
Micro-Trak Corp.
Miles Associates Div. Miles Products Ltd.
R-Columbia Products Co., Inc.
Setcom Corp.
Television Equipment Associates
Telex Communications, Inc.

Heads, Audio Stack

Glentronix (1977) Ltd.
Grandy, Inc.
International Electro-Magnetics
Lipps, Inc.
Norton Associates Inc.
Nortronics Co., Inc. Recorder Care Div.
Saki Magnetics, Inc.
Taber Mfg. & Eng. Co.
Vikron, Inc.

Heads, Contactor

Lipps, Inc.
Nortronics Co., Inc. Recorder Care Div.

Heads, Erase Magnetic

Broadcast Electronics, Inc.
Ercona Corp.
Grandy, Inc.
International Electro-Magnetics
Lipps, Inc.
Magna-Tech Electronic Co., Inc.
Minneapolis Magnetics
Norton Associates Inc.
Nortronics Co., Inc. Recorder Care Div.
Saki Magnetics, Inc.
Taber Mfg. & Eng. Co.
UMC Electronics Co. Broadcast Products Div.
Vikron, Inc.

Heads, Film Stripe

Grandy, Inc.
International Electro-Magnetics
Lipps, Inc.
Magna-Tech Electronic Co., Inc.
Multi-Track Magnetics, Inc.
Norton Associates Inc.
Nortronics Co., Inc. Recorder Care Div.
Saki Magnetics, Inc.

Heads, Recording Magnetic

Ampex Corp.
Ampro Broadcasting
Broadcast Electronics, Inc.
Ercona Corp.
Glentronix (1977) Ltd.
Grandy, Inc.
Harris Corp. Broadcast Products Div.
International Electro-Magnetics
Lipps, Inc.
Magna-Tech Electronic Co., Inc.
Minneapolis Magnetics
Nagra Magnetic Recorders, Inc.
Norton Associates Inc.
Nortronics Co., Inc. Recorder Care Div.
Saki Magnetics, Inc.
Soundscriber Magnetic Recording Co., Inc.
Spin Physics, Inc.
UMC Electronics Co. Broadcast Products Div.
Videomagnetics, Inc.
Videomax Div. Orrox Corp.
Vikron, Inc.

Heads, Refurbishing or Services for Audio and/or VTR

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Ampex Corp.
CMC Technology Corp.
Glentronix (1977) Ltd.
Grandy, Inc.
International Electro-Magnetics
Lipps, Inc.
Merlin Engineering Works, Inc.
Minneapolis Magnetics
Norton Associates Inc.
RCA Broadcast Systems
Saki Magnetics, Inc.
Sound Dynamics, Inc.
Spin Physics, Inc.
Videomagnetics, Inc.
Videomax Div. Orrox Corp.

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Asaca Corp. of America
Glentronix (1977) Ltd.
Javelin Electronics A Subs. of Kidde, Inc.
Minneapolis Magnetics
RCA Broadcast Systems
Spin Physics, Inc.
Taber Mfg. & Eng. Co.
Videomagnetics, Inc.

Heat Exchangers

Comark Communications, Inc.
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Leasametric
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Century Precision Cine/Optics
Ercona Corp.
Fujinon Optical, Inc.
Alan Gordon Enterprises Inc.
Tele-Cine Inc.

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Ercona Corp.
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Jos. Schneider GmbH & Co.
Warren R. Smith Co.
Tele-Cine Inc.
3D Television Systems Inc.
VMI-Visual Methods Inc.

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Buhl Optical Co.
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Century Precision Cine/Optics
Cinema Products Corp.
D.O. Industries, Inc.
Ercona Corp.
Frezzolini Electronics, Inc.
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Lenzar Optics Corp.
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Jos. Schneider GmbH & Co.
Schudel, Inc.
Tele-Cine Inc.
3D Television Systems Inc.
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Ercona Corp.
Fujinon Optical, Inc.
Karl Heitz, Inc.
Hitachi Denshi America, Ltd.
Javelin Electronics A Subs. of Kidde, Inc.
Lenzar Optics Corp.
Jos. Schneider GmbH & Co.
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Thorn Lighting, Inc.

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Lighting, TV Portable System

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Janson Industries
Kliegl Bros. Lighting
LTM Corp. of America
Lowel-Light
Matthews Studio Equipment, Inc.
Packaged Lighting Systems
Panoak Lighting Systems
Smith-Victor Corp.
Strand Century, Inc.

Lighting Transformers

Decca Austin Insulators
Harris Corp. Broadcast Products Div.
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MCG Electronics Inc.
Multiplier Industries Corp.
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Wilkinson Electronics, Inc.

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Berkey-Colortran Inc.
Cinema Products Corp.
The Great American Market
Kliegl Bros. Lighting
LTM Corp. of America
Mole-Richardson Co.
Osram/Macbeth Sales Corp.
Panoak Lighting Systems
Strand Century, Inc.

Lights, On Air

Broadcast Electronics, Inc.
Fidelipac Corp.
Harris Corp. Broadcast Products Div.

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Belden Communications, Inc.
Berkey-Colortran Inc.
Cine 60, Inc.
Cinema Products Corp.
Cool Light Co., Inc.
Film/Video Equip. Service Co.
Frezzolini Electronics, Inc.
Harwood Mfg. Co. Subs. Elgin Nat'l. Industries, Inc.
Karl Heitz, Inc.
Kliegl Bros. Lighting
LTM Corp. of America
Lowel-Light
Mole-Richardson Co.
Multiplier Industries Corp.
Packaged Lighting Systems
Panoak Lighting Systems
Strand Century, Inc.
Thorn Lighting, Inc.

Lights, Portable, Kit

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Cine 60, Inc.
Cinema Products Corp.
Cool Light Co., Inc.
Electronics Diversified, Inc.
The Great American Market
Harris Corp. Broadcast Products Div.
Impact Case Sales Ltd.
Kliegl Bros. Lighting
LTM Corp. of America
Lowel-Light
Mole-Richardson Co.
Multiplier Industries Corp.
Packaged Lighting Systems
Panoak Lighting Systems
Smith-Victor Corp.
Strand Century, Inc.

Lights, Studio Warning

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Harris Corp. Broadcast Products Div.

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Elcom Engineering Co.
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dbx, Inc.
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Elcom Specialty Products, Inc.
Eventide Clock Works Inc.
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Kahn Communications, Inc.
James B. Lansing Sound, Inc.
Marti Electronics
Modular Audio Products Unit of Modular Devices, Inc.
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Rupert Neve, Inc.
Opamp Labs, Inc.
Orange County Elec. Int'l., Inc.
Orban Assoc. Inc.
ProTech Audio Corp.
QEI Corp.
Ramko Research Inc.
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SGL Waber Electric
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CSP Inc.
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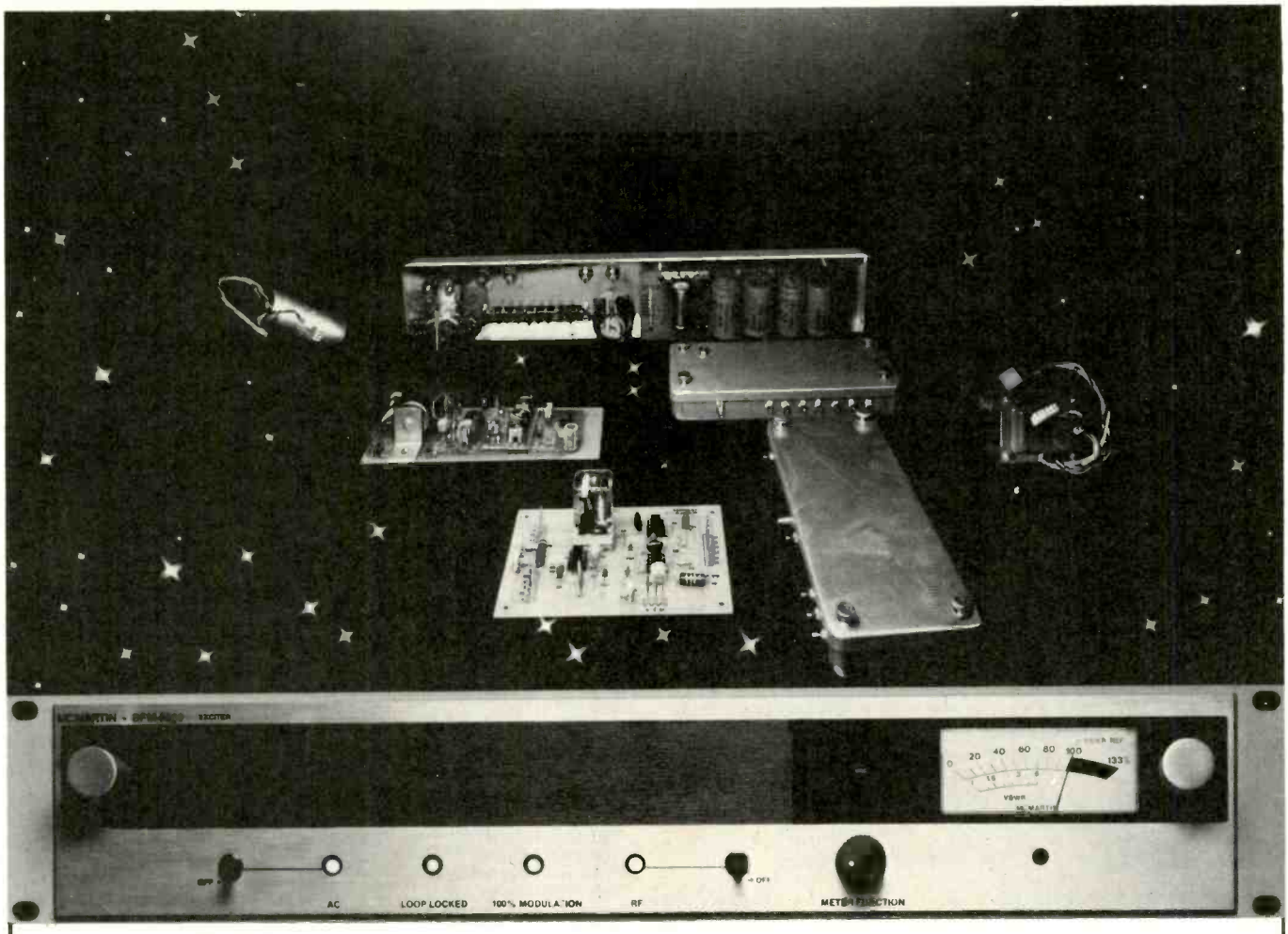

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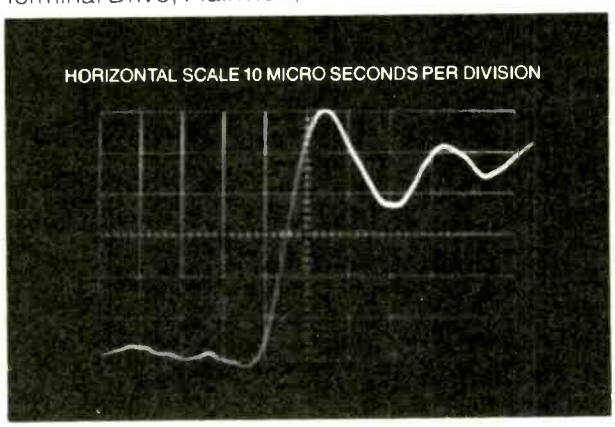

Actual unretouched oscilloscope photograph showing rise time of 980LZS using CBS STR112 record.

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D'San Corp.
Fernseh Inc.
Gorman-Redlich Mfg. Co.
LeCroy Fiberoptic Systems

Monitor Mounts, Wall and Ceiling

Electrohome Ltd.
GKM Mfg. Corp.

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CSP Inc.
Cetec Broadcast Group
Delta Electronics Inc. (Va.)
Gorman-Redlich Mfg. Co.
Harris Corp. Broadcast Products Div.
Lampkin Lab. Inc.
McKay Dymek Co.
McMartin Industries, Inc.
Micro-Trak Corp.
QEI Corp.
Sono-Mag Corp.
Soundscriber Magnetic Recording Co., Inc.
Telemet Div. A Geotel, Co.
Time & Frequency Tech., Inc.
Wilkinson Electronics, Inc.

Monitors, FM System

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Belar Electronics Lab., Inc. 245

Belar Electronics Lab., Inc.
Cetec Broadcast Group
Eidson Electronic Co.
Emergency Alert Receiver Inc.
Harris Corp. Broadcast Products Div.
Lampkin Lab. Inc.
McMartin Industries, Inc.
Micro-Trak Corp.
QEI Corp.
Sono-Mag Corp.
Soundscriber Magnetic Recording Co., Inc.
Studer Revox America
Time & Frequency Tech., Inc.

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Cetec Broadcast Group
Emergency Alert Receiver Inc.
Harris Corp. Broadcast Products Div.
McMartin Industries, Inc.
QEI Corp.
Time & Frequency Tech., Inc.

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CSP Inc.
Delta Electronics Inc. (Va.)
Gorman-Redlich Mfg. Co.
Harris Corp. Broadcast Products Div.
Potomac Instruments, Inc.

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CSP Inc.
Delta Electronics Inc. (Va.)
Gorman-Redlich Mfg. Co.
Harris Corp. Broadcast Products Div.
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Tennaplex Systems Ltd.
Wide Band Engineering Co., Inc.

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CSP Inc.
Comark Industries Inc.
Delta Electronics Inc. (Va.)
Gorman-Redlich Mfg. Co.
Harris Corp. Broadcast Products Div.
Micro Communications, Inc.
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Cetec Broadcast Group
Dranetz Engineering Labs., Inc.
Eaton Corp., L.A. Plant Elec. Instrumentation Div.
Eidson Electronic Co.
Elcom Engineering Co.
Harris Corp. Broadcast Products Div.
Lampkin Lab. Inc.
McMartin Industries, Inc.
Motorola Communications and Electronics Inc.
Philips Test & Measuring Instruments, Inc.
Time & Frequency Tech., Inc.
Versa Count Engineering
Wilkinson Electronics, Inc.

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Monitors, Modulation

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Lampkin Lab. Inc.
Marconi Instruments Div. of Marconi Electronics Inc.
McMartin Industries, Inc.
QEI Corp.
Time & Frequency Tech., Inc.
Versa Count Engineering
Wilkinson Electronics, Inc.

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Dranetz Engineering Labs., Inc.
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Bird Electronic Corp.
Delta Electronics Inc. (Va.)
Dranetz Engineering Labs., Inc.
G & M Power Products
Harris Corp. Broadcast Products Div.
Harris Corp. PRD Electronics Div.
Moseley Associates, Inc.
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Altec Lansing Sound Products
Amber Electro Design, Ltd.
Audicon, Inc.
Audio Technology
Auratone Corp.
Autogram Corp.
B & I Electronics, Inc.
Belar Electronics Lab., Inc.
Bogen Div. Lear Siegler, Inc.
Comrex Corp.
Crown International, Inc.
dbx, Inc.
Delta Electronics Inc. (Va.)
Di-Tech Inc.
DYMA Engineering, Inc.
Electro-Voice Inc.
Gotham Audio Corp.
Harris Corp. Broadcast Products Div.
James B. Lansing Sound, Inc.
Marconi Communication Systems Ltd.
Marti Electronics
Micro-Trak Corp.
Modular Audio Products Unit of Modular Devices, Inc.
Rupert Neve, Inc.
Orange County Elec. Int'l., Inc.
ProTech Audio Corp.
RTS Systems, Inc.
Ramko Research Inc.
Sennheiser Electronic
Soundscriber Magnetic Recording Co., Inc.
Spectra Sonics
Studer Revox America
Telemet Div. A Geotel, Co.
Ultra Audio Pixtec
United Recording Electronics Industries

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Belar Electronics Lab., Inc. 245

Belar Electronics Lab., Inc.
Bird Electronic Corp.
Delta Electronics Inc. (Va.)
Harris Corp. Broadcast Products Div.
Lampkin Lab. Inc.
Moseley Associates, Inc.
Soll, Inc.
Tektronix Inc.
Wide Band Engineering Co., Inc.

Monitors, Set-up and Matching Equipment

Power-Optics, Inc.

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Kahn Communications, Inc.
McMartin Industries, Inc.
QEI Corp.
Sono-Mag Corp.
Spectra Sonics
3D Television Systems Inc.
Time & Frequency Tech., Inc.
Versa Count Engineering
Wilkinson Electronics, Inc.

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Cohu, Inc. Electronics Div.
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Fernseh Inc.
GBC Closed Circuit TV Corp.
Harris Corp. Broadcast Products Div.
Hitachi Denshi America, Ltd.
Javelin Electronics A Subs. of Kidde, Inc.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Marconi Instruments Div. of Marconi Electronics Inc.
Panasonic Company
Panasonic Co. Video Systems Div.
Tektronix Inc.
3D Television Systems Inc.
Time & Frequency Tech., Inc.
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Conrac Div. Conrac Corp.
Consolidated Electronic Industries
Crosspoint Latch Corp.
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Electrohome Ltd.
Fernseh Inc.
Glentronix (1977) Ltd.
Harris Corp. Broadcast Products Div.
Hitachi Denshi America, Ltd.
Ikegami Electronics (USA) Inc.
Javelin Electronics A Subs. of Kidde, Inc.
Lenco Inc. Electronics Div.
Motorola Communications and Electronics Inc.
Panasonic Company
Panasonic Co. Video Systems Div.
Rohde & Schwarz Sales Co.
Sony Corp. of America
Tektronix Inc.
Unimedia Corp.
VMI-Visual Methods Inc.
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Crosspoint Latch Corp.
Electro & Optical Systems Ltd.
Electrohome Ltd.
Fernseh Inc.
Glentronix (1977) Ltd.
Harris Corp. Broadcast Products Div.
Hitachi Denshi America, Ltd.
Ikegami Electronics (USA) Inc.
Image Magnification, Inc.
Image Resource Corp.
Leasametric
Lectrotech Inc.
Lenco Inc. Electronics Div.
Marconi Electronics Inc. Broadcast & Communication Div.
Panasonic Company
Panasonic Co. Video Systems Div.
Rohde & Schwarz Sales Co.
Sharp Electronics Corp.
Sony Corp. of America
Tektronix Inc.
US JVC Corp. Professional Video Div.
Unimedia Corp.
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Electrohome Ltd.
Fernseh Inc.
Lenco Inc. Electronics Div.
Rohde & Schwarz Sales Co.
Tektronix Inc.
Unimedia Corp.
Video Aids of Colorado
Video Data Systems
Videotek, Inc.
World Video Inc.

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Leader Instruments Corp.
Leasametric
Lectrotech Inc.
Marconi Communication Systems Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
Philips Broadcast Equip Corp.
Philips Test & Measuring Instruments, Inc.
Rohde & Schwarz Sales Co.
Sharp Electronics Corp.
Tektronix Inc.
Ultra Audio Pixtec
Videotek, Inc.

Multicarrier Systems, FM

Coastcom
Moseley Associates, Inc.

Multimeters, Microwave

The Narda Microwave Corp.

Multiplexers

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Robert Bosch GmbH
Buhl Optical Co.
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Coastcom
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Comark Industries Inc.
Dielectric Communications A Unit of General Signal
Fernseh Inc.
Harris Corp. Broadcast Products Div.
Kalart Victor Corp.
Laird Telemedia Inc.
LeCroy Fiberoptic Systems
Micro Communications, Inc.
Moseley Associates, Inc.
Motorola Semiconductor Products Inc.
Mu-Del Electronics, Inc.
North Hills Electronics, Inc.
Portac Inc.
Rockwell Int'l. Collins Broadcast Products
Shively Laboratories, Inc.
Strand Century, Inc.
TT Electronics, Inc.
Tektronix Inc.
TerraCom Loral Corp.
Times Fiber Communications, Inc. Div. Times Wire & Cable

Music, Production

Emil Ascher, Inc.
The CnB Studios
Columbia Special Products
De Wolfe Music Library
Live Sound Inc.
Money Machine
William B. Tanner Co. Inc.

Music, Programmed

Emil Ascher, Inc.
Broadcast Programming Int'l., Inc.
The CnB Studios
CaVox Stereo Productions
Chase Media, Inc.
Command Productions Radio Broadcasting Services
KalaMusic
Live Sound Inc.
William B. Tanner Co. Inc.
Tape-Athon Corp. Cavox Stereo Productions
Thomas Valentino Inc.

Music, Sound Effects/Libraries

Emil Ascher, Inc.
The CnB Studios
Columbia Special Products
De Wolfe Music Library
Money Machine
William B. Tanner Co. Inc.

Narrow Band FM Equipment

CSI Electronics, Inc.
Coastcom
Dielectric Communications A Unit of General Signal
Marti Electronics
McMartin Industries, Inc.
Motorola Communications and Electronics Inc.
Times Fiber Communications, Inc. Div. Times Wire & Cable

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Cetec Broadcast Group
ESE
IGM Communications

Networks, Matching Audio

Altec Lansing Sound Products
DYMA Engineering, Inc.
Gerard Tech
ProTech Audio Corp.
Quad-Eight Electronics
TT Electronics, Inc.
Tech Laboratories Inc.

Networks, Matching RF

Alford Mfg. Co.
CSI Electronics, Inc.
Comark Communications, Inc.
Comark Industries Inc.
Continental Electronics Mfg. Co.
Dielectric Communications A Unit of General Signal
ESC Electronics Corp.
Micro Communications, Inc.
North Hills Electronics, Inc.
TT Electronics, Inc.
Wide Band Engineering Co., Inc.

Networks, Mixing

Dielectric Communications A Unit of General Signal
Maldwyn Bowden Int'l. Ltd.
ProTech Audio Corp.
Quad-Eight Electronics
Tech Laboratories Inc.

Networks, Phasing --See also Phasing Units

CSI Electronics, Inc.
CSP Inc.
Comark Industries Inc.
Continental Electronics Mfg. Co.
Dielectric Communications A Unit of General Signal
Geleco Electronics Ltd.
Kahn Communications, Inc.
TT Electronics, Inc.

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Audicon, Inc.
Audio & Design Recording
Robert Bosch GmbH
Coastcom
dbx, Inc.
Dolby Laboratories, Inc.
Electro & Optical Systems Ltd.
Faroudja Labs
Fernseh Inc.
Gotham Audio Corp.
Harris Corp. Broadcast Products Div.
Harris Video Systems
Inovonics Inc.
Integrex, Inc.
Kahn Communications, Inc.
MCI/Quantel
Microtime, Inc.
NEC America, Inc. Broadcast Equip. Div.
Orange County Elec. Int'l., Inc.
Philips Broadcast Equip Corp.
Siegel Electronics
Valley People, Inc.
Van San Corp.

Oscillator Transformers

Nortronics Co., Inc. Recorder Care Div.
TT Electronics, Inc.

Oscillators, AM

Delta Electronics Inc. (Va.)
DYMA Engineering, Inc.
John Fluke Mfg. Co., Inc.
Frequency Devices Inc.
International Microwave Corp.
Lampkin Lab. Inc.
Marconi Instruments Div. of Marconi Electronics Inc.
Opamp Labs, Inc.
Potomac Instruments, Inc.
Rohde & Schwarz Sales Co.
Texscan Corp.

Oscillators, FM

John Fluke Mfg. Co., Inc.
Frequency Devices Inc.
Marconi Instruments Div. of Marconi Electronics Inc.
Rohde & Schwarz Sales Co.
Texscan Corp.

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Audisar
Bald Mountain Lab
Channelmatic, Inc.
Frequency Devices Inc.
Gorman-Redlich Mfg. Co.
Modular Audio Products Unit of Modular Devices, Inc.
Monroe Electronics, Inc.
Motorola Communications and Electronics Inc.
Neal Ferrograph U.S.A., Inc.
Rupert Neve, Inc.
Opamp Labs, Inc.
ProTech Audio Corp.
Quad-Eight Electronics
Scantex Labs Inc.
Sphere Electronics
TM Systems, Inc.
Tri Tec Systems Inc.
Wang Voice Comm. Inc.
Ward-Beck Systems, Ltd.

Oscillators, TV

Asaca Corp. of America
Leitch Video Ltd.
Marconi Instruments Div. of Marconi Electronics Inc.
Rohde & Schwarz Sales Co.
Tektronix Inc.

Oscilloscope Cameras

Harris Corp. Broadcast Products Div.
Karl Heitz, Inc.
Leasametric
Lenzar Optics Corp.
Philips Test & Measuring Instruments, Inc.
Tektronix Inc.

Oscilloscope Vector Displays

Alford Mfg. Co.
B & K Precision Dynascan Corp.
Broadcast Video Systems, Ltd.
Electro & Optical Systems Ltd.
Harris Corp. Broadcast Products Div.
Leasametric
Lectrotech Inc.
Sencore, Inc.
Tektronix Inc.
Ultra Audio Pixtec

Oscilloscopes, Dual Trace

B & K Precision Dynascan Corp.
Gould Inc. Instruments Div.
Harris Corp. Broadcast Products Div.
Hickok Elec. Inst. Co.
Hitachi Denshi America, Ltd.
ITT Instruments & Components Metrix Div.
Leader Instruments Corp.
Leasametric
Lectrotech Inc.
Motorola Communications and Electronics Inc.
Philips Test & Measuring Instruments, Inc.
Sencore, Inc.
Tektronix Inc.
VIZ Mfg. Co.

Oscilloscopes, Rack Type

B & K Precision Dynascan Corp.
Gould Inc. Instruments Div.
Harris Corp. Broadcast Products Div.
Hickok Elec. Inst. Co.
Leader Instruments Corp.
Leasametric
Philips Test & Measuring Instruments, Inc.
Tektronix Inc.

Oscilloscopes, Triggered Sweep

B & K Precision Dynascan Corp.
Gould Inc. Instruments Div.
Harris Corp. Broadcast Products Div.
Hickok Elec. Inst. Co.
ITT Instruments & Components Metrix Div.
Leader Instruments Corp.
Leasametric
Lectrotech Inc.
Motorola Communications and Electronics Inc.
Philips Test & Measuring Instruments, Inc.
Sencore, Inc.
Tektronix Inc.
VIZ Mfg. Co.

Oscilloscopes, Wideband

Gould Inc. Instruments Div.
Harris Corp. Broadcast Products Div.
Hickok Elec. Inst. Co.
ITT Instruments & Components Metrix Div.
Leader Instruments Corp.
Leasametric
Lectrotech Inc.
Philips Test & Measuring Instruments, Inc.
Sencore, Inc.
Tektronix Inc.

Parts and Components, Electronic Equipment

ADC Products
Audicon, Inc.
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Broadcast Electronics, Inc.
G C Electronics Div. Wallace Murray
Geleco Electronics Ltd.
Global Specialties Corp.
Merlin Engineering Works, Inc.
Microtran Co., Inc.
Panasonic Company
Varian Associates, Inc. Electron Device Group
Vector Electronic Co., Inc.

Patch Panels, Jacks and Plugs

ADC Products
ADM Technology, Inc.
AVA Electronics
Altec Lansing Sound Products
Audicon, Inc.
Audio Accessories, Inc.
Auditronics, Inc.
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Berkey-Colortran Inc.
Broadcast Electronics, Inc.
Comark Industries Inc.
Dielectric Communications A Unit of General Signal
DYMA Engineering, Inc.
Dynatech Data Systems
Electronics Diversified, Inc.
Farrtronics Ltd.
Glentronix (1977) Ltd.
Harris Corp. Broadcast Products Div.
Kliegl Bros. Lighting
Micro Communications, Inc.
Millen Components Div. of E.I. & S. Corp.
Panoak Lighting Systems
Phelps Dodge Communications Co.
Potomac Instruments, Inc.
Rex Rheostat & Co., Inc.
Shively Laboratories, Inc.
Strand Century, Inc.
Switchcraft Inc.
TEAC Corp of America
Tangent Systems, Inc.
Telectric Co.
Theatre Techniques Inc.
Trompeter Electronics, Inc.
Union Connector Co., Inc.

Phase Converters, Single to Three Phase

California Instruments
Harris Corp. Broadcast Products Div.
Kay Industries, Inc.

Phasing Units --See also Networks, Phasing

Alford Mfg. Co.
CSI Electronics, Inc.
CSP Inc.
Comark Industries Inc.
Continental Electronics Mfg. Co.
Dielectric Communications A Unit of General Signal
Eventide Clock Works Inc.
Geleco Electronics Ltd.
Harris Corp. Broadcast Products Div.
Ikegami Electronics (USA) Inc.
Kahn Communications, Inc.
TT Electronics, Inc.

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Audicon, Inc.
Don Britton Enterprises
CSP Inc.
Jim Cason Electronics
Centro Corp.
DYMA Engineering, Inc.
Harris Corp. Broadcast Products Div.
Radiotechniques
Ruslang Corp.
Sharepoint Systems Inc.
Soll, Inc.

Pointers, Video Screen

Central Dynamics Corp.
Ednalite Corp.
Industrial Sciences, Inc. (ISI)
Interand Corp. Telestrator Div.

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AKG Acoustics, Inc.
Altec Lansing Sound Products
Anderson Scientific
B & K Precision Dynascan Corp.
California Instruments
Delta Electronics Inc. (N.C.)
Dynamote Corp.
Engineering Associates
G C Electronics Div. Wallace Murray
GTE Products Corp. Sylvania CATV Div.
Kay Industries, Inc.
Merill Cable Equipment Corp.
Microwave Associates Communications Co.
Microwave Power Devices, Inc.

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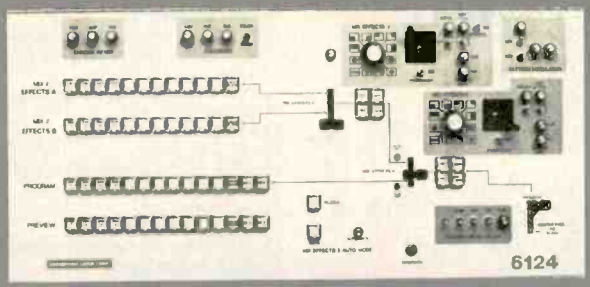
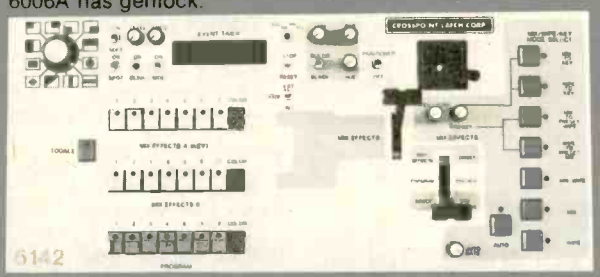
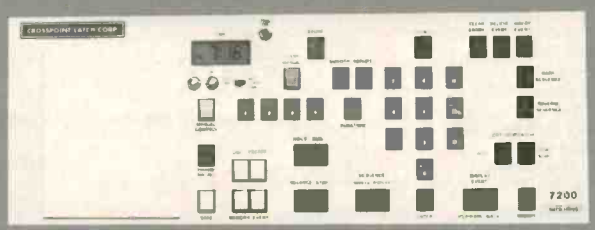


Model 6124 Twelve inputs (including colorizer/black). Two fully independent mix effects systems each with double re-entry. Master fade to black. Remote control panel. Downstream keyer with matte and blink. Plug compatible with **AUTO DRIVE.™** Chroma keyer.

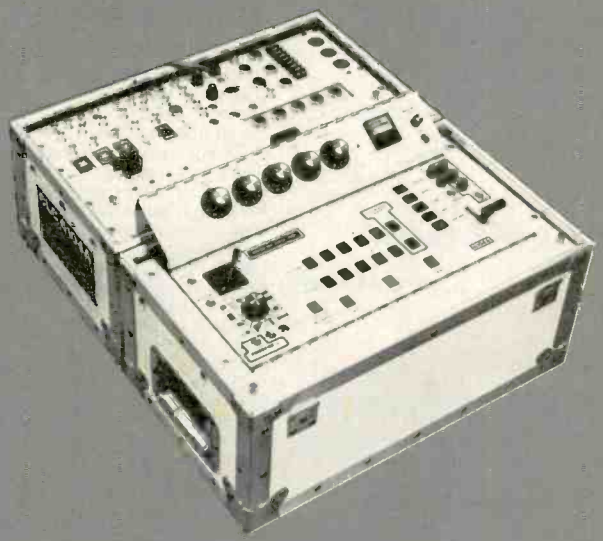
Model 6006/6006A Sync generator with four independently phase adjustable outputs for sync; four 360° adjustable subcarrier outputs. Two black burst outputs. 6006A has genlock.



Model 6142 Three bus switcher with eight inputs including colorizer. Double re-entry. Two fader handles permits mixing from one input to a wipe between two other inputs.

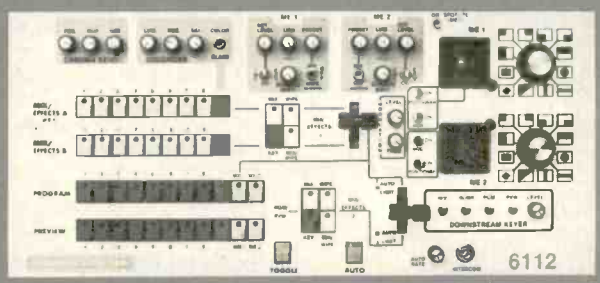


Model 7200 AUTO DRIVE™ Computer controller. Plug compatible option for 6112 and 6124 switchers stores 255 events which can be grouped into any number of sequences. Each event has a maximum duration of 99 minutes: Frame accurate. Production tool which enables complex effects to be run in rapid sequence. Drastically cuts down editing time. It also interfaces with editors.



Model 6104A Portable switching system in a suitcase. 117V AC or 12V DC operation. Built-in sync generator with full set of drives for five cameras of any make or model. Audio mixer. Built into robust carrying case. Companion monitor units also in rugged cases.

Model 6118 PIXIE™ Six inputs (including colorizer/black). Automatic lock for four Sony 1610, 1640 or JVC G71US cameras. Also operates with any kind of camera. Intercom, tally. Genlocks to camera 1. Colorizer.



Model 6112 Nine inputs (including colorizer/black) four buses. Two fully independent MIX EFFECTS systems, downstream keyer with preview, matte and blink. Remote control panel. Double re-entry on each ME. Optional encoded Chroma keyer.

For information on these and other products call or write to:

CROSSPOINT LATCH CORP.

316 Broad Street Summit, New Jersey 07901 Tel. (201) 273-1090

Circle (122) on Reply Card

Motorola Communications and Electronics Inc.
Nagra Magnetic Recorders, Inc.
Nova Electric Mfg. Co.
Opamp Labs, Inc.
Quad-Eight Electronics
SGL Waber Electric
Sorenson Co. A Unit of Raytheon Co.
Tektronix Inc.
Topaz Electronics
VIZ Mfg. Co.
Vanner, Inc.

Power Supplies, Precision

Altec Lansing Sound Products
Analog Devices, Inc.
B & K Precision Dynascan Corp.
Boston Sound & Power Systems
Comark Communications, Inc.
Computer Products Inc. Power Products Div.
dbx, Inc.
Engineering Associates
Frequency Devices Inc.
G C Electronics Div. Wallace Murray
Harris Corp. PRD Electronics Div.
Modular Audio Products Unit of Modular Devices, Inc.
North Hills Electronics, Inc.
Opamp Labs, Inc.
ProTech Audio Corp.
Sorenson Co. A Unit of Raytheon Co.
Tektronix Inc.
Topaz Electronics
VIZ Mfg. Co.
Vanner, Inc.
Ward-Beck Systems, Ltd.

Power Supplies, Standby

Computer Products Inc. Power Products Div.
Dynamote Corp.
G & M Power Products
GTE Products Corp. Sylvania CATV Div.
Kay Industries, Inc.
Microwave Associates Communications Co.
Nova Electric Mfg. Co.
Tech Laboratories Inc.
Topaz Electronics
Vanner, Inc.

Preamplifiers, Audio

ADM Technology, Inc.
ATI-Audio Technologies Inc.
Altec Lansing Sound Products
American Data Corp. A North American Philips Co.
Audicon, Inc.
Audio & Design Recording
Audio Technology
Audionics, Inc.
Autogram Corp.
BGW Systems Inc.
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Bell Audio Systems, Inc.
Bogen Div. Lear Siegler, Inc.
Boston Sound & Power Systems
Broadcast Electronics, Inc.
Cetec Broadcast Group
Crown International, Inc.
dbx, Inc.
Delta Electronics Inc. (N.C.)
DYMA Engineering, Inc.
Dynair Electronics, Inc.
Edcor
Eumig USA, Inc. 225 Community Dr.
G C Electronics Div. Wallace Murray
Gregg Laboratories
Harris Corp. Broadcast Products Div.
Integrated Sound Systems Inc.
International Nuclear Corp.
James B. Lansing Sound, Inc.
LeCroy Fiberoptic Systems
Logitek Electronic Systems, Inc.
McCurdy Radio Ind. Inc.
McMartin Industries, Inc.
Micro-Trak Corp.
Modular Audio Products Unit of Modular Devices, Inc.
Motorola Semiconductor Products Inc.
Nagra Magnetic Recorders, Inc.
Rupert Neve, Inc.
Opamp Labs, Inc.
Orange County Elec. Int'l., Inc.
Panasonic Company
Panasonic Co. Professional Audio Div.
Paso Sound Products Inc.
ProTech Audio Corp.
QRK Broadcast Electronics
Quad-Eight Electronics
RTS Systems, Inc.
Ramko Research Inc.
Richmond Sound Design, Ltd.
Russco Electronics Mfg. Inc.
Sansui Electronics Corp.
Scantex Labs Inc.
Sescom, Inc.
Shure Brothers Inc.
Sono-Mag Corp.
Sontec Electronics
Spectra Sonics
Sphere Electronics
Stanton Magnetics Inc.
Studer Revox America
Superscope Inc.
TEAC Corp of America
Tangent Systems, Inc.
Telex Communications, Inc.
Tri Tec Systems Inc.
United Recording Electronics Industries
VIF International
Wilkinson Electronics, Inc.

Preamplifiers, Limiter-Compressor

ATI-Audio Technologies Inc.
Altec Lansing Sound Products
Applied Technology Corp.
Audicon, Inc.
Audio & Design Recording
Coastcom
DYMA Engineering, Inc.
Gregg Laboratories
Harris Corp. Broadcast Products Div.
ITI Electronics, Inc.
Orange County Elec. Int'l., Inc.
ProTech Audio Corp.
Quad-Eight Electronics
Ramko Research Inc.
Richmond Sound Design, Ltd.
Scantex Labs Inc.
Sescom, Inc.
Sontec Electronics
Spectra Sonics
Ultra Audio Pixtec
United Recording Electronics Industries
Wang Voice Comm. Inc.

Preamplifiers, Microphone

ADM Technology, Inc.
AKG Acoustics, Inc.
ATI-Audio Technologies Inc.
Altec Lansing Sound Products
Audicon, Inc.
Audio & Design Recording
Autogram Corp.
Broadcast Electronics, Inc.
Bruel & Kjaer Instruments, Inc.
DYMA Engineering, Inc.
Edcor
Gregg Laboratories
Harris Corp. Broadcast Products Div.
Harrison Systems Inc.
ITI Electronics, Inc.
Micro-Trak Corp.
Modular Audio Products Unit of Modular Devices, Inc.
Nagra Magnetic Recorders, Inc.
Opamp Labs, Inc.
Paso Sound Products Inc.
ProTech Audio Corp.
Quad-Eight Electronics
RTS Systems, Inc.
Ramko Research Inc.
Richmond Sound Design, Ltd.
Russco Electronics Mfg. Inc.
Scantex Labs Inc.
Sescom, Inc.
Sontec Electronics
Spectra Sonics
Sphere Electronics
Tri Tec Systems Inc.

Preamplifiers, Microwave

Mu-Del Electronics, Inc.
North Hills Electronics, Inc.
Tayburn Electronics, Inc.

Preamplifiers, Stereo

ATI-Audio Technologies Inc.
Audio Technology
Broadcast Electronics, Inc.
Cetec Broadcast Group
DYMA Engineering, Inc.
Eumig USA, Inc. 225 Community Dr.
The Finney Co.
Harris Corp. Broadcast Products Div.
Integrated Sound Systems Inc.
Logitek Electronic Systems, Inc.
Micro-Trak Corp.
Panasonic Company
Paso Sound Products Inc.
ProTech Audio Corp.
QRK Broadcast Electronics
Ramko Research Inc.
Richmond Sound Design, Ltd.
Russco Electronics Mfg. Inc.
Scantex Labs Inc.
Sontec Electronics
Spectra Sonics
Superscope Inc.
TEAC Corp of America
Wang Voice Comm. Inc.

Preamplifiers, Turntable

ATI-Audio Technologies Inc.
Ampro Broadcasting
Applied Technology Corp.
Audio Technology
Audionics, Inc.
Broadcast Electronics, Inc.
Cetec Broadcast Group
DYMA Engineering, Inc.
EAR Systems, Inc.
EMT-FRANZ GMBH
Gregg Laboratories
Harris Corp. Broadcast Products Div.
Howe Audio Productions, Inc.
LPB Inc.
Logitek Electronic Systems, Inc.
McCurdy Radio Ind. Inc.
McMartin Industries, Inc.
Micro-Trak Corp.
Modular Audio Products Unit of Modular Devices, Inc.
Rupert Neve, Inc.
Opamp Labs, Inc.
Pinzone Communications Products Inc.
ProTech Audio Corp.
QRK Broadcast Electronics
RTS Systems, Inc.
Radio Systems Inc.
Ramko Research Inc.
Russco Electronics Mfg. Inc.
Scantex Labs Inc.
Shure Brothers Inc.
Sontec Electronics
Spectra Sonics
Stanton Magnetics Inc.
United Recording Electronics Industries
Westrex
Wilkinson Electronics, Inc.

Preamplifiers, Video

The Finney Co.
Gardiner Communications Corp.
International Nuclear Corp.
LeCroy Fiberoptic Systems

Pressurization Equipment, Transmission Line

Andrew Corp.
Cablewave Systems Inc.
Cetec Broadcast Group
Dielectric Communications A Unit of General Signal
General Cable Corp.
Harris Corp. Broadcast Products Div.
Micro Communications, Inc.
Shively Laboratories, Inc.

Probes, Oscilloscope

B & K Precision Dynascan Corp.
Hickok Elec. Inst. Co.
ITT Instruments & Components Metrix Div.
Leader Instruments Corp.
Leasametric
Lectrotech Inc.
Philips Test & Measuring Instruments, Inc.
Tektronix Inc.
VIZ Mfg. Co.

Processing Equipment, Audio

AATON Cameras, Inc.
ADM Technology, Inc.
ATI-Audio Technologies Inc.
Applied Technology Corp.
Audicon, Inc.
Audio & Design Recording
Broadcast Electronics, Inc.
Circuit Research Labs, Inc.
dbx, Inc.
Delta Electronics Inc. (Va.)
Dolby Laboratories, Inc.
Elcom Specialty Products, Inc.
Gregg Laboratories
Harris Corp. Broadcast Products Div.
Inovonics Inc.

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DALLAS
2659 Fondren, Dallas, TX 75206 (214) 369-1165
DETROIT
32380 Howard, Madison Hgts., MI 48071 (313) 589-1900

Kahn Communications, Inc.
Orange County Elec. Int'l., Inc.
Orban Assoc. Inc.
Peterson Enterprises, Inc.
Phasecom Corp.
Quintek Inc.
Scantex Labs Inc.
Sescom, Inc.
Tangent Systems, Inc.
United Recording Electronics Industries

Processing Equipment, Video

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Automation Techniques, Inc.
Robert Bosch GmbH
Dynasciences Div. Whittaker Corp.
Faroudja Labs
Fernseh Inc.
Harris Corp. Broadcast Products Div.
Hollywood Film Co.
Image Resource Corp.
Kreonite, Inc.
Leitch Video Ltd.
Lenco Inc. Electronics Div.
MCI/Quantel
Marconi Electronics Inc. Broadcast & Communication Div.
Microtime, Inc.
Siegel Electronics
3M Co. Mincom Div.
Versa Count Engineering

Processors, Bleach Regeneration

Eastman Kodak Co.

Processors, Electronic Still

ADDA Corp.
Arvin/Echo Science Corp.
MCI/Quantel

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Audicon, Inc.
Broadcast Electronics, Inc.
Cetec Broadcast Group
Harris Corp. Broadcast Products Div.
LPB Inc.
MICMIX Audio Products, Inc.
Micro-Trak Corp.
Moseley Associates, Inc.
Orange County Elec. Int'l., Inc.
Pacific Recorders & Eng. Corp.
ProTech Audio Corp.
Sharepoint Systems Inc.
Tangent Systems, Inc.
Ward-Beck Systems, Ltd.

Programmer/Comparators

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ESE
PWH Electronics Ltd.
Tape-Athon Corp. Cavox Stereo Productions

Projector Lamps/Accessories

Belden Communications, Inc.
Bell & Howell Audio Visual Div.
Eastman Kodak Co.
Impact Case Sales Ltd.
Packaged Lighting Systems
Plastic Reel Corp. of America
Schuessler Case Co., Inc.
Sitler's Supplies, Inc.
Strand Century, Inc.
Thorn Lighting, Inc.
Varian Associates, Inc. Electron Device Group

Projectors, Film

Bell & Howell Audio Visual Div.
Dukane Corp. Audio-Visual Div.
Eastman Kodak Co.
Alan Gordon Enterprises Inc.
Harris Corp. Broadcast Products Div.
Hollywood Film Co.
Kalart Victor Corp.
L-W International
Laird Telemedia Inc.
Multi-Track Magnetics, Inc.
Optical Radiation Corp.
Radmar, Inc.

Projectors, Film Cassette Loading

Dukane Corp. Audio-Visual Div.

Projectors, Film Rear

Dukane Corp. Audio-Visual Div.
Radmar, Inc.
Research Technology, Inc.

Projectors, Slide

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Buhl Optical Co.
Eastman Kodak Co.
Harris Corp. Broadcast Products Div.
Kliegl Bros. Lighting
Laird Telemedia Inc.
Mast Development Co. A-V Systems Div.
Optical Radiation Corp.
Radmar, Inc.
Spindler & Sauppe, Inc.

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Electro & Optical Systems Ltd.
Electrohome Ltd.
General Electric Co. Video Display Equip. Op.
Image Magnification, Inc.
Kalart Victor Corp.
Panasonic Company
Panasonic Co. Video Systems Div.
Projection Systems, Inc.
Schudel, Inc.
Sony Corp. of America

Prompters

BEI-Beston Electronics, Inc.
Cinema Products Corp.
D'San Corp.
Harris Corp. Broadcast Products Div.
Q-TV
Telescript, Inc.

Proof Workbook (For FCC test requirements)

Intertec Publishing Corp.

Pulse Assignment Systems

Broadcast Video Systems, Ltd.
Central Dynamics Corp.
Leitch Video Ltd.

Purchasing Services, Broadcast Equipment

Jim Cason Electronics
Centro Corp.
DYMA Engineering, Inc.
Industrial Marketing Advisory Services, Inc.

Quadraphonic Systems

Audionics, Inc.
Belar Electronics Lab., Inc.
Catel Div. United Scientific Corp.
Edcor
Rupert Neve, Inc.
Sansui Electronics Corp.
Spectra Sonics
Tangent Systems, Inc.

Radar, Weather

Arvin/Echo Science Corp.
Enterprise Electronics Corp.
Information Processing Systems Of California, Inc.
Oktel Corp.
Sperry Marine Systems Sperry Corp.
Technology Service Corp. Development Labs Div.
Varian Associates, Inc. Electron Device Group
Weathermation, Inc.
Weather Services Corp.

Radomes

Andrew Corp.
Cetec Broadcast Group
Gabriel Electronics, Inc.
Harris Corp. Broadcast Products Div.
Micro Communications, Inc.
Nurad, Inc.
Shively Laboratories, Inc.

Receivers, AM

Bell Audio Systems, Inc.
Bogen Div. Lear Siegler, Inc.
Delta Electronics Inc. (Va.)
Elcom Engineering Co.
Eumig USA, Inc. 225 Community Dr.
International Microwave Corp.
Kahn Communications, Inc.
Marconi Instruments Div. of Marconi Electronics Inc.
McKay Dymek Co.
McMartin Industries, Inc.
Micro Communications, Inc.
Panasonic Company
Sansui Electronics Corp.
Studer Revox America
TEAC Corp of America

Receivers, Data

Coastcom
Electrohome Ltd.
International Microwave Corp.
Johnson Electronics Inc.
LeCroy Fiberoptic Systems
McMartin Industries, Inc.
Microwave Associates Communications Co.
Moseley Associates, Inc.
Valtec Corp. Communication Fiberoptics

Receivers, EBS

Elcom Engineering Co.
Emergency Alert Receiver Inc.
Gorman-Redlich Mfg. Co.
Harris Corp. Broadcast Products Div.
Logitek Electronic Systems, Inc.
McMartin Industries, Inc.
Microwave Associates Communications Co.
Time & Frequency Tech., Inc.

Receivers, Earth Station

California Microwave
Electrohome Ltd.
Gardiner Communications Corp.
Harris Corp. Broadcast Products Div.
Microdyne Corp.
Microwave Associates Communications Co.
Pinzone Communications Products Inc.
Rockwell Int'l. Collins Broadcast Products
Schudel, Inc.
TerraCom Loral Corp.
Western Tele-Communications, Inc.

Receivers, FM

Altec Lansing Sound Products
Bell Audio Systems, Inc.
Bogen Div. Lear Siegler, Inc.
Catel Div. United Scientific Corp.
Electrohome Ltd.
Emergency Alert Receiver Inc.
International Microwave Corp.
Johnson Electronics Inc.
LNR Communications, Inc.
Marconi Instruments Div. of Marconi Electronics Inc.
Marti Electronics
McMartin Industries, Inc.
Micro Communications, Inc.
Panasonic Company
Pyramid Loudspeaker Corp.
RHG Electronics Laboratory, Inc.
Rohde & Schwarz Sales Co.
Sansui Electronics Corp.
The Ken Schaffer Group, Inc.
Scientific Radio Systems, Inc.
Sonar Radio Corp.
Studer Revox America
Superscope Inc.
TEAC Corp of America
Times Fiber Communications, Inc. Div. Times Wire & Cable
Wilkinson Electronics, Inc.

Receivers, HF

Elcom Engineering Co.
Engineering Associates
Marconi Electronics Inc. Broadcast & Communication Div.
Marconi Instruments Div. of Marconi Electronics Inc.
McKay Dymek Co.
Rohde & Schwarz Sales Co.
Scientific Radio Systems, Inc.
Superscope Inc.

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Engineering Associates
Farinon Video
International Microwave Corp.
Marti Electronics
Micro Control Associates, Inc.
Microdyne Corp.
Microwave Associates Communications Co.
Moseley Associates, Inc.
Nurad, Inc.
RHG Electronics Laboratory, Inc.
Rockwell Int'l. Collins Broadcast Products
Scientific-Atlanta, Inc.
Tayburn Electronics, Inc.
Tepco Corp.
TerraCom Loral Corp.
Varian Associates, Inc. Electron Device Group

Receivers, Multiplex

Coastcom
International Microwave Corp.
Johnson Electronics Inc.
LeCroy Fiberoptic Systems
McMartin Industries, Inc.
Moseley Associates, Inc.
Pyramid Loudspeaker Corp.

Receivers, SCA

Contel Mfg.
Emergency Alert Receiver Inc.
Harris Corp. Broadcast Products Div.
Johnson Electronics Inc.
Marti Electronics
McMartin Industries, Inc.
Moseley Associates, Inc.

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Datametrics Inc.

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Image Magnification, Inc.
Panasonic Company
Panasonic Co. Video Systems Div.
Rohde & Schwarz Sales Co.
Sharp Electronics Corp.
Sony Corp. of America

Receivers, TV Monochrome

Electrohome Ltd.
Panasonic Company
Panasonic Co. Video Systems Div.
Sony Corp. of America

Receivers, Weather

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Gorman-Redlich Mfg. Co.
Motorola Communications and Electronics Inc.
Scientific Radio Systems, Inc.
Texas Electronics

Record Care Products

Osawa & Co. (USA), Inc.
Panasonic Company
Stanton Magnetics Inc.
United Research Lab Corp.

Recorder Amplifiers

Gould Inc. Instruments Div.
Harris Corp. Broadcast Products Div.
Inovonics Inc.
International Tapetronics Corp.
Magnasync/Moviola Corp.
Studer Revox America
Taber Mfg. & Eng. Co.
Telectro Systems Corp.
Telex Communications, Inc.
United Research Lab Corp.
VIF International

Recorder Care Products

KAPCO Communications
Nortronics Co., Inc. Recorder Care Div.
Osawa & Co. (USA), Inc.
Projector Recorder Belt Corp.

Recorder Carrying Systems, Videotape Portable

Comprehensive Video Supply Corp.
Gruber Products Co.
Impact Case Sales Ltd.
Javelin Electronics A Subs. of Kidde, Inc.
K & H Products, Ltd.
Lee-Ray Industries, Inc.
Panasonic Company

Recorder Drive Motor Power Supply Units

Merlin Engineering Works, Inc.

Recorder Modifications, Reel Servo

Inovonics Inc.
Merlin Engineering Works, Inc.
Recortec, Inc.
Telectro Systems Corp.
United Research Lab Corp.

Recorder Reconditioning, Videotape

A. F. Associates, Inc.
Lawhed, Ltd.
Merlin Engineering Works, Inc.
RCA Broadcast Systems

Recorder Replacement Capstan Assembly

United Research Lab Corp.

Recorder Replacement Electronics

Ampro/Scully Div. Ram Mfg. Inc.
Inovonics Inc.
Lawhed, Ltd.
Merlin Engineering Works, Inc.
Opamp Labs, Inc.
Orange County Elec. Int'l., Inc.
Sharepoint Systems Inc.
Sontec Electronics
Studer Revox America
Taber Mfg. & Eng. Co.
Telex Communications, Inc.
United Research Lab Corp.
VIF International

Recorder Replacement Motors

Ampro/Scully Div. Ram Mfg. Inc.
Broadcast Electronics, Inc.
Merlin Engineering Works, Inc.
UMC Electronics Co. Broadcast Products Div.
United Research Lab Corp.

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K B Systems
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Recorder Tape Tension Controls, VTR

Merlin Engineering Works, Inc.
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Nagra Magnetic Recorders, Inc.
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Recorder Velocity Error Correctors

CMC Technology Corp.
Lawhed, Ltd.
Merlin Engineering Works, Inc.

Recorder V-Lock Helical Attachments

Merlin Engineering Works, Inc.
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Recorders, Airborne Videotape

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Ampro Broadcasting
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Broadcast Electronics, Inc.
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Consolidated Electronic Industries
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EMT-FRANZ GMBH
Harris Corp. Broadcast Products Div.
IGM Communications
International Electro-Magnetics
McCurdy Radio Ind. Inc.
Micro-Trak Corp.
Pacific Recorders & Eng. Corp.
RCA Broadcast Systems
Ramko Research Inc.
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3M Co. Mincom Div.
Video Research Corp.

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Amilon Corp.
Eumig USA, Inc. 225 Community Dr.
Foundation Elec. Instruments Inc.
Javelin Electronics A Subs. of Kidde, Inc.
Micro-Trak Corp.
Neal Ferrograph U.S.A., Inc.
Panasonic Company
Ramko Research Inc.
Superscope Inc.
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Triple I, Inc.
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Consolidated Electronic Industries
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Harris Corp. Broadcast Products Div.
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MCI Inc.
Magnasync/Moviola Corp.
McCurdy Radio Ind. Inc.
Micro-Trak Corp.
Nagra Magnetic Recorders, Inc.
Neal Ferrograph U.S.A., Inc.
Rupert Neve, Inc.
Otari Corp.
Panasonic Company
Panasonic Co. Professional Audio Div.
Ramko Research Inc.
Studer Revox America
TEAC Corp of America
Tektronix Inc.
Telectro Systems Corp.
Telex Communications, Inc.
United Research Lab Corp.
Video Research Corp.

Recorders, Digital Audio

MCI Inc.
Panasonic Company
Studer Revox America
3M Co. Mincom Div.

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Bruel & Kjaer Instruments, Inc.
Cetec Broadcast Group
Dictaphone Corp.
EMT-FRANZ GMBH
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Harris Corp. Broadcast Products Div.
Magnasync/Moviola Corp.
Nagra Magnetic Recorders, Inc.
Neal Ferrograph U.S.A., Inc.
QSI Systems, Inc.
Sono-Mag Corp.
Soundscriber Magnetic Recording Co., Inc.
Stancil-Hoffman Corp.
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Telex Communications, Inc.
Video Research Corp.

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QSI Systems, Inc.
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Eigen Video
Image Resource Corp.
Oktel Corp.
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Robert Bosch GmbH
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Hitachi Denshi America, Ltd.
Javelin Electronics A Subs. of Kidde, Inc.
Marconi Electronics Inc. Broadcast & Communication Div.

NEC America, Inc. Broadcast Equip. Div.
Oktel Corp.
Panasonic Company
TEAC Corp of America

Recorders, Videotape Cartridge

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Cinema Products Corp.
Fernseh Inc.
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RCA Broadcast Systems

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Fernseh Inc.
Javelin Electronics A Subs. of Kidde, Inc.
Motorola Communications and Electronics Inc.
Panasonic Company
Panasonic Co. Video Systems Div.
Recortec, Inc.
Sony Corp. of America
TEAC Corp of America
US JVC Corp. Professional Video Div.

Recorders, Videotape Helical

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Cinema Products Corp.
Fernseh Inc.
Hitachi Denshi America, Ltd.
International Video Corp.
Javelin Electronics A Subs. of Kidde, Inc.
Marconi Electronics Inc. Broadcast & Communication Div.
NEC America, Inc. Broadcast Equip. Div.
Philips Broadcast Equip Corp.
RCA Broadcast Systems
Recortec, Inc.
Sony Corp. of America
TEAC Corp of America
3M Co. Mincom Div.
US JVC Corp. Professional Video Div.
Video Rentals, Inc.

Recorders, Videotape Quad

A. F. Associates, Inc.
Ampex Corp.
Asaca Corp. of America
Merlin Engineering Works, Inc.
RCA Broadcast Systems
Recortec, Inc.
Video Rentals, Inc.

Recording Services, Audiotape

Audio Magnetics Corp.
Command Productions Radio Broadcasting Services
Media Concepts, Inc.
See Hear Industries Div. of RJA Inc.
Tape-Athon Corp. Cavox Stereo Productions
United Research Lab Corp.
Thomas Valentino Inc.

Recording Services, Videotape to Film

Image Resource Corp.
Image Transform, Inc.

Recording Synchronizers

The BTX Corp.
Central Dynamics Corp.
EECO Inc.
Magna-Tech Electronic Co., Inc.
Nagra Magnetic Recorders, Inc.
Philips Broadcast Equip Corp.
Quintek Inc.
Tangent Systems, Inc.
Telex Communications, Inc.
Tiffen Mfg. Corp.

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Impact Case Sales Ltd.
Neumade Products Corp.
Plastic Reel Corp. of America
Research Technology, Inc.
Schuessler Case Co., Inc.
Storeel Corp.
Wallach & Associates Inc.
Winsted Corp.

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E-N-G Corp.
Clifford B. Hannay & Son, Inc.

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Audio Magnetics Corp.
Fuji Photo Film USA, Inc. Magnetic Tape Div.
Harris Corp. Broadcast Products Div.
Maxell Corp. of America
Nagra Magnetic Recorders, Inc.
Panasonic Company
Plastic Reel Corp. of America
Polyline Corp.
Recording Supply Co.
Schuessler Case Co., Inc.
Soundscriber Magnetic Recording Co., Inc.
Storeel Corp.
Studer Revox America
TEAC Corp of America
3M Co. Magnetic Audio/Video Prod. Div.

Reels, Videotape

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Javelin Electronics A Subs. of Kidde, Inc.
Maxell Corp. of America
Panasonic Company
Plastic Reel Corp. of America
Polyline Corp.
Recording Supply Co.
Schuessler Case Co., Inc.
Sony Corp. of America
Storeel Corp.
3M Co. Magnetic Audio/Video Prod. Div.

Reflectors, Passive

Fort Worth Tower Co.
Microflect Co., Inc.
Microwave Associates Communications Co.
Unarco-Rohn Div. of Unarco Ind., Inc.
Utility Tower Co.

Regulators, Voltage

California Instruments
Harris Corp. Broadcast Products Div.
Kay Industries, Inc.
Motorola Semiconductor Products Inc.
The Superior Electric Co.

Remote Antennas --See Antennas, Remote

Remote Broadcast Cue Systems

Cetec Vega
Channelmatic, Inc.
Comrex Corp.
DYMA Engineering, Inc.
Harris Corp. Broadcast Products Div.
McMartin Industries, Inc.
Moseley Associates, Inc.
Motorola Communications and Electronics Inc.
Power-Optics, Inc.

Remote Control Monitors, VIT

Harris Corp. Broadcast Products Div.
Marconi Instruments Div. of Marconi Electronics Inc.
Philips Test & Measuring Instruments, Inc.

Remote Control Systems

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American Laser Systems, Inc.
Bayly Engineering Ltd. Member of AEG-Telefunken Group
Cetec Broadcast Group
Cetec Vega
Channelmatic, Inc.
Comark Communications, Inc.
Comark Industries Inc.
Commerce Airborne Corp.
Continental Electronics Mfg. Co.
Control Video Corp.
Delta Electronics Inc. (Va.)
DYMA Engineering, Inc.
Hallikainen & Friends, Inc.
Harris Corp. Broadcast Products Div.
Harrison Systems Ltd.
IGM Communications
Image Magnification, Inc.
Image Video Ltd.
Kaitronics Corp.
Logitek Electronic Systems, Inc.
Marconi Communication Systems Ltd.
Marconi Instruments Div. of Marconi Electronics Inc.
Marti Electronics
McMartin Industries, Inc.
Micro Control Associates, Inc.
Microwave Associates Communications Co.
Monroe Electronics, Inc.
Moseley Associates, Inc.
Nurad, Inc.
PWH Electronics Ltd.
Portac Inc.
Power-Optics, Inc.
ProTech Audio Corp.
Richmond Sound Design, Ltd.
Sharepoint Systems Inc.
Soll, Inc.
Sono-Mag Corp.
Tele-Cine Inc.
Time & Frequency Tech., Inc.
Torpey Controls & Eng. Ltd.
Utah Scientific, Inc.

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Comrex Corp.
Farinon Video
Gorman-Redlich Mfg. Co.
Harris Corp. Broadcast Products Div.
International Microwave Corp.
Marti Electronics
McMartin Industries, Inc.
Microwave Associates Communications Co.
Moseley Associates, Inc.
Motorola Communications and Electronics Inc.
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Kliegl Bros. Lighting
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Bird Electronic Corp.

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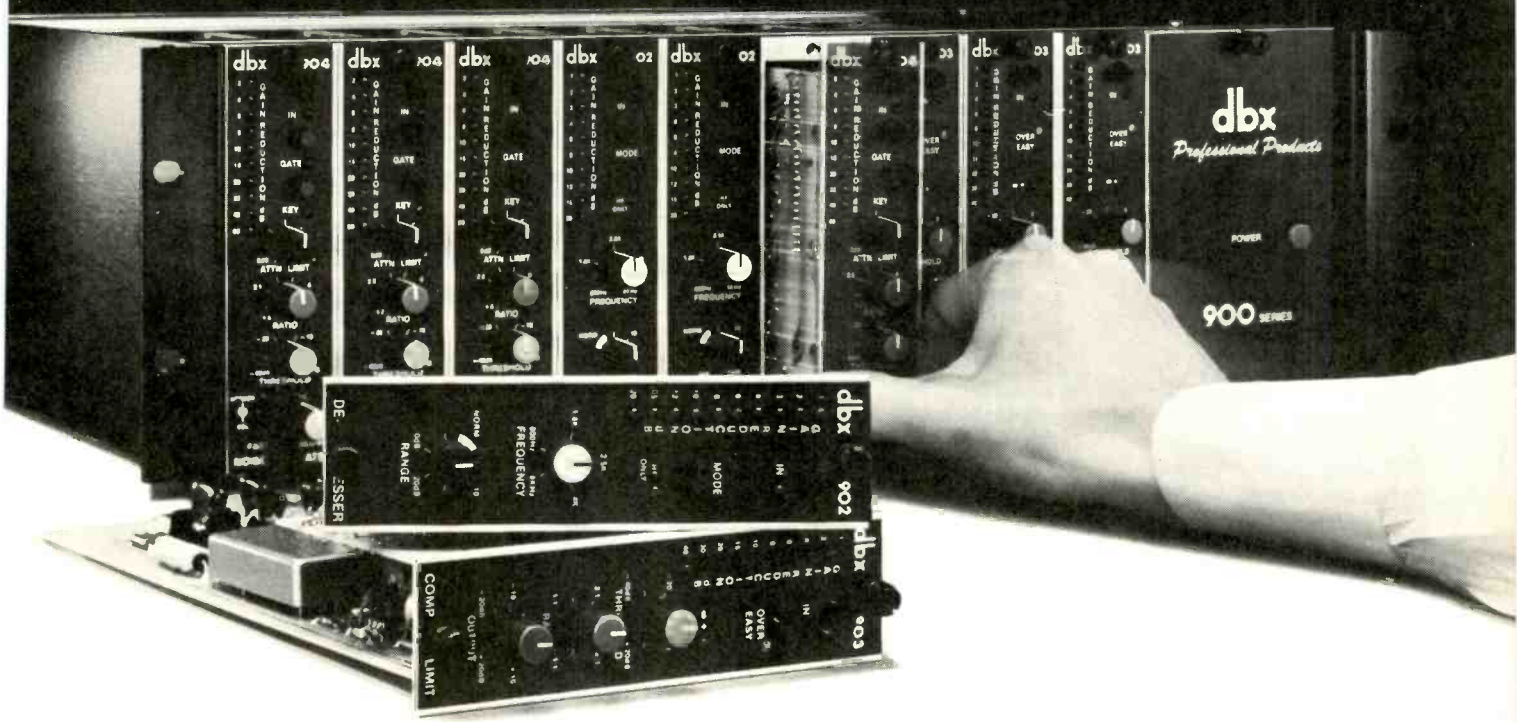

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Lexicon Inc.
MICMIX Audio Products, Inc.
Opamp Labs, Inc.
Orban Assoc. Inc.
ProTech Audio Corp.
Quad-Eight Electronics
Sansui Electronics Corp.
The Ken Schaffer Group, Inc.
URSA MAJOR, Inc.
Wang Voice Comm. Inc.

Rewinders, Film

Ediquip, Inc.
Hollywood Film Co.
K B Systems
Kalart Victor Corp.
Magnasync/Moviola Corp.
Neumade Products Corp.
Plastic Reel Corp. of America
Research Technology, Inc.

Rewinders, Tape

Audico, Inc.
Broadcast Electronics, Inc.
Magnesonics Mfg. & Sales Co.
Merlin Engineering Works, Inc.
Neumade Products Corp.
Pentagon Industries, Inc.
Plastic Reel Corp. of America

Satellite Communications/Systems

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Compact Video Sales
Compucan, Inc.
Data Communications Corp.
Harris Corp. Broadcast Products Div.
McMartin Industries, Inc.
Microwave Associates Communications Co.
Misar Industries
Oak Communications Inc.
Rockwell Int'l. Collins Broadcast Products
Schudel, Inc.
Western Tele-Communications, Inc.
Western Union Broadcast Services

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RCA American Communications
Western Tele-Communications, Inc.
Western Union Broadcast Services

SCA Equipment

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Edcor
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Schudel, Inc.
Simon & Associates
Wilcox-Lange, Inc.

Semiconductors, ICs

Analog Devices, Inc.
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Cherry Electrical Products
Cherry Semiconductor
Datel-Intersil Inc.
EEV Canada Ltd.
G C Electronics Div. Wallace Murray
Harris Corp. Broadcast Products Div.
Mallory Distributor Prod. Co. Mallory Components Group
Motorola Semiconductor Products Inc.
Opamp Labs, Inc.
Panasonic Company
RCA Distributor & Special Products Div.
UHF Associates

Semiconductors, Microprocessor/LSI (Solid State)

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G C Electronics Div. Wallace Murray
Harris Corp. Broadcast Products Div.
Motorola Semiconductor Products Inc.
Panasonic Company
RCA Distributor & Special Products Div.
Westinghouse Elec. Corp. Semiconductor Div.

Semiconductors, Rectifier General

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EEV Canada Ltd.
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Mallory Distributor Prod. Co. Mallory Components Group
Motorola Semiconductor Products Inc.
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Varian Associates, Inc. Electron Device Group
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Wilkinson Electronics, Inc.

Semiconductors, Rectifier Power

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Panasonic Company
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Semiconductors, Transistors

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Mallory Distributor Prod. Co. Mallory Components Group
Motorola Semiconductor Products Inc.
Panasonic Company
RCA Distributor & Special Products Div.
Varian Associates, Inc. Electron Device Group
Westinghouse Elec. Corp. Semiconductor Div.

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Channelmatic, Inc.
Consolidated Electronic Industries
Frequency Devices Inc.
IGM Communications
Monroe Electronics, Inc.
TM Systems, Inc.

Set-up Trucks

Harris Corp. Broadcast Products Div.
Storeel Corp.
Winsted Corp.

Shifters, Phase Microwave

Comark Industries Inc.
Dielectric Communications A Unit of General Signal
Maury Microwave Corp.
Micro Communications, Inc.
The Narda Microwave Corp.

Slow Scan TV Systems

American Laser Systems, Inc.
Colorado Video Inc.
Interand Corp. Telestrator Div.
International Video Corp.
Javelin Electronics A Subs. of Kidde, Inc.
NEC America, Inc. Broadcast Equip. Div.

Sound Effect Systems

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Audio & Design Recording
DYMA Engineering, Inc.
Eventide Clock Works Inc.
Gotham Audio Corp.
IGM Communications
Orange County Elec. Int'l., Inc.
Richmond Sound Design, Ltd.
The Ken Schaffer Group, Inc.
Spectrum Instruments, Inc.
URSA MAJOR, Inc.
United Recording Electronics Industries
Thomas Valentino Inc.

Sound Systems, Automatic Level Control

Altec Lansing Sound Products
Edcor
Moseley Associates, Inc.
Orange County Elec. Int'l., Inc.
ProTech Audio Corp.
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Delta Electronics Inc. (N.C.)
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DYMA Engineering, Inc.
Electro-Voice Inc.
Gotham Audio Corp.
Hartley Products Corp.
IGM Communications
Integrated Sound Systems Inc.
Kintek, Inc.
James B. Lansing Sound, Inc.
Magna-Tech Electronic Co., Inc.
McMartin Industries, Inc.
Micro-Trak Corp.
Modular Audio Products Unit of Modular Devices, Inc.
Orange County Elec. Int'l., Inc.
Panasonic Company
Paso Sound Products Inc.
ProTech Audio Corp.
Quad-Eight Electronics
Richmond Sound Design, Ltd.
The Ken Schaffer Group, Inc.
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Telectro Systems Corp.
Ultra Audio Pixtec

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Atlas Sound
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Harris Corp. Broadcast Products Div.
Hartley Products Corp.
Integrated Sound Systems Inc.
James B. Lansing Sound, Inc.
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Orange County Elec. Int'l., Inc.
Panasonic Company
Panasonic Co. Professional Audio Div.
Paso Sound Products Inc.
Perma Power Electronics, Inc.
Quam-Nichols Co.
Ramko Research Inc.
Rank Hi Fi, Inc.
Rohde & Schwarz Sales Co.
Sansui Electronics Corp.
Spectra Sonics
Studer Revox America
Telectro Systems Corp.
Transylvania Power Co.
Ultra Audio Pixtec
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NEW!

SM63
Omnidirectional Dynamic Microphone (actual size)

Take it from the professionals

A top-quality Shure microphone makes a measurable difference in upgrading sound. Now, Shure has added a new microphone designed to upgrade the *appearance* of your act, as well as the sound. The SM63 is a top-quality omnidirectional microphone with high output and clear, crisp sound quality—an innovative blending of smaller size, handsome appearance, and truly noteworthy broadcast-quality performance. Highly effective pop protection, low handling noise and very low profile (so it won't obscure the performer's face) make it the perfect choice for on-camera applications. The SM63 omnidirectional dynamic microphone measures just $5^{11}/_{16}$ in. long, 1¼ in. in diameter and weighs only 2.8 ounces with no compromise in Shure's standard of reliability. It offers twice the voltage sensitivity of our own SM61 (6 dB) and features a humbucking coil for superior rejection of electromagnetic hum (up to 20 dB better than competitive units) and an elastomer isolation shock mount for minimized handling noise. The new SM63 also features the Shure-developed VERAFLEX® dent resistant grille and a smooth satin finish perfect for on-stage and on-camera applications. Send for complete literature on all Shure professional microphones—including the new SM63. (Please let us know your microphone application.)

SPECIFICATIONS
Frequency Response: 50 to 20,000 Hz
Polar Pattern: Omnidirectional
Impedance: 150 ohms
Output Level (at 1,000 Hz): Open Circuit Voltage (0 dB = 1 volt per microbar) −76.0 dB
(0.16 mV) Power Level (0 dB = 1 milliwatt per 10 microbars) −56.5 dB
Hum Pickup (typical at 60 Hz): 13 dB equivalent SPL in 1 millioersted field
Shock Mount: Patented internal vibration isolator
Case: Champagne finish aluminum with VERAFLEX® grille
Dimensions and weight: $5^{11}/_{16}$ in. long, 1¼ in. in diameter; 2.8 ounces

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VSC Corp.

Spindle Height Gages

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Tentel

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International Microwave Corp.
LeCroy Fiberoptic Systems
Marti Electronics
McMartin Industries, Inc.
Micro Control Associates, Inc.
Moseley Associates, Inc.
NEC America, Inc. Broadcast Equip. Div.
Nurad, Inc.
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Electro & Optical Systems Ltd.
MCI/Quantel

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ESE
Electro & Optical Systems Ltd.
QSI Systems, Inc.
Sharepoint Systems Inc.

Storage Racks, Film and Tape Container

Ediquip, Inc.
Equipto Storage Systems
Impact Case Sales Ltd.
Neumade Products Corp.
Schuessler Case Co., Inc.
Vulcan Binder & Cover
Winsted Corp.

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Walter S. Brewer Co., Inc.
C.R.V. Systems, Inc.
Jim Cason Electronics
Centro Corp.
Compact Video Sales
DYMA Engineering, Inc.
Electro & Optical Systems Ltd.
Imero Fiorentino Associates, Inc.
The Graphic Express
Harris Corp. Broadcast Products Div.
Harrison Systems Ltd.
Link Electronics Ltd.
London Electric Co.
Maldwyn Bowden Int'l. Ltd.
L. E. Nelson Corp.
Orange County Elec. Int'l., Inc.
Panoak Lighting Systems
Radiotechniques
Ruslang Corp.
Sharepoint Systems Inc.
Soll, Inc.
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IGM Communications
James B. Lansing Sound, Inc.
LeCroy Fiberoptic Systems
Magna-Tech Electronic Co., Inc.
Maldwyn Bowden Int'l. Ltd.
McCurdy Radio Ind. Inc.
McMartin Industries, Inc.
Micro-Trak Corp.
Opamp Labs, Inc.
Orange County Elec. Int'l., Inc.
Panasonic Company
ProTech Audio Corp.
Quad-Eight Electronics
Ramko Research Inc.
Richmond Sound Design, Ltd.
Scantex Labs Inc.
Sharepoint Systems Inc.
Spectra Sonics
TEAC Corp of America
Tangent Systems, Inc.
Tweed Audio USA Inc.
Ultra Audio Pixtec
United Recording Electronics Industries
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Crosspoint Latch Corp.
Datatron, Inc.
DYMA Engineering, Inc.
Fernseh Inc.
Glentronix (1977) Ltd.
Grass Valley Group, Inc.
Ikegami Electronics (USA) Inc.
Image Video Ltd.
Industrial Sciences, Inc. (ISI)
International Nuclear Corp.
Javelin Electronics A Subs. of Kidde, Inc.
Marconi Electronics Inc. Broadcast & Communication Div.
McCurdy Radio Ind. Inc.
Rupert Neve, Inc.
Panasonic Company
Panasonic Co. Video Systems Div.
Richmond Sound Design, Ltd.
Ross Video Ltd.
Shintron Co. Inc.
Sono-Mag Corp.
Sony Corp. of America
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NEC America, Inc. Broadcast Equip. Div.
Pacific Recorders & Eng. Corp.
RTS Systems, Inc.
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Ross Video Ltd.
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Sigma Electronics, Inc.
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Tri Tec Systems Inc.
Triple Crown Electronics, Inc.
Utah Scientific, Inc.
Videomedia, Inc.
Viscount Industries Ltd.
Ward-Beck Systems, Ltd.

Switches, Coaxial

AVA Electronics
Bird Electronic Corp.
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Cetec Broadcast Group
Comark Industries Inc.
Delta Electronics Inc. (Va.)
Dielectric Communications A Unit of General Signal
DowKey Div. Of Kilovac Corp.
Dynatech Data Systems
Electronic Inst. & Spec.
Harris Corp. Broadcast Products Div.
ITT Jennings
Javelin Electronics A Subs. of Kidde, Inc.
Magnecraft Electric Co.
Marshall Electronics
Micro Communications, Inc.
Rohde & Schwarz Sales Co.
SWR Inc.
Soll, Inc.
Texscan Corp.
Varian Associates, Inc. Electron Device Group
Wide Band Engineering Co., Inc.

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ATI-Audio Technologies Inc.
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Delta Electronics Inc. (Va.)
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Grass Valley Group, Inc.
Harris Corp. Broadcast Products Div.
Hughes Elec. Devices Corp. (HEDCO)
IGM Communications
Image Video Ltd.
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International Nuclear Corp.
Javelin Electronics A Subs. of Kidde, Inc.

Leitch Video Ltd.
Marconi Electronics Inc. Broadcast & Communication Div.
McCurdy Radio Ind. Inc.
Micro Communications, Inc.
Modular Audio Products Unit of Modular Devices, Inc.
Rupert Neve, Inc.
Opamp Labs, Inc.
Panasonic Company
ProTech Audio Corp.
Richmond Sound Design, Ltd.
Rockwell Int'l. Collins Broadcast Products
Ross Video Ltd.
Scantex Labs Inc.
Sigma Electronics, Inc.
Sono-Mag Corp.
Sony Corp. of America
Tech Laboratories Inc.
Tektronix Inc.
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Microtime, Inc.
NEC America, Inc. Broadcast Equip. Div.
Plastic Reel Corp. of America
Thomson-CSF Broadcast, Inc.
Vital Industries Inc.

Synthesizers, FM Stereo

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Wavetek Rockland, Inc.

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Ampro Broadcasting
Atlantic Research Corp.
Automation Electronics, Inc. Autotron Systems, Div.
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C.R.V. Systems, Inc.
Compact Video Sales
Dielectric Communications A Unit of General Signal
DYMA Engineering, Inc.
Electro & Optical Systems Ltd.
Imero Fiorentino Associates, Inc.
Harris Corp. PRD Electronics Div.
International Electro-Magnetics
Link Electronics Ltd.
MPB Technologies Inc.
Marconi Communication Systems Ltd.
Microwave Associates Communications Co.
QSI Systems, Inc.
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Maxell Corp. of America
Memorex Corp. Professional Products Group
Panasonic Company
Panasonic Co. Video Systems Div.
Polyline Corp.
Recording Supply Co.
Re-Play Video Cartridge Service
Sony Corp. of America
TDK Electronics Corp.
3M Co. Magnetic Audio/Video Prod. Div.

Tape, Recording Logging

Ampex Corp.
Harris Corp. Broadcast Products Div.
Recording Supply Co.
Sono-Mag Corp.
Soundscriber Magnetic Recording Co., Inc.
Stancil-Hoffman Corp.
Studer Revox America
3M Co. Magnetic Audio/Video Prod. Div.

Tape, Time Announced

Cetec Broadcast Group
Fidelipac Corp.
Hallikainen & Friends, Inc.
Harris Corp. Broadcast Products Div.
Tape-Athon Corp. Cavox Stereo Productions

Tape Addressors, Video

Recortec, Inc.

Tape Cartridge Loaders

Audico, Inc.
Broadcast Electronics, Inc.
Neumade Products Corp.
Re-Play Video Cartridge Service
Video Cassette Services, Inc.

Tape Cassette Loaders

Audico, Inc.
Datel-Intersil Inc.
Neumade Products Corp.
Recortec, Inc.

Tape Cassettes, Audio

Ampex Corp.
Audio Magnetics Corp.
Bonneville Productions Div. of Bonneville Int'l. Corp.
Dictaphone Corp.
Fuji Photo Film USA, Inc. Magnetic Tape Div.
Maxell Corp. of America
Memorex Corp. Professional Products Group
Panasonic Company
Pentagon Industries, Inc.
Polyline Corp.
RKO Tape Corp.
Recording Supply Co.
TDK Electronics Corp.
3M Co. Magnetic Audio/Video Prod. Div.

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Maxell Corp. of America
Memorex Corp. Professional Products Group
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Panasonic Co. Video Systems Div.
Plastic Reel Corp. of America
Recording Supply Co.
Schuessler Case Co., Inc.
Sony Corp. of America
TDK Electronics Corp.
3M Co. Magnetic Audio/Video Prod. Div.
Video Cassette Services, Inc.

Tape Cleaners

Chyron Corp. Video Products Div.
Chyron Telesystems
G C Electronics Div. Wallace Murray
Maxell Corp. of America
N.O.V.A. Corp.
Nortronics Co., Inc. Recorder Care Div.
Osawa & Co. (USA), Inc.
Plastic Reel Corp. of America
Recortec, Inc.
TEAC Corp of America
Telectro Systems Corp.
Television Equipment Associates
3M Co. Magnetic Audio/Video Prod. Div.

Tape Conditioners, Video

Chyron Corp. Video Products Div.
Compact Video Sales
Microtran Co., Inc.
N.O.V.A. Corp.
Recortec, Inc.
Research Technology, Inc.
Television Equipment Associates

Tape Deck and Turntable Speed Controls

Ampro/Scully Div. Ram Mfg. Inc.
Eventide Clock Works Inc.
Harris Corp. Broadcast Products Div.
Telectro Systems Corp.

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Gotham Audio Corp.
Harris Corp. Broadcast Products Div.
IGM Communications
International Electro-Magnetics
International Tapetronics Corp.
Nagra Magnetic Recorders, Inc.
Neal Ferrograph U.S.A., Inc.
Otari Corp.

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TEAC Corp of America
Tape-Athon Corp. Cavox Stereo Productions
Telectro Systems Corp.
Telex Communications, Inc.
United Research Lab Corp.
VSC Corp.
Video Research Corp.

Tape Duplicators

CaVox Stereo Productions
Garner Industries
Magnefax Int'l., Inc.
Otari Corp.
Panasonic Company
Panasonic Co. Video Systems Div.
Pentagon Industries, Inc.
RKO Tape Corp.
Recortec, Inc.
See Hear Industries Div. of RJA Inc.
Telex Communications, Inc.
Video Research Corp.

Tape Evaluators, Video

Chyron Corp. Video Products Div.
Chyron Telesystems
Kaitronics Corp.
Merlin Engineering Works, Inc.
Recortec, Inc.
Television Equipment Associates

Tape Meters

Tentel

Tape Motion Controls, Audio

Aitken Communications Inc.
The BTX Corp.
Quintek Inc.
Tape-Athon Corp. Cavox Stereo Productions
United Research Lab Corp.

Tape Racks, Cartridge

Aristocart Div. Western Broadcasting, Ltd.
Audio Magnetics Corp.
Broadcast Electronics, Inc.
Cetec Broadcast Group
Display Media, Inc.
DYMA Engineering, Inc.
Fidelipac Corp.
Harris Corp. Broadcast Products Div.
Impact Case Sales Ltd.
McCurdy Radio Ind. Inc.
Micro-Trak Corp.
Neumade Products Corp.
Rack Techniques Corp.
Research Technology, Inc.
Storeel Corp.
Wallach & Associates Inc.
Winsted Corp.

Tape Recording Accessories

Ampex Corp.
Ampro Broadcasting
Ampro/Scully Div. Ram Mfg. Inc.
R. B. Annis, Co.
Broadcast Electronics, Inc.
Cezar International, Ltd.
Dolby Laboratories, Inc.
Fidelipac Corp.
G C Electronics Div. Wallace Murray
Lawhed, Ltd.
Memorex Corp. Professional Products Group
Micro-Trak Corp.
Microtran Co., Inc.
N.O.V.A. Corp.
Nagra Magnetic Recorders, Inc.
Nortronics Co., Inc. Recorder Care Div.
Panasonic Company
Pentagon Industries, Inc.
Ramko Research Inc.
Recording Supply Co.
Robins Industries Corp.
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TDK Electronics Corp.
TEAC Corp of America
Taber Mfg. & Eng. Co.
Telex Communications, Inc.
Tentel
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Video Associates Labs
Videomax Div. Orrox Corp.

Tape Splice Finders

Ampro Broadcasting
Broadcast Electronics, Inc.
Cetec Broadcast Group
Harris Corp. Broadcast Products Div.
IGM Communications
International Tapetronics Corp.
Research Technology, Inc.
UMC Electronics Co. Broadcast Products Div.

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Audico, Inc.
Broadcast Electronics, Inc.
Ciro Equipment Corp.
Ediquip, Inc.
Fidelipac Corp.
G C Electronics Div. Wallace Murray
Harris Corp. Broadcast Products Div.
Hollywood Film Co.
Neumade Products Corp.
Nortronics Co., Inc. Recorder Care Div.
Plastic Reel Corp. of America
Robins Industries Corp.

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United Research Lab Corp.

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Pentagon Industries, Inc.
Sono-Mag Corp.
Sound Dynamics, Inc.
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Electrohome Ltd.
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Oak Communications Inc.
Philips Broadcast Equip Corp.
Unitel

Termination Units

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Coastcom
Dielectric Communications A Unit of General Signal
Electro Impulse, Inc.
Harris Corp. Broadcast Products Div.
Hughes Elec. Devices Corp. (HEDCO)
Micro Communications, Inc.
Studer Revox America

Test Chart Pattern Illuminators

Century Precision Cine/Optics
Glentronix (1977) Ltd.
Porta-Pattern Telecommunications Industries Ltd.

Test Charts, Camera

D and S Corley Ltd.
EEV Canada Ltd.
Electronic Industries Assn.
Glentronix (1977) Ltd.
Harris Corp. Broadcast Products Div.
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Pace Int'l. Corp.
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Leasametric
Potomac Instruments, Inc.

Test Inserter/Readers, VIT

Philips Test & Measuring Instruments, Inc.

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Bald Mountain Lab
Dielectric Communications A Unit of General Signal
Global Specialties Corp.
Harris Corp. Broadcast Products Div.
Harris Corp. PRD Electronics Div.
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Lenco Inc. Electronics Div.
Motorola Communications and Electronics Inc.
Neal Ferrograph U.S.A., Inc.
Potomac Instruments, Inc.
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Telemet Div. A Geotel, Co.
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Eastman Kodak Co.
Harris Corp. Broadcast Products Div.
Marconi Electronics Inc. Broadcast & Communication Div.
Porta-Pattern Telecommunications Industries Ltd.

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Ampex Corp.
Aristocart Div. Western Broadcasting, Ltd.
Broadcast Electronics, Inc.
Cetec Broadcast Group
Consolidated Electronic Industries
Fidelipac Corp.
Harris Corp. Broadcast Products Div.
Nagra Magnetic Recorders, Inc.
Nortronics Co., Inc. Recorder Care Div.
Pentagon Industries, Inc.
Standard Tape Laboratory, Inc.
TDK Electronics Corp.
TEAC Corp of America
Taber Mfg. & Eng. Co.

Testers, Demodulator/Detector

Philips Test & Measuring Instruments, Inc.
Telemet Div. A Geotel, Co.

Testers, Integrated Circuit

Analog Devices, Inc.
Global Specialties Corp.
Tektronix Inc.

Testers, Semiconductor

B & K Precision Dynascan Corp.
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Delta Electronics Inc. (N.C.)
Hickok Elec. Inst. Co.
ITT Instruments & Components Metrix Div.
Leader Instruments Corp.
Rohde & Schwarz Sales Co.
Sencore, Inc.
Tektronix Inc.

Testers, Tape Recorder

Amber Electro Design, Ltd.
R. B. Annis, Co.
Audicon, Inc.
Broadcast Aids, Inc.
Fidelipac Corp.
Marconi Instruments Div. of Marconi Electronics Inc.
Neal Ferrograph U.S.A., Inc.
Tentel

Testers, Vacuum Tube

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Harris Video Systems
Hitachi Denshi America, Ltd.
MCI/Quantel
Marconi Electronics Inc. Broadcast & Communication Div.
Merlin Engineering Works, Inc.
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Glentronix (1977) Ltd.
IGM Communications
Logitek Electronic Systems, Inc.
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Philips Broadcast Equip Corp.
Power-Optics, Inc.
Reynolds/Leteron Co.
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Magnecraft Electric Co.
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SSAC Inc.
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Crouse Hinds Co.
Flash Technology Corp. of America
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High-Lite Corp.
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Microflect Co., Inc.
Motorola Communications and Electronics Inc.
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Modular Audio Products Unit of Modular Devices, Inc.
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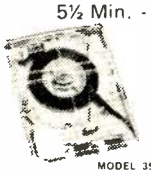

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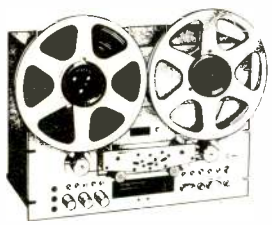

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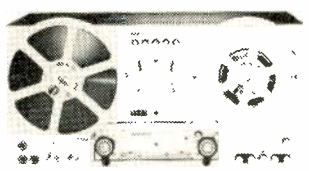

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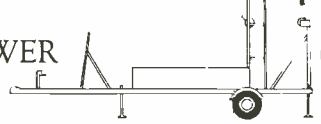

STUDIO TRANSMITTER LINK

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Moseley
Micro-Control
Vega

REMOTE CONTROL

Marti
Moseley
Micro-Control

MICROPHONES

AKG
Electro-Voice
Shure

MICROPHONE STANDS & ARMS

AKG
Astatic
Electro-Voice
Luxo
Shure

TAPE CARTRIDGE MACHINES

Broadcast Electronics
DB Electronics
Telex

TAPE RECORDERS

Ampex
JVC
Pioneer
Revox
Technics

RECORDING TAPE

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Audiopak
Fidelipac
Maxell
TDK

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BUD
Soundolier

JACK PANELS & PATCHCORDS

ADC
Switchcraft

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Nortronic

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Marconi Electronics Inc. Broadcast & Communication Div.
NEC America, Inc. Broadcast Equip. Div.
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The Finney Co.
Gabriel Electronics, Inc.
Harris Corp. Broadcast Products Div.
Maury Microwave Corp.
Micro Communications, Inc.
Motorola Communications and Electronics Inc.
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Transmission Sets

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Transmission Systems, TV Audio

DYMA Engineering, Inc.
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GTE Products Corp. Sylvania CATV Div.
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Transmission Systems, TV Optical Carrier

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LeCroy Fiberoptic Systems
Motorola Communications and Electronics Inc.
Telemet Div. A Geotel, Co.
Times Fiber Communications, Inc. Div. Times Wire & Cable
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CSI Electronics, Inc.
Comark Communications, Inc.
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VMI-Visual Methods Inc.

Transmitter Modulation Controllers, Automatic

Delta Electronics Inc. (Va.)
DYMA Engineering, Inc.
Harris Corp. Broadcast Products Div.
Sharepoint Systems Inc.
Time & Frequency Tech., Inc.

Transmitter Output Controllers, Automatic

Delta Electronics Inc. (Va.)
DYMA Engineering, Inc.
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Marconi Electronics Inc. Broadcast & Communication Div.
McMartin Industries, Inc.
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RCA Broadcast Systems
Rockwell Int'l. Collins Broadcast Products
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CSI Electronics, Inc.
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Transmitters, TV Microwave

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Tepco Corp.
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Transponders

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Tuners, AM

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Sansui Electronics Corp.
Studer Revox America
TEAC Corp of America

Tuners, FM

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Bogen Div. Lear Siegler, Inc.
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Superscope Inc.
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Times Fiber Communications, Inc. Div. Times Wire & Cable
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Amperex Electronic Corp. Slatersville Div.
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Vacuum Tubes, Rectifier

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RCA Electro Optics and Devices
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Thomson-CSF-Electron Tubes

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Vacuum Tubes, Transmitting Rebuilt

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Freeland Products Co.
Vacuum Tube Industries

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Harris Corp. Broadcast Products Div.
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Lectrotech Inc.
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Philips Test & Measuring Instruments, Inc.
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Viewfinders, Closed Circuit Camera

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Volt Ohm Meters --See Meters, Volt Ohm

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Times Fiber Communications, Inc. Div. Times Wire & Cable
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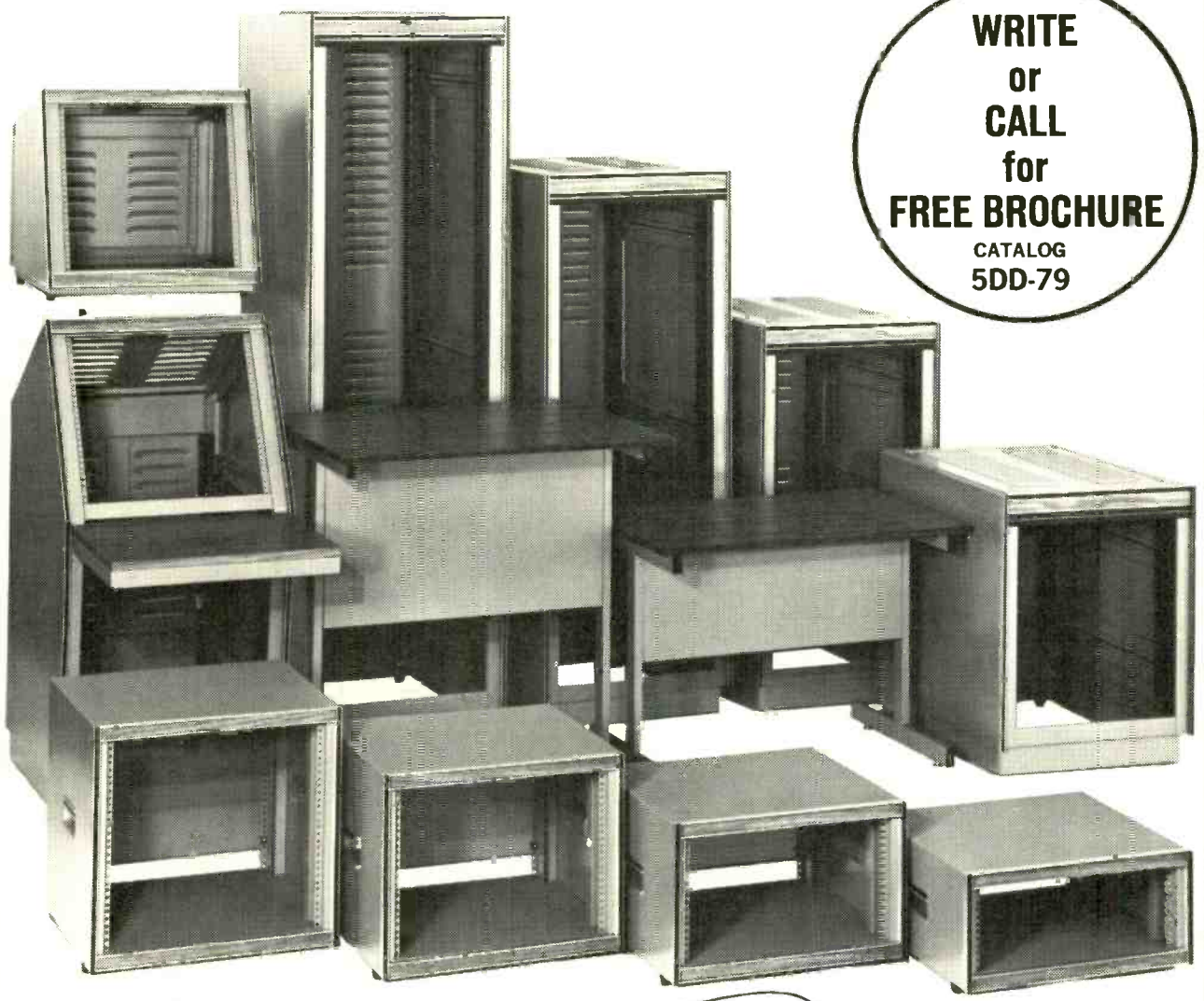

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DYMA Engineering, Inc., Box 1697, Taos, NM 87571

Dynair Electronics, Inc., 5275 Market St., San Diego, CA 92114

Robert A. Jacobs (714) 263-7711

Dynamote Corp., 1200 W. Nickerson, Seattle, WA 98119

Dynasciences, Div. Whittaker Corp., Township Line Road, Blue Bell, PA 19422

J. Samony, Mktg. Dir. (215) 643-0250

Dynatech Data Systems, 7644 Dynatech Ct., Springfield, VA 22153

E

EAR Systems, Inc., 1807 Old Shay Court, Columbus, OH 43229

Gale Gilbreath, V.P. (614) 890-1346

EECO Inc., 1601 E. Chestnut Ave., Santa Ana, CA 92701

EEG Enterprises, Inc., 1 Rome St., Farmingdale, NY 11735

EEV, Inc., 7 Westchester Plaza, Elmsford, N.Y. 10523

Tom Soldano, RF Products and Dick Betts Imaging Devices (914) 592-6050

REGIONAL SALES CONTACTS:

EEV, Canada Ltd., 67 Westmore Dr., Rexdale, Ont. Canada M9V 3Y6 (416) 745-9494 Bob Parkes
EEV, Inc., 15 Dunwoody Park, Suite 100E, Atlanta, GA 30338 (404) 394-9201 Harry Kozicki
English Electric Valve Co. Ltd., Waterhouse Lane, Chelmsford England CM1 2QU (0245) 61777 Mark Knight
EEV, Inc., Route 1, Anna, TX 75003 (214) 837-2464 R. Knowles
EEV, Inc., 18 Indian Hill Rd., Union, KY 41091 (606) 384-4477 Richard Bossert
EEV, Inc., 3 Buckingham Rd., Natick, MA 01760 (617) 653-8300 Dan Green
EEV, Inc., 19001 40th Place N.E., Seattle, WA 98155 (206) 363-2200 D Rose

EEV Canada Ltd., 67 Westmore Dr., Rexdale, Ont., Canada M9V 3Y6

EG&G Electro Optics Div., 35 Congress St., Salem, MA 01970

EIMAC, Div. of Varian, 301 Industrial Way, San Carlos, CA 94070

Bob Hoffman (415) 592-1221

EMCEE Broadcast Products, Box 68, White Haven, PA 18661

EMT-FRANZ GMBH, Box 1520, D-763 Lahr, W. Germany

E-N-G Corp., 1009 C. Shary Circle, Concord, CA 94518

ENG Helicopter Satellites, Ltd., 7920 Airpark Rd., Gaithersburg, MD 20760

ESC Electronics Corp., 534 Bergen Blvd., Palisades Park, N. J. 07650

ESE, 142 Sierra St., El Segundo, CA 90245

R. M. Mayers (213) 322-2136

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David Bain Associates, 11 Orchard Farm Rd., Port Washington, N.Y. 11050 (516) 883-4818 David Bain
Audio Distributors Inc., 2342 S. Division, Grand Rapids, MI 49507 (616) 452-1596 Dave Veldsma
Broadcast Supply West, 7012 27th St. W., Tacoma, WA 98466 (206) 565-2301 Irv Law
David Green Broadcast Consultant, 21 N. Wirt St., Leesburg, Va. 22075 (703) 777-8660 David Green
Martin Audio, 423 West 55th St., New York, N.Y. 10019 (212) 541-5900
Allied Broadcast Equipment, 635 South E St., Richmond, Ind. 47374 (317) 962-8596 Jim Jones
Ro-Cel Electronics, 731 Voice of the Theater Bldg., Rt. 8 No., Pittsburgh, Pa. 15223 (412) 781-2326 Claire Rosenberger

Eastman Kodak Co., 343 State St., Rochester, N.Y. 14650

Eaton Corp., L.A. Plant, Elec. Instrumentation Div., 5340 Alla Rd., Los Angeles, CA 90066

Echolab, 175 Bedford Rd., Burlington, MA 01803

Econco Broadcast Service Inc., Rt. 2 Box 188, Woodland, Calif. 95695

Edcor, 16782 Hale Ave., Irvine, CA 92714

Ediquip, Inc., 6820 Romaine St., Hollywood, CA 90038

Editall Corp., Box 17435, Washington, DC 20041

Ednalite Corp., 200 N. Water St., Peekskill, NY 10566

Edutron, Inc., 11003 U.S. Hwy. 19, Roswell, GA 30075

Eidson Electronic Co., Box 96, Temple, Tex. 76501

Eigen Video, Box 1027, Grass Valley, CA 95945

George Foster (916) 273-1341

Elcom Engineering Co., Box 10432, Santa Ana, Calif. 92711

Elcom Specialty Products, Inc., 2810 Redding Ave., #E, Sacramento, CA 95820

Electro Controls, 2975 S. 300 W., Salt Lake City, Utah 84115

Electro Impulse, Inc., Box 870, Red Bank, N.J. 07701

Mark Rubin (201) 741-0404

Electro & Optical Systems Ltd., 31 Progress Court, Scarborough, Ont., Canada M1G 3V5

Electro-Voice Inc., 600 Cecil St., Buchanan, Mich. 49107

Greg Silsby (616) 695-6831

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Centennial Marketing Ltd., 8505 E. Orchard Rd., Suite 116, Englewood, CO 80110 (303) 770-0771 Marv Squire
George M. Conneen Co., Inc., 24 South Newton Street Rd., Newton Square, PA 19073 (215) 353-2441 (2) George Conneen
The Cummings Co., 1839 Fall Meadow, Missouri City, TX 77459 (713) 437-9043 Ernie Cummings
Gemini Electronics Marketing, Ernie Cummings, 1110 N. 175th Suite 106, Seattle, WA 98133 (206) 542-1116
Marcus Johnson & Associates, 400 Brookes Drive, Suite 213, Hazelwood, MO 63042 (314) 731-4110 Marc Johnson
C. L. Pugh & Associates, Inc., 2144 Riverside Drive, Columbus, OH 43221 (614) 486-9678 Ted Magnuson
Harry J. Lang & Associates, 1371 Hillcrest Dr. #303, Anchorage, AK 99503 (907) 279-5741 Harry Lang
Riley & Petchell Sales, Inc., 25700 Plymouth Rd., Detroit, MI 48239 (313) 937-3000 Tom Petchell

Product Listings Begin on Page 116

Wm. M. Linz Associates, Inc., 821 Skokie Blvd., Northbrook, IL 60062 (312) 498-9600 Bill Linz
Skor, 1821 University Ave., St. Paul, MN 55104 (612) 645-6461 Gene Kurzweg
Meyer & Ross, 1485 Rollins Rd., Burlingame, CA 94010 (415) 348-6800 Mordy Foodym
The Smith Company, 599 New Park Avenue, W. Hartford, CT 06110 (203) 523-0512 George Smith
Maitland K. Smith, Inc., 2321 Fourth St. Suite 210, Tucker, GA 30084 (404) 939-3323 Bob Tyler
Sproch Sales, Inc., 3520 W. Broward Blvd., Ft. Lauderdale, FL 33312 (305) 587-3792 Elaine Sproch
Paul Stone Sales Company, Inc., 5174 N. Allisonville Rd., Indianapolis, IN 46205 (317) 257-4277 Paul Stone
Waxman-Currant Sales, Inc., 990 Kenmore Ave., Buffalo, NY 14216 (716) 873-0442 Alex Waxman

Electrohome Ltd., 809 Wellington St. N., Kitchener, Ont., Canada N2G 4J6

Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, N.Y. 10710

Electronic Industries Assn., 2001 Eye St., N.W., Washington, DC 20006

Electronic Inst. & Spec., 42 Pleasant St., Stoneham, Mass. 02180

Electronics Diversified, Inc., 1675 N.W. 216th, Hillsboro, Ore. 97123

Luis Walsh (503) 645-5533

Emcor Products, GF Business Equipment, Inc., 1600 4th Ave. N.W., Rochester, MN 55901

Emergency Alert Receiver Inc., 1 West 30th St., New York, NY 10001

Enclosure Corp., 4529 Adams Circle, Cornwell Heights, PA 19020

Engineering Associates, 7567 Rt. 49A East, Arcanum, Ohio 45304

English Electric Valve Co. Ltd., Waterhouse Lane, Chelmsford, Essex England CM1 2QU

Enterprise Electronics Corp., Box 1216, Enterprise, Ala. 36330

Equipto Electronics Corp., 447 Woodlawn Ave., Aurora, IL 60507

Cliff Fields (415) 595-3500

Equipto Storage Systems, 225 S. Highland, Aurora, Ill. 60507

Ercona Corp., 2492 Merrick Rd., Bellmore, NY 11710

Eumig USA, Inc., 225 Community Dr., Lake Success Business Park, Great Neck, N.Y. 10020

Eventide Clock Works Inc., 265 West 54th St., New York, N. Y. 10019

Exact Electronics, Inc., Box 347, Tillamook, OR 97141

F

Farinon Video, 1680 Bayport Ave., San Carlos, Calif. 94070

Faroudja Labs, 946 Benicia Ave., Sunnyvale, CA 94086

Farrtronics Ltd., 185 Denison St., Markham, Ont., Canada L3R 1B5

Fenwal Inc., Div. of Walter Kidde & Co., Inc., 400 Main St., Ashland, MA 01721

Fernseh Inc., Box 15068, Salt Lake City, UT 84115

T. Pignoni (801) 972-8000

REGIONAL SALES CONTACTS:

Fernseh, Inc., 6300 Arizona Circle, Los Angeles, CA 90045 (213) 641-1636 T. Magliocco
Fernseh, Inc., 1247 N. Glassel, Suite 1, Orange, CA 92667 (714) 997-0790 C. Olson
Fernseh, Inc., 720 Landwehr Rd., Northbrook, IL 60062 (312) 291-1150 D. Spindle
Fernseh, Inc., 1532 Valley View Dr., Claremore, OK 74017 (918) 341-9066 M. Richardson
Fernseh, Inc., 279 Midland Ave., Saddle Brook, NJ 07662 (201) 797-7400 J. Webb
Fernseh, Inc., 7921 Jones Branch Dr., Suite 275, McLean, VA 22102 (703) 790-5570 A. Schoenberg
Telemation Int'l., Branch of Fernseh, Inc., 293 Regent St., London England 01-636-9447 M. Montag

Fesco Inc., 1634 Colorado Blvd., Los Angeles, CA 90041

Fiberbilt, 601 West 26th St., New York, NY 10001

Fidelipac Corp., 109 Gaither Dr., Mt. Laurel, N.J. 08057

Arthur Constantine (609) 235-3511

REGIONAL SALES CONTACTS:

300 Authorized distributors worldwide. Contact factory

Film/Video Equip. Service Co., 1875 S. Pearl St., Denver, CO 80210

The Finney Co., 34 W. Interstate St., Bedford, Ohio 44146

Imero Fiorentino Associates, Inc., 10 West 66th St., New York, N. Y. 10023

Fisher Berkeley Corp., 5800 Christie Ave., Emeryville, Cal. 94608

Flash Technology Corp. of America, 55 Lake St., Nashua, N. H. 03060

John Fluke Mfg. Co., Inc., Box 43210, Mountlake Terrace, Wash. 98043

Fort Worth Tower Co., Box 8597, Ft. Worth, Tex. 76112

Foundation Elec. Instruments Inc., 1794 Courtwood Crescent, Ottawa, Ont., Canada K2C 2B5

A.Y. Szanto, President (613) 226-4000

Freeland Products Co., 3233 Conti St., New Orleans, LA 70119

Frequency Devices Inc., 25 Locust St., Haverhill, Mass. 01830

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

James Crawford V.P. (201) 427-1160

REGIONAL SALES CONTACTS:

Export Agents: Cinecraft International, Inc., 11 Caesar Place, Moonachie, NJ 07074 (201) 939-0875
In Canada: Kingsway Film Equipment Ltd., 821 Kipling Ave., Toronto Ont., M8Z 5G8 Canada (416) 233-1101

Fuji Photo Film USA, Inc., Magnetic Tape Div., 350 Fifth Ave., 68th Fl., New York, N. Y. 10001

John Dale (212) 736-3335

Fujinon Optical, Inc., 672 White Plains Rd., Scarsdale, N.Y. 10583

John Dawson (914) 472-9800

REGIONAL SALES CONTACTS:

Fuji Optical Systems, 4855 Atherton Ave., San Jose, CA 95013 (408) 866-5466 Dave Cooper
Fuji Optical Systems, 118 Savarona Way, Carson, CA 90746 (213) 532-2861 Keith Tindall

G

GBC Closed Circuit TV Corp., 315 Hudson St., New York, N.Y. 10013

G C Electronics, Div. Wallace Murray, 400 S. Wyman St., Rockford, Ill. 61101

GKM Mfg. Corp., 47 Bridgewater St., Brooklyn, NY 11222

G & M Power Products, 6500 Santa Monica Blvd., Los Angeles, CA 90038

GTE Products Corp., Sylvania CATV Div., 10841 Pellicano Dr., El Paso, TX 79935

Gabriel Electronics, Inc., Box 626, Scarborough, ME 04074

Gardiner Communications Corp., 1980 S. Post Oak Rd., Ste. 2040, Houston, TX 77056

Garner Industries, 4200 No. 48th St., Lincoln, Nebr. 68504

Bruce A. Alderman (402) 464-5911

Geleco Electronics Ltd., 2 Thorncliffe park Dr., Unit 28, Toronto, Ont., Canada M4H 1H2

General Cable Corp., Box 700, Woodbridge, NJ 07095

General Electric Co., Video Display Equip. Op., Electronics Park 6-206, Syracuse, N. Y. 13221

Jerrold P. Gunderson, Mgr. Mktg. (315) 456-2562

Gerard Tech, Box 634, Anoka, MN 55303

The Gerstenslager Co., 1425 E. Bowman St., Wooster, Ohio 44691

A.W. Baehr (216) 262-2015

Glentronix (1977) Ltd., 160 Duncan Mill Rd., Don Mills, Ont., Canada M3B 1Z5

Global Communications & Eng., Inc., 914 White Plains Rd., Trumbull, CT 06611

R. M. Read (203) 261-2068

Global Specialties Corp., 70 Fulton Terr., New Haven, CT 06509

Alan Gordon Enterprises Inc., 1430 N. Cahuenga Blvd., Hollywood, CA 90028

Gorman-Redlich Mfg. Co., 6 Curtis St., Athens, Ohio 45701

Gotham Audio Corp., 741 Washington St., New York, N.Y. 10014

Gould Inc., Instruments Div., 3631 Perkins Ave., Cleveland, Ohio 44114

Gralex Industries, 155 Marine St., Farmingdale, N. Y. 11735

Grandy, Inc., 1275 Bloomfield Ave., Fairfield, N.J. 07006

The Graphic Express, 7969 Engineer Rd., Suite 201, San Diego, CA 92111

Grass Valley Group, Inc., P.O. Box 1114, Grass Valley, CA 95945

Gray Engineering Labs, 504 West Chapman Ave., Orange, Calif. 92668

Tom C. Clark (714) 997-4151

The Great American Market, Box 178, Woodland Hills, Calif. 91364

Gregg Laboratories, 2120 E. Howell, Suite 505-506, Anaheim, CA 92806

Groton Computer Inc., 19 Fort Hill Rd., Groton, CT 06340

Gruber Products Co., 5254 Jackman Rd., Toledo, Ohio 43613

H

HM Electronics, Inc., 6151 Fairmount Ave., San Diego, Calif. 92120

R. Dale Scott (714) 280-6050

REGIONAL SALES CONTACTS:

Rep Tech Inc., 1110 Altoga Court, Louisville, TX 75028 (214) 436-4111
A B and T Sales Corp., Jackson Creek Rd., P.O. Box 111, Grasonville, MD 21638 (301) 827-8046; 8909
N. Browning & Co., 207 S. Court St., Medina, OH 44256 (216) 723-1901
A B and T Sales Corp., 1000 Valley Forge Circle, King of Prussia, PA 19406 (215) 265-2028, 783-7220
Northern California Mkt., 1725 San Carlos Ave. #1, P.O. Box 697, San Carlos, CA 94070 (415) 592-8160
John B. Anthony Co., 992 High Ridge Rd., Stamford, CT 06905 (203) 322-9202, (212) 585-2027
N. Browning & Co., 133 N. Jefferson St., Dayton, OH 45402 (513) 222-3946
CB Electronic Marketing, 6429 Iris Way, Arvada, CO 80004 (303) 422-0561
Bernard Darmstedter Assoc. Inc., 41 R. Oswego St., Baldwinsville, NY 13027 (315) 638-1261
Capital Communications Ind., P.O. Box 481, Olympia, WA 98507 (206) 943-5378
Technical Systems Reps, 2065 Peachtree St. Industrial Center, Suite 215, Chamblee, GA 30341 (404) 457-0426
Filmways Audio Services, 5540 Cleon Ave., North Hollywood, CA 91601 (213) 877-9711
Forristal-Young Sales Co., 7110 Oakland Ave., St. Louis, MO 63117 (314) 645-2360
Forristal-Young Sales Co., 9010 East 50 Hiway, Kansas City, MO 64133 (816) 358-6771
Forristal-Young Sales Co., 11312 Martha, Omaha, NE 68124 (402) 333-0800
Forristal-Young Sales Co., 6400 Hickman, Lot 37, Des Moines, IA 50322
Kodo Associates, Inc., 8100 Penn Ave. South, Minneapolis, MN 55431 (612) 881-1255
Riley & Petchell Sales, Inc., 25700 Plymouth Rd., Detroit, MI 48239 (313) 937-3000
Riley & Petchell Sales, Inc., 401 Chippewa, Buchanan, MI 49107 (616) 695-6365
Sproch Sales, Inc., 3520 W. Broward Blvd., Ft. Lauderdale, FL 33312 (305) 587-3792
Sproch Sales, Inc., 12 Anchor Way, Gulf Harbour, New Port Richey, FL 33552 (813) 849-6067
VF Sales, Inc., 181 Worcester Rd., Natick, MA 01760 (617) 237-6544

HSC, Inc., Box 155, River Grove, IL 60171

Hallikainen & Friends, Inc., 101 Suburban Rd., San Luis Obispo, CA 93401

Len Filomeo (805) 541-0200

REGIONAL SALES CONTACTS:

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Ring Associates, Inc., P.O. Box 188, Easthampton, MA 01027 (413) 527-4430 John Ring
Sound Solutions, 7641 19 Mile Rd., Sterling Heights, MI 48078 (313) 979-6320 Dave Hill
Videomedia, 250 N. Wolfe Rd., Sunnyvale, CA 94086 (408) 733-6500 Hank Wilkes
VIF International, P.O. Box 1555, Mountain View, CA 94042 (408) 739-9740 Gordon MacKechnie

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Product Listings Begin on Page 116

QUANTAFONT™

Teleproduction Graphic Titlers

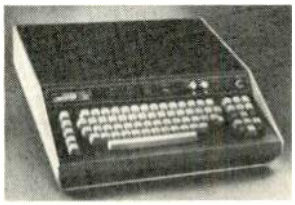
The unique microcomputer technology that enables self-contained, high performance titling at affordable costs.

Q-7A

- Proportional characters and spacing with
- NANOLOG 20 nsec resolution*
- 16 resident fonts from 8 to 64 raster lines high
- Colorized characters and backgrounds
- Full border and shadow edge selections
- Extensive composition and editing functions
- 10, 16-row page resident memory with memory protect battery
- Roll, crawl and flash with 2-speed control
- And more

Q-VII

- 3 resident fonts with 20 selectable display sizes of all fonts
- NANOLOG 20 nsec resolution*
- Colorized characters and backgrounds
- Full border and shadow edge selections
- 12, 16-row page resident memory with memory protect battery
- Extensive composition and editing functions
- Roll, crawl and flash with 2-speed control
- And more

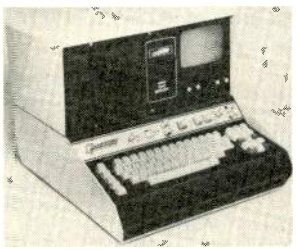


Q-VI

- 24 character sizes selectable by row
- Upper and lower case font of capital letters
- Character resolution up to 32 horizontal pixels
- Color backgrounds and graphic separators
- Extensive composition and editing functions
- 12, 16-row page resident memory with memory protect battery
- Roll, crawl and flash with 2-speed control
- And more
- Monochrome only (Q-VI/A)

Q-V

- 12 character sizes selectable by row
- Upper and lower case font of capital letters
- Character resolution up to 32 horizontal pixels
- 12, 16-row page resident memory
- Random access to 48 resident positionable titles
- Vertical title positioning at any raster location
- Roll, crawl and flash
- Mini-cassette extended memory — optional
- And more



Flexible Disc Memory Accessories

- Single or dual mini-disc storage systems
- 100, 16-row pages per disc
- Random or sequential page access of less than .5 seconds
- Data block of titler resident memory per disc
- Memory console can accommodate 6-inch monitor

Digital Cassette Memory Accessories

- High speed computer grade cassette tape systems
- Block load storage of entire resident memory
- **Top mounting** console with or without 6-inch monitor
- **Self standing** style coordinated tape transport only

QST Sub Titling System

Incorporates all of the Q-7A composing and display capabilities for self-contained, automatic sub-titling. Interfaces directly to audio or TTL level EBU/SMPTE time code.

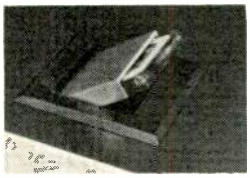
- Full function titler for entry of translated text
- Automatic disc indexing
- Flexible title editing
- Off-air edit and control display

Q-VI/M Automatic Mass Memory Display

- Programmable control over a digital cassette mass memory
- Over 3,000 rows — 400 pages, typical
- All display capabilities of Q-VI titler available for automatic recall

International Alphabets

- Accented international alphabets available for all titling systems



Mini-Cassette Digital Tape Transport

- **On board** mini-cassette digital tape extended memory — Q-V only
- Block load storage of resident memory on each side of mini-cassette

SYSTEM CONCEPTS

To Be Letter Perfect

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395 Ironwood Drive
Salt Lake City, Utah 84115
Phone: (801) 486-3833
TWX: 910-925-5684

Eastern Corporate Office and
System Concepts International
16006 Waterloo Road
Cleveland, Ohio 44110
Phone: (216) 692-3410
TWX: 810-421-8192

*Effective average start-point resolution with patent pending NANOLOG™ circuit.

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Harris Corp., Broadcast Products Div., Box 4290, Quincy, Ill. 62301

Kenneth R. Schwenk, Sls. Dir. (217) 222-8200 Ext. 3400

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Harris Corp., BPD, P.O. Box 4290, Quincy, IL 62301 (217) 222-8200 J. W. Ariana, Mgr. Radio Sales, Western U.S.
Harris Corp., BPD, 675 Third Ave., New York, NY 10017 (212) 986-7600 Hal Kneller
Harris Corp., BPD, P.O. Box 4290, Quincy, IL 62301 (217) 222-8200 John Delissio, VP Int'l. Sales
Harris Corp., BPD, 2600 Virginia Ave. NW, 8th Flr., Washington, D.C. 20037 (202) 342-3946 Lew Page; Kinsley Jones
Harris Corp., BPD, 7000 Regency Sqr. Blvd., Suite 200, Houston, Tex. 77036 (713) 977-2411 London T. England; Vern Killion
Harris Corp., BPD, 5839 Green Valley Circle, Suite 200, Culver City, Calif. 90230 (213) 641-5032 Tom O'Hara; Rick Stevens
Harris Systems Ltd., 212 Brunswick Blvd., Pointe-Claire, Que. H9R 1A6 Canada (514) 694-3371 Leo E. Gilbeau, Dist. Sls. Mgr.

Harris Corp., PRD Electronics Div., 1200 Prospect Ave., Westbury, NY 11590

Harris Video Systems, 1255 E. Arques Ave., Sunnyvale, Calif. 94086

Harrison Systems Inc., Box 22964, Nashville, TN 37211

Harrison Systems Ltd., 6117 63rd Ave., Riverdale, MD 20840

Hartley Products Corp., 620 Island Rd., Ramsey, N.J. 07446

Harwood Mfg. Co., Subs. Elgin Nat'l. Industries, Inc., 1800 W. Fullerton, Chicago, IL 60614

Karl Heitz, Inc., 979 Third Ave., New York, NY 10022

Hickok Elec. Inst. Co., 10514 Dupont Ave., Cleveland, Ohio 44108

High-Lite Corp., 23 Selwyn Dr., Greenville, SC 29615

Hitachi Denshi America, Ltd., 175 Crossways Park W., Woodbury, NY 11797

Jack Breitenbucher-Regional Sls. Mgr. (516) 921-7200

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Cincinnati, 11250 Cornell Park Dr., Cincinnati, OH 45242 (513) 489-6500 Skip McWilliams
Dallas:, 14169 Proton Rd., Dallas, TX 75234 (214) 233-7623 Bob McLaughlin
Denver:, 3538 Peoria, Aurora, CO 80010 (303) 344-3156 Rome Cheals
Los Angeles:, 21015 S. Figuroa, Carson, CA 90745 (213) 328-2110 Nick Pisciotha
Seattle:, 1051 Andover Park W., Tukwilla, WA 91188 (206) 575-1680
Washington DC, 4720 P Boston Way, Lanham, MD 20801 (301) 459-8262 Bill Weston

Hollywood Film Co., 3294 East 26th St., Los Angeles, CA 90023

Howe Audio Productions, Inc., Box 383, Boulder, CO 80306

Howe-Yin Research Co. Inc., Box 3518, Fremont, Calif. 94538

Hughes Aircraft Co., Microwave Communications Products, Box 2999, Torrance, Calif. 90509

Hughes Elec. Devices Corp. (HEDCO), Box 1985, Grass Valley, CA 95945

Hughey & Phillips Inc., 3050 N. California St., Burbank, Calif. 91504

C. E. Stephens, Sales Mgr. (213) 849-1104

Philip A. Hunt Chemical Corp., Roosevelt Place, Palisades Park, N.J. 07650

K. R. Hyman Co., 5006 E. Beverly Mae, San Antonio, TX 78229

I

IGM Communications, 4041 Home Rd., Bellingham, Wash. 98225

Darrell Wichers (206) 733-4567

REGIONAL SALES CONTACTS:

IGM/NTI, 1301 Fraser, Suite A-12, Bellingham, WA 98225 (206) 671-3970 Carl Peterson
IGM/NTI, 1925 Century Blvd., Suite 4, Atlanta, GA 30345 (404) 325-3726 Jim Drummond
Dyma Engineering, P.O. Box 1697, Taos, NM 87571 (505) 758-2686 Mike Ziomko
Eastern Broadcast Supply, 46 Mechanic St., Leominster, MA 01453 (617) 537-4706 Ron Dagenais
MZB & Associates, 4203 Beltway Dr., Dallas, TX 75234 (214) 233-5535 Darryl Parker

ITI Electronics, Inc., 369 Lexington Ave., Clifton, NJ 07011

ITT Instruments & Components, Metrix Div., BP.30, Annecy, France 74000

ITT Jennings, 970 McLaughlin Ave., San Jose, CA 95122

Ikegami Electronics (USA) Inc., 37 Brook Ave., Maywood, NJ 07607

John Chow (201) 368-9171

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West Coast Office:, 19164 Van Ness Ave., Torrance, CA 90501 (213) 328-2814 H. Caplan
Southwest Office:, 330 North Belt E., Suite 228, Houston, TX 77060 (713) 445-0100 L. Wolff
Southeast Office, 552 S. Lee St., Americus, GA 31709 (912) 924-0061 O. Mills

Ikelheimer-Ernst, Inc., Fiberbilt, 601 West 26th St., New York, NY 10001

Image Magnification, Inc., 739 Airway Circle, New Smyrna Beach, Fla. 32069

Don Quinlan, President (904) 427-5293

Image Resource Corp., 2260 Townsgate Rd., Westlake Village, CA 91361

Image Transform, Inc., 4142 Lankershim Blvd., No. Hollywood, CA 91602

Image Video Ltd., 700 Progress Ave. #16, Scarborough, Ont., Canada M1H 2Z7

Impact Case Sales Ltd., 150 Ferrier St., Unit 4, Markham, Ont., Canada L3R 3K3

Industrial Marketing, Advisory Services, Inc., 2425 Wilson Blvd., Arlington, VA 22201

Industrial Research Products, 321 Bond St., Elk Grove Village, IL 60007

Industrial Sciences, Inc. (ISI), Box 1495, Gainesville, Fla. 32602

Richard S Hajdu (904) 373-6783

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Gray Communications, 3684 Clearview Ave., Doraville, GA 30340 (404) 455-3121 Gino Nappo
Lake Systems, 55 Chapel St., Newton, MA 02134 (617) 244-6881 Frank DeMayo
Magnetic Media, 5555 N. Lamar, Suite J-115, Austin, TX 78751 (512) 451-0138 John Harms
Midwest Telecommunications, 4700 Boston Way, Lanham, MD 20801 (301) 577-4903 E. J. Midkiff
MPCS Video Industries, 514 W. 57th St., New York, NY 10019 (212) 586-3690 Marty Frange
Pacific Video, 2600 E. Katella, Anaheim, CA 92806 (714) 634-8585 Keith Hughes
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Hoffman Video Systems, 800 W. Pico, Los Angeles, CA 90015 (213) 749-3311 Bill Wallace
Professional Products, 4964 Fairmont Ave., Betheda, MD 20014 (301) 657-2141 Carter Kaufman
Videosonics, 821 SE 14th Ave., Portland, OR 97214 (503) 232-4632 Bill Achatz
Roscor, 6160 W. Oakton, Morton Grove, IL 60053 Phil Roston
Video Equipment Corp., 7377 Convoy Court, San Diego, CA 92111 (714) 278-4274 Bill Bennett
Technical Industries, 6000 Peachtree Rd., Atlanta, GA 30341 (404) 455-7610 Ed Matthews
Snader and Associates, 216 E. Strawberry Dr., Mill Valley, CA 94941 (415) 383-4263 Bob Snader
Technical Video, 245 Executive Park Blvd., Winston Salem, NC 27103 (919) 768-9536 Jim Holladay
Klopf Audio Video, 3381 Successful Way, Dayton, OH 45414 (513) 236-5500 Russ Johnson

Information Processing Systems, Of California, Inc., 70 Glenn Way, Belmont, CA 94002

Inmark Corp., 38 Brushwood Rd., Stamford, CT 06903

Innovative Television Equipment, Inc., P.O. Box 681, Woodland Hills, CA 91365

Inovonics Inc., 503-B Vandell Way, Campbell, CA 95008

J. B. Wood, Pres. (408) 374-8300

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Mel Audio/Video, 1122 E. Chevy Chase Dr., Glendale, Calif. 91205 (213) 245-7708
VIF International, 1151 Viscaino Ave., Sunnyvale, Calif. 94086 (408) 739-9740
Savco, Box 427, Richardson, Tex. 75080 (214) 234-1841
Inovonics, Box 1014, Port Washington, N.Y. 11050 (516) 883-4818
Joel Associates, 528 River Rd., Teaneck, N.J. 07666 (201) 836-8741
Lebow Labs, 424 Cambridge St., Allston, Mass. 02134 (617) 782-0600
Broadcast Equip. & Supply, Box 3141, Bristol, Tenn. 37620 (615) 968-7342
The Harris Co., 1779 Tiggertail Rd., Miami, Fla. 33145 (305) 854-2003
John J. Harding Ltd., 2825 Valena St., Honolulu, Hawaii 96819 (808) 841-0941
Broadcast Supply West, 2711 Locust Ave. W., Tacoma, Wash. 98466 (206) 565-2301

Integrated Sound Systems Inc., 29-50 Northern Blvd., Long Island City, N.Y. 11101

Integrex, Inc., Box 747, Havertown, PA 19083

Interand Corp., Telestrator Div., 666 N. Lake Shore Dr., Chicago, Ill. 60611

International Electro-Magnetics, 350 Eric Dr., Palatine, Ill. 60067

International Microwave Corp., 33 River Rd., Cos Cob, Conn. 06807

International Nuclear Corp., 608 Norris Ave., Nashville, Tenn. 37204

International Tapetronics Corp., Box 241, Bloomington, Ill. 61701

Larry Cutchens (309) 828-1381

International Video Corp., 453 W. Maude Ave., Sunnyvale, Calif. 94086

Intertec Publishing Corp., Box 12901, Overland Park, Ks 66212

Ivie Electronics, Inc., 500 West 1200 South, Orem, Utah 84057

J

Janson Industries, Box 6090, Canton, Ohio 44706

Jatex, Inc., 2626 Freewood Dr., Dallas, TX 75220

Javelin Electronics, A Subs. of Kidde, Inc., 19831 Magellan Dr., Torrance, CA 90502

Jensen Transformers, 1617 N. Fuller Ave., Hollywood, Calif. 90046

Bruce Black (213) 876-0059

REGIONAL SALES CONTACTS:

Scenic Sounds Equipment, 97-99 Dean St., London England W1V 5RA 01-734-2812 David Hawkins
TOWA Engineering, No. 7 Azuma Bldg. 1-9 Sakama-cho, Kanada Chiyoda-ku, Tokyo 101 Japan
Syntec Pty. Ltd., 53 Victoria Ave., Chatswood, N.S.W. 2067 Australia 406-4557 Robert Sloss

Johnson Electronics Inc., Box 7, Casselberry, FL 32707

K

KAPCO Communications, Box 538, Morton Grove, IL 60053

K B Systems, 10407 62nd Place West, Everett, WA 98204

KD Components, Inc., 3016 Orange Ave., Santa Ana, CA 92707

K & H Products, Ltd., Box 246, North Bennington, VT 05257

Kahn Communications, Inc., 839 Stewart Ave., Garden City, NY 11530

Kaitronics Corp., 1540 Gilbreth Rd., Burlingame, CA 94010

Kalart Victor Corp., Hultenius St., Plainville, Conn. 06062

KalaMusic, 600 ISB Bldg., Kalamazoo, MI 49007

Kaman Sciences/BCS, Box 7463, Colorado Springs, CO 80933

Kapco Communications, 5221 N. Elston Ave., Chicago, IL 60630

Ken Rubel (312) 545-2544

Kappa Networks, Inc., 165 Roosevelt Ave., Carteret, N.J. 07008

Kay Elemetrics Corp., 12 BE Maple Ave., Pine Brook, N.J. 07058

Kay Industries, Inc., 604 N. Hill St., South Bend, Ind. 46617

Kinetronics Corp., 42 Sherwood Terr., Lake Bluff, IL 60044

Kings Electronics Co., Inc., 40 Marbledale Rd., Tuckahoe, N.Y. 10707

Kintek, Inc., 61 Chapel St., Newton, MA 02158

Product Listings Begin on Page 116

The Power Paradox:

The AC power your computer needs in order to operate is also a major cause of computer error, malfunction and damage.

The computers that control your operations (and therefore your profits) are designed to operate from a clean, steady supply of ac power.

This ac power *must* be kept within manufacturer-specified tolerances in order for the computers to operate properly and safely.

In fact, the U.S. Department of Commerce states that "if a computer's voltage exceeds 120% [of the rated voltage] for a duration as short as 1 to 10 milliseconds, the computer will make errors."[1] Unfortunately, interruptions and disturbances of this nature are commonplace occurrences within most computer facilities.

A comprehensive study of power line disturbances which affect sensitive computerized equipment was conducted by two IBM researchers. They concluded that such disturbances occur on an average of 128 times each month.[2] For users of computer-based equipment, power disturbances can and do create a variety of costly problems.

Effects upon data processing computers.

When these power disturbances occur in your data processing center they can cause entry errors, program changes or loss, head crash, data loss, the generation of false or garbled data, the need to rerun programs, and computer downtime.

Effects upon computerized process control equipment.

Process control equipment is also vulnerable to power disturbances. Common problems created by these disturbances include improper batch termination and even program changes. The program changes can result in the repetition of process errors and in downtime while equipment is being reprogrammed.

Effects upon energy management systems.

Most energy management systems use small computers to make energy-saving decisions, but their effectiveness can be offset by these same disturbances. Program changes and errors may prevent useful operation of these systems as energy savers.

Thus, the computers your company depends on to reduce operating costs actually may be increasing them.

Topaz power peripherals can protect all of your computers.

Topaz can provide the power peripherals specifically designed to keep your company's data processing, process control and energy management computers from making costly power-related errors.

And if you manufacture computers or computerized equipment, Topaz peripherals can make your product more reliable as well as reduce the requirements for needless service calls.

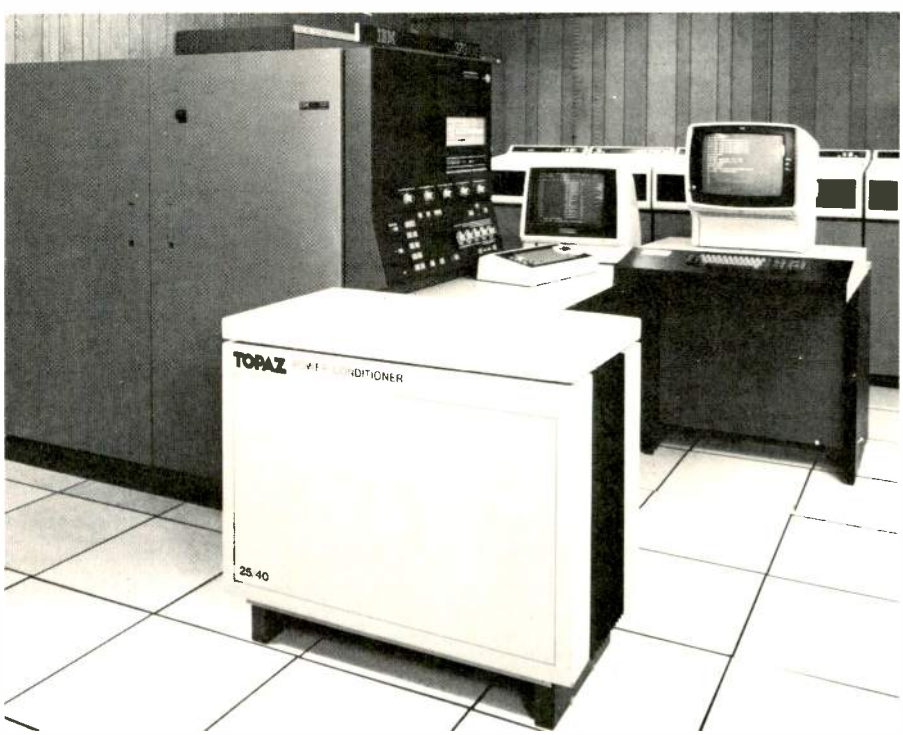
Immediate delivery and guaranteed solutions to power problems have made Topaz the leading computer power peripheral company in the world.

For more information about Topaz and its products:

1. Tear out this ad and mail it to us along with your business card; or
2. Circle the reader service card; or
3. Call us:

References:

1. *U.S. Department of Commerce, "The Effects of Electrical Power Variation Upon Computers: an Overview."*
2. *George W. Allen and Donald Segall, IBM Systems Development Div., "Monitoring of Computer Installations for Power Line Disturbances," presented to the IEEE Power Engineering Society.*



Topaz peripherals solve the power paradox by conditioning normal ac power for your computer and computer-based equipment.

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Arclite Systems, Inc., P.O. Box 471, Ardsley, NY 10502 (212) 220-1022
Richard E. Nicholson, 75 W. Main St., E. Bloomfield, NY 14443 (716) 657-7512
Lengemann and Vetter, Inc., 1504 Walnut Ave., Oreland, PA 19075 (215) 884-5375
The Bob Foley Co., Inc., 9609 Parallel Pkwy., Kansas City, KS 66109 (913) 299-3002
Charles Hansing Co., 4127 Beard Ave. South, Minneapolis, MN 55410 (612) 926-2244
Charlesworth-Ward-Rafferty Assoc., 10127 Manchester Rd., St. Louis, MO 63122 (314) 821-7800
Great Plains Lighting Corp., 2305 S. 33rd St., Omaha, NE 68105 (402) 348-9194
Galbraith & Kurtz, 10 N. Main St., Chagrin Falls, OH 44022 (216) 247-6866
Ed-Ward & Co., P.O. Box 09482, Milwaukee, WI 53209 (414) 461-5570
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Newman-Penter-James Co., Inc., 4790 Mendel Ct., Atlanta, GA 30336 (404) 696-1300
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Somar, Inc., P.O. Box 10543, Jefferson, LA 70181 (504) 733-9525
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Ed C. Vaughn Co., 3 Cderonella Drive, Chapel Hill, NC 27514 (919) 383-2938
Robert Nott Co., 2712 East 5th Place, Tulsa, OK 74104 (918) 939-4541
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Putterman, Scharck & Assoc. Inc., P.O. Box 36508, Houston, TX 77036 (713) 664-7111
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Peterson/Vine, Inc., 15230 Burbank Blvd. Suite 105, Van Nuys, CA 91141 (213) 988-8661
Harry L. Stearns, Inc., 522 N. W. 23rd St., Portland, OR 97210 (503) 227-0593
Robert Bacon, 50 East Malvern Avenue, Salt Lake City, UT 84115 (801) 484-1701
Sanborn Sales, P.O. Box 80825, Seattle, WA 98108 (206) 767-3050

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Schaffer Associates, 16-44 202nd St., Bayside, NY 11360 (212) 352-8838 Jack Schaffer
Hack Associates, 22 Cedar St., Auburn, MA 01501 (617) 832-3175 Fred Hack
Radford Associates, 1331 Otter Creek Rd., Nashville, TN 37215 (615) 373-0231 Ralph Hucaby
MARCOM, 3590 Central Ave., #208, Riverside, CA 92506 (714) 684-7502 Dave Diels
EME, 112 Buena Vista, High Point, NC 27260 (919) 869-3335 George Gold
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Mile High Marketing, 9191-D No. Washington St., Thornton, CO 80229 (303) 457-2058 Chuck Jones
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Kroy Industries Inc., Box 43716, St. Paul, MN 55104

L

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LPB Inc., 28 Bacton Hill Rd., Frazer, PA 19355

Harry N. Larkin (215) 644-1123

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MSC Electronics, Ltd., 254 Wildcat Rd., Downsview, Ont. Canada M3J 2N5 (416) 661-4180 Dennis Hinstridge

LTM Corp. of America, 1160 N. Las Palmas, Hollywood, CA 90038

L-W International, 6416 Variel Ave., Woodland Hills, CA 91367

Laird Telemedia Inc., 2424 So. 2570 West, Salt Lake City, UT 84119

Lampkin Lab. Inc., Box 9048, Bradenton, Fla. 33506

James B. Lansing Sound, Inc., 8500 Balboa Blvd., Northridge, Calif. 91329

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JBL, 1413 Leicester St., Garland, TX 75042 (214) 495-5415 Carl Cathcart

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Leader Instruments Corp., 380 Oser Ave., Hauppauge, NY 11787

Leasametric, 1164 Triton Dr., Foster City, CA 94404

LeBlanc & Royle Comm. Towers Ltd., 514 Chartwell Rd., Box 880, Oakville, Ontario, Canada L6J 5C5

LeCroy Fiberoptic Systems, 10024 York Rd., Cockeysville, MD 21030

Lectrotech Inc., 5810 N. Western Ave., Chicago, Ill. 60659

Leedal, Inc., 1918 S. Prairie Ave., Chicago, IL 60616

Lee-Ray Industries, Inc., 38 E. First Ave., Mesa, Ariz. 85202

Leitch Video Ltd., 705 Progress, Unit 46, Scarborough, Ont., Canada M1H 2X1

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Didier/Denver, 11465 West 48th Ave., Wheat Ridge, Colo. 80033 (303) 422-6666 Herb Didier
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Nortec West Ltd., 7056 B Farrell Rd. S.E., Calgary, Alta. T2H 0T2 Canada (403) 252-8141 Ron Hill
Nortec West Ltd., 325 West 5th Ave., Vancouver, B.C. V5Y 1J6 Canada (604) 872-8525 Bob Whitehouse
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Broadcast Video Systems Inc., 1050 E. Dominquez St., Unit P, Carson, CA 90746 (213) 637-2971 John Spiker
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The Gene Sudduth Co. Inc., 845 39th S.E., Paris, TX 75460 (214) 785-5764 Gene Sudduth
Kim Oh & Co., C.P.O. Box 3590, Seoul Korea 22-0337 Jeong Seon Oh
Seltech Equipment Ltd., 16 York Rd. Maidenhead, Berkshire England SL6 1SF (628) 36315 Bill Jeynes; Dave Craddock
Tresco Communications Inc., 2910 Halpern St., N., St. Laurent, Que. Canada H4S 1N7 (514) 332-3430 Claude Tresidder
Leitch Video Inc., 210 S. 8th St., Lewiston, NY 14092 (716) 754-4349 Lowell Colbus

Lemo USA Inc., Box 6626, Santa Rosa, CA 95406

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Lenco, Inc., Electronics Div., 1120 South 4th St., Atchison, KS 66002 (913) 367-1146 Merton L. Knold
Lenco, Inc., Electronics Div., Box 4042, Albany, GA 31706 (912) 436-4927 Thomas J. Sabiston Jr.

Lenzar Optics Corp., 1006 West 15th St., Riviera Beach, FL 33404

Lexicon Inc., 60 Turner St., Waltham, MA 02154

Lightning Elimination Assoc., Inc., 12516 Lakeland Rd., Santa Fe Springs, CA 90670

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Applied Measurements, Inc., RD #1, Hillside Street, North Bennington, VT 05257 (802) 442-2222 Chris Henningsen
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Walter J. Brauer & Associates, Inc., P.O. Box 35, Vandalia, OH 45377 (513) 898-1224 Bill Williams
Gordon Fixman Engineering Company, 8160 Stanford Avenue, St. Louis, MO 63130 (314) 725-5219 Gordon Fixman
Leemark Engineers, 7234 Wornall Rd., Kansas City, MO 64114 (913) 648-0124 Eugene Shapiro
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F M Associates Limited, 110 Yacht Club Place, P.O. Box 996, Jupiter, FL 33458 (305) 746-2996 Don Kehr
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R. A. Mayes Company, 1445 E. Thomas Road, #218, Phoenix, AZ 85014 (602) 279-5243 Thimothy A. Weaver
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Nomad Engineering, 466 Central Ave., Suite 28, Northfield, IL 60093 (312) 446-2725 Hugh Eadie
S.M.I. Company, 1138 - 37th St., Des Moines, IA 50311 Dave Shearer
Universal Data Systems, Box 10-1888, Anchorage, AK 99511 John R. Drew
Thibodeau Engineering, 725 South Adams, Suite L-1, Birmingham, MI 48011 (313) 642-6620 Paul J. Thibodeau
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R. A. Mayes Company, 9449 Briar Forest Dr., #3511, Houston, TX 77063 (713) 783-3856 Bob Deal
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F M Associates Limited, 106 Elam Avenue, P.O. Box 156, Ramseur, NC 27316 (919) 824-2196; 824-8461 Phil Brooks
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Century Dynamics, Inc., 4704 Collbran Court, Ft. Wayne, IN 46815 (219) 486-2681 Robert J. Eifert
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Magna-Techtronics, Crows Nest, N.S. W. 2065 14 Whiting Street, P.O. Box 150, Artarmon, N.S. W. 2064 Australia F. L. Lloyd, Managing Director
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Product Listings Begin on Page 116

DYNAMIC NEW DIMENSIONS IN VISUAL PRESENTATION —with General Electric Professional Large Screen TV Projection

General Electric professional large screen television projectors—displaying color or monochrome pictures up to 25 feet wide—bring new dimensions of presentation impact to a broad spectrum of applications.

A wide choice of new and improved color and monochrome models is available to meet specific requirements for television display applications, in standard or high brightness, for various scan standards.

The color projectors utilize General Electric's exclusive single optical path light valve. All color information is projected simultaneously in one light beam. This system eliminates time-consuming registration of three separate images which is required for all other color television projectors.

These projectors can display any size television picture from two feet to 25 feet wide, with high resolution and contrast over their full range of light output.

Among the primary applications of the projectors are:

Medical and Dental Education. Technique and procedural training.

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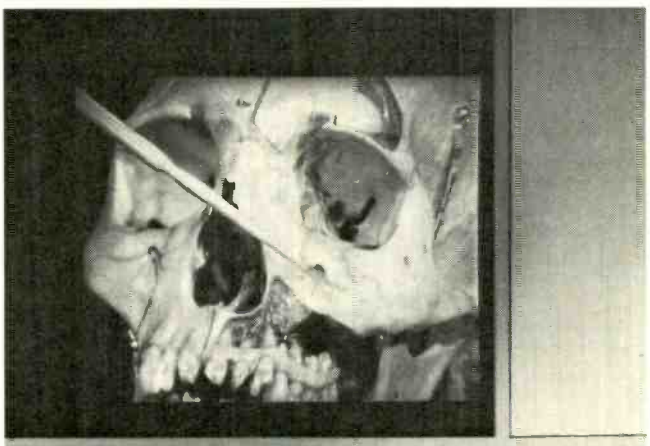
Television Production. Backgrounds for news programs, special effects, data display, program previewing.

Call or write: General Electric Company, Video Display Equipment Operation, Electronics Park 6-206, Syracuse, New York 13221. Phone: (315) 456-2562/2533/2179.

IN THE BOARD ROOM: At Mellon Bank N.A., Pittsburgh, General Electric color projector displays data, graphs, and information programs.



IN EDUCATION: General Electric color projector gives students the big picture of minute detail at Upstate Medical Center, Syracuse, New York.

IN BUSINESS: General Electric projectors display real-time computer-generated data for Merrill Lynch Government Securities, New York.

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Japan: C. Itoh & Company, Ltd., 555 South Flower Street, Los Angeles, CA 90071 (213) 687-0610
C. Itoh & Company Ltd., Osaka Head Office, Central P.O. Box 117, Osaka Japan S. Fusejima
Patrick Trading Corporation, 20th Floor, Hong Chong Building, G.P.O. Box 9963, 5 Queens Rd. Central, Hong Kong 5-220964; 5-225406 C. S. Hsu, General Manager
M.S. C. Electronics Limited, 254 Wildcat Road, Downsview, Ont. Canada M3J 2N5 (416) 661-4180 N.D. LaFrenais President
M. S. C. Electronics Limited, 847 Dale Blvd., Winnipeg, Man. Canada R3R 1R4 (204) 895-8380 Bruce Edgar
M. S. C. Electronics Limited, 2356 Bachard, Montreal, Que. J3L 4E9 Canada (514) 658-0065 Pierre Briau

Link Electronics Ltd., North Way, Andover, Hants, England SP10 5AJ

Lipps, Inc., 1630 Euclid St., Santa Monica, CA 90404

Lipsner-Smith Corp., 4700 Chase St., Lincolnwood, Ill. 60646

Live Sound Inc., 1741 N. Ivar, Suite 101, Hollywood, CA 90028

Logitek Electronic Systems, Inc., 3320 Bering Dr., Houston, TX 77057

L. Scott Hochberg (713) 782-4592

REGIONAL SALES CONTACTS:

Giesler Broadcast Supply, 9440L Harwin Dr., Houston, TX 77036 (713) 974-6205 Bernie Giesler
Guarantee Radio Supply, Export Only, 1314 Iturbide St., Laredo, TX 78040 (512) 723-6913 Rick Reyes
H.M. Holzberg Associates, Inc., P.O. Box 322, Totowa, NJ 07511 (201) 256-0455 Herb Holzberg
S&W Broadcast Sales, 122 Lyon N.w., 100G Water Bldg., Grand Rapids, MI 49503 (616) 451-0074 John Seymour
S&W Broadcast Sales, 334 Industrial State Bank Bldg., Kalamazoo, MI 49007 (616) 342-4973 Ray Winters
Southeast Electronics Inc., Box 41308, Jacksonville, FL 32203 (904) 356-3007 Clark Overton
Southeast Electronics Inc., 1311 Executive Center Dr., Tallahassee, FL 32301 (904) 878-8606 Neff Cox, Jr.

London Electric Co., 27-16 Fortyfirst Ave., Long Island City, NY 11101

Lowel-Light, 421 W. 54th St., New York, N.Y. 10019

Lowenthal Mfg., 2076 N. Elston, Chicago, IL 60614

Lyon Metal Products, Inc., Box 671, Aurora, IL 60507

M

MCG Electronics Inc., 160 Brook Ave., Deer Park, N.Y. 11729

MCI Inc., 1400 W. Commercial Blvd., Ft. Lauderdale, FL 33309

Lutz H. Meyer, V.P. Marketing (305) 491-0825

REGIONAL SALES CONTACTS:

Audio Industries Corp., 1419 N. LaBrea Ave., Hollywood, CA 90028 (213) 851-4111 Ike Benoun
Audiotechniques Inc., 652 Glenbrook Rd., Stamford, CT 06906 (203) 359-2312 Mike Faulkner
MCI, Inc./Nashville Office, Nashville Commerce Mall, Suite B-9, 1717 Elm Hill Pike, Nashville, TN 37027 (615) 366-0333 H. Graeme Goodall
Milam Audio Corp., 1504 North 8th St., Pekin, IL 61554 (309) 346-3161 Jerry Milam
Pacific Recorder & Engineering Corp., 11100 Roselle St., San Diego, CA 92121 (714) 453-3255 Jack Williams
Pro Audio General Store, Inc., 1378 Northwest 100th Ave., Coral Springs, FL 33065 (305) 752-0330 William G. Shute
Pro Audio Seattle, 11057 - 8th Ave. N.E., Seattle, WA 98125 (206) 367-6800 Craig G. Ingle
Recording Studio Equip. Co., 18917 Northeast 5th Ave., North Miami Beach, FL 33160 (305) 949-8918 Seth Snyder
Sound 80, 2709 East 25th St., Minneapolis, MN 55406 (612) 721-6341 Gary Erickson
Southwest Professional Audio, 308 West 6th St., Austin, TX 78701 (512) 477-3706 Stephen Shields
Control Technology, Inc., 991 Southwest 27th Ave., Ft. Lauderdale, FL 33312 (305) 792-7791 James C. Woodworth

MCI/Quantel, Box 50810, Palo Alto, CA 94303

MICMIX Audio Products, Inc., 2995 Ladybird Lane, Dallas, Texas 75220

MPB Technologies Inc., P.O. Box 160, Ste-Anne-de-Bellevue, Que., Canada H9X 3L5

MSI Television, 4788 S. State St., Salt Lake City, UT 84107

Mackintosh Consultants, Inc., 2444 Moorpark Ave., Ste. 211, San Jose, CA 95128

Magnasync/Moviola Corp., 5539 Riverton Ave., North Hollywood, CA 91603

Magna-Tech Electronic Co., Inc., 630 Ninth Ave., New York, N.Y. 10036

Magnavox CATV Systems, Inc., 100 Fairgrounds Dr., Manlius, NY 13104

Magnecraft Electric Co., 5575 N. Lynch Ave., Chicago, Ill. 60630

Magnefax Int'l., Inc., Route 1 Box 764, Rogers, AK 72756

Magnesonics Mfg. & Sales Co., Box 758, Ventura, CA 93001

Maldwyn Bowden Int'l. Ltd., 168 Edward St., Brighton, Sussex, England BN2 2JB

Mallory Distributor Prod. Co., Mallory Components Group, Box 1284, Indianapolis, IN 46206

The Management, Box 111, Aledo, TX 76008

Marconi Communication Systems Ltd., Marconi House, Chemsford, Essex, England CM1 1PL

Marconi Electronics Inc., Broadcast & Communication Div., 100 Stonehurst Ct., Northvale, N. J. 07647

Fred Bones, A. V. Lummiss (201) 767-7250

Marconi Instruments, Div. of Marconi Electronics Inc., 100 Stonehurst Ct., Northvale, N. J. 07647

Keith Elkins, Tony Ramsden (201) 767-7250

REGIONAL SALES CONTACTS:

L&M Associates, 511 Victor St., Saddle Brook, N.J. 07662 (201) 843-8700 Martin Silver
CEC, 1602 S. Parker Rd., Suite 102, Denver, CO 80231 (303) 751-3252 Richard Seery
S&S Associates, 4924 Hampden Lane, Bethesda, Md. 20014 (301) 654-1434 Bill Becker
Kenneth W. Meyers Co., 1242 Remington Rd., Schaunburg, Ill. 60195 (312) 882-4808 Ken Meyers
Ken Corp., 38 Montvale, Stoneham, Mass. 02180 (617) 438-5464 Sam Kenton
Lee Associates, 817 Wheeler Ave., Huntsville, Ala. 35801 (205) 533-5896 Steve Shelley
TASCO, 606 110th Ave. N.E., Suite 204, Belleview, Wash. 98004 (206) 453-1414 Helbert Bartels
BRADENCO, 11500 Stemmons Freeway, Suite 113, Dallas, Tex. 75229 (214) 243-7261 Bob Braden
Moxon Electronics, 1440 S. State College Blvd., Anaheim, Calif. 92806 (714) 635-7600 Jim Jordan
John Robinson, 817 Fifth St., Santa Monica, Calif. 90403 (213) 451-9019 John Ro
Measurement Consultants, Inc., Box 966, Scottsdale, Ariz. 85252 (602) 994-9519 Dave Memegay
PAC, 11920 Grandview Rd., Grandview, Mo. 64030 (816) 763-4155 Daryl Booth

Marshall Electronics, Box 2027, Culver City, CA 90230

Marti Electronics, Box 661, Cleburne, Tex. 76031

Mast Development Co., A-V Systems Div., 2212 E. 12th St., Davenport, IA 52803

Matrix Systems Inc., Box 31386, Dallas, TX 75231

Matthews Studio Equipment, Inc., 2405 Empire Ave., Burbank, CA 91504

Maury Microwave Corp., 8610 Helms Ave., Cucamonga, Calif. 91730

Maxell Corp. of America, 60 Oxford Dr., Moonachie, N. J. 07074

Jim Ringwood (201) 440-8020

McCurdy Radio Ind. Inc., 1711 Carmen Dr, Elk Grove Village, Ill. 60007

McInnis, Skinner & Associates, 3317 N. Shartel Ave., Oklahoma City, OK 73118

McKay Dymek Co., Box 5000, Claremont, Calif. 91711

McMartin Industries, Inc., 4500 South 76th St., Omaha, Neb. 68127

Robert Switzer (402) 331-2000

REGIONAL SALES CONTACTS:

McMartin Industries, 3317 Barrow Hill Trail, Tallahassee, FL 32308 (904) 893-1382 Robert Beattie
McMartin Industries, 15316 Russett, Rt. 1, Pride, LA 70770 (504) 261-7507 Roland F. Coppola, Jr.
McMartin Industries, 4691 West 142nd St., Apple Valley, MN 55124 (612) 423-1489 Bill Emery
McMartin Industries, 4044 Knoll Top Court, Carmichael, CA 95608 (916) 485-2605 Richard Hanseth
McMartin Industries, 2608 Mollimar, Plano, TX 75074 (214) 596-5503 Don S. Jones
McMartin Industries, 10 Kregg Rd., Fairport, NY 14450 (716) 223-5270 Rick L. Marshall
McMartin Industries, 914 S. Lynn, Champaign, IL 61820 (217) 356-5436 John Tollefson
McMartin Industries, 2944 Carnaby St., Indianapolis, IN 46229 (317) 897-1933 Richard J. Sawicki
McMartin Industries, 13516 N.E. 89th Pl., Kirkland, WA 98033 (206) 823-1500 John Schneider

Media Concepts, Inc., 559 49th St. S., St. Petersburg, FL 33707

Memorex Corp., Professional Products Group, 1200 Memorex Drive, Santa Clara, CA 95052

Merill Cable Equipment Corp., Box 13741, Phoenix, Ariz. 85002

Merlin Engineering Works, Inc., 1880 Embarcadero, Palo Alto, Calif. 94303

Metrifast, 51 S. Denton Ave., New Hyde Park, NY 11040

Micro Communications, Inc., Box 4365, Grenier Field, Manchester, N.H. 03108

Micro Control Associates, Inc., Box 694, Cleburne, TX 76031

Robert Richards, President (817) 295-7771

Micro-Trak Corp., 620 Race St., Holyoke, Mass. 01040

William Stacy, Pres. (413) 536-3551

REGIONAL SALES CONTACTS:

Allied Broadcast Equip. Co., 635 South 'E' St., Richmond, IN
Audio Distributors Inc., 2342 Division Ave., Grand Rapids, MI
Audio Innovators, 216 Blvd. of the Allies, Pittsburgh, PA
Audiomedia Associates, P.O. Box 29264, New Orleans, LA
Barry Trading Co., 105 W. Market, P.O. Box 609, Lebanon, TN
Broadcast Communication Products, P.O. Box 204, Golden, CO.
Broadcast Communication Assoc., P.O. Box 2606, Peachtree City, GA
Broadcast Consultants, Inc., P.O. Box 590, Leesburg, VA
Broadcast Distributors, Bible Place, Cleveland, OH
Broadcast Electronic Service, Eastern Ave., P.O. Box 94, Ft. Atkinson, WI
Broadcast Int'l. Inc., 1229 Northeast 37th St., Ft. Lauderdale, FL
Broadcast Services, 2877 Kalakawa, Honolulu, HI
Broadcast Supply West, 7012 - 27th, West Tacoma, WA
Broadcom, Tilghman at Jefferson Sts., Allentown, PA
Comex Corp., P.O. Box 17011, Washington, DC
Continental Electronic Wholesale, 1620 West 32nd Place, Hialeah, FL
Cramer Video, 120 Hampton Ave., Needham Hgts., MA
Doug Brown Enterprises, P.O. Box 7494, Tulsa, OK
Dyma Engineering, 213 Pueblo del Sur, Taos, NM
Electronic Equip. Co., 526 Plaster Ave., Atlanta, GA
Guarantee Radio Supply Corp., 1314 Iturbide St., Laredo, TX
Holt Technical Services, Westgate Mall, Suite 205, Bethlehem, PA
Klopf Audiio Video Co., 3381 Successful Way, Dayton, OH
Lake Systems, 55 Chapel St., Newton, MA.
Ma-Cal Enterprises, Inc., 230 Livingston St., Northvale, NJ
Martin Audio/Video, 423 West 55th St., New York, NY
Media-West, Inc., 187 West 3100 South, P.O. Box 458, Bountiful, UT
Peirce Phelps Inc., 2000 Block North 59th St., Philadelphia, PA
Tower Distributors, P.O. Box 12, Lewes, DE
W.R.H. Production, 5 Industrial Way, Riverside, RI
Comad Communications Ltd., 91 Kelfield St., Unit 5, Rexdale, Ont. Canada
Nortec West, Ltd., 325 - 5th Ave., Vancouver, B.C. Canada
Oakwood Audio Labs Ltd., 650 King Edward St., Winnipeg, Man. Canada
Radio Service Inc., 2500 Bates Rd., Montreal, Que. Canada

Microdyne Corp., Box 7213, Ocala, FL 32672

Microflect Co., Inc., 3575 25th St. S.E., Salem, OR 97302

Microprobe Electronics, Inc., 875 N. Michigan Ave., Suite 1532A, Chicago, IL 60611

Microtime, Inc., 1280 Blue Hills Ave., Bloomfield, Conn. 06002

Microtran Co., Inc., Box 236, Valley Stream, N.Y. 11582

Walter Benscher, V.P.-Sales (516) 561-6050

REGIONAL SALES CONTACTS:

Fred Schoeffler Assoc., Inc., 8630 Via de Encanto, Scottsdale, AZ 85258 (602) 948-1004 Fred Schoeffler
Kottmeier Associates, Inc., 10057 Alhambra St., Cupertino, CA 95014 (408) 255-3710 Frank Kottmeier
Cook Enterprises, Inc., 11401 E. Valley Blvd., El Monte, CA 91731 (213) 686-2120 John Cook
Omega, Ltd., 6565 E. Evans Ave., Denver, CO 80224 (303) 758-1508 Roger Long
Chaco Sales, 2233 Nursery Rd., Clearwater, FL 33516 (813) 536-9503 Harold Galley
Chaco Sales, 601 W. Oakland Park Blvd., Ft. Lauderdale, FL 33311 (305) 561-3155 Bill Charles
Lancastle, Ltd., 111 North Ave., Barrington, IL 60010 (312) 381-6780 Lou Bacher

Product Listings Begin on Page 116

John F. Guernsey Co., 100100 Santa Fe Dr., Mark 1 Bldg., Suite 101, Overland Park, KS 66212 (913) 381-2225 John F. Guernsey
Coastal Sales Co., 10055 St. Paul Ave., New Orleans, LA 70123 (504) 737-8074 Paul Arceneaux
Callas Electronics, Inc., 6409 Frederick Ave., Baltimore, MD 21228 (301) 744-7711 Bill Callas
Meco, Inc., 400 Main St., Reading, MA 01867 (617) 944-6660 Leo McNamara
Ed Glass Associates, 120 Sylvan Ave., Englewood Cliffs, NJ 07632 (212) 586-8440 Ed Glass
C.T. Carlberg & Associates, Inc., 2611 Quincy N.E., P.O. Box 3177, Station D, Albuquerque, NM 87110 (505) 265-1579 C.T. Carlberg
J.G. Welch Associates, Inc., 98 Fairview Crescent, Rochester, NY 14617 (716) 244-1100 J.G. Welch
Over & Over, Inc., 500 Archdale Dr., Charlotte, NC 28210 (704) 527-3070 Allan Over
John O. Olsen Co., 5171 Joseph St., Cleveland, OH 44137 (216) 662-3454 Edward J. Krenek
John O. Olsen Co., 781 Neeb Rd., Cincinnati, OH 45238 (513) 451-5995 W.F. Needles
Arnold Associates, P.O. Box 1012, Jenkintown, PA 19046 (215) 887-7870 Arnold Bookman
John O. Olsen Co., 104 Elatan Dr., Pittsburgh, PA 15243 (412) 279-2550 E.A. Snefsky
Howell Sales, Inc., P.O. Box 747, Grand Prairie, TX 75051 (214) 262-5153 Joe Howell
Don Newman Co., 16232 - 38th Ave. N.E., Seattle, WA 98155 (206) 365-1190 Don Newman
Lancastle, Ltd., 6414 Copps Ave., Madison, WI 53716 (608) 222-7550 Larry Nelson

Microwave Associates, Communications Co., 63 Third Ave., Burlington, MA 01803

Microwave Power Devices, Inc., 330 Oser Ave., Hauppauge, NY 11787

Mid State Communications, Inc., 174 S. 1st Ave., Beech Grove, IN 46107

Miles Associates, Div. Miles Products Ltd., 240 Birmingham St., Toronto, Ont., Canada M8V 2C8

Millen Components, Div. of E.I. & S. Corp., 5 Lowell Ave., Winchester, MA 01890

L. Matthew Miller Assoc. Ltd., 205 East 42nd St., Suite 1316, New York, NY 10017

Miller Professional Equipment, Inc., 10816 Burbank Blvd., North Hollywood, CA 91601

Minneapolis Magnetics, 3104 W. Lake St., Minneapolis, MN 55416

Misar Industries, 1477 E. Warner Ave., Santa Ana, CA 92705

Modular Audio Products, Unit of Modular Devices, Inc., 50 Orville Dr., Bohemia, N. Y. 11716

Julius Brick (516) 567-9620

REGIONAL SALES CONTACTS:

Richard S. Pass Associates, 9003 Eastview Rd., Philadelphia, PA 19152 (215) 464-9444 Richard Pass
Bencsik Associates, 1311 N.E. 13th Ave., Ocala, FL 32670 (904) 732-9775 Bill Bencsik
Pine Sales Corp., 570 Yonkers Ave., Yonkers, NY 10704 (914) 423-4747 Paul Pusecker
N.E.R.E.M., 64 Whittier Rd., Wakefield, MA 01880 (617) 245-4426 Owen Cook
Gra-Mar Inc., 3165 McCrory Pl., Orlando, FL 32814 (305) 894-3351 Neal Imhoof

Mole-Richardson Co., 937 N. Sycamore Ave., Hollywood, CA 90038

Money Machine, Box 23355, Nashville, TN 37202

Monroe Electronics, Inc., 212 Housel Ave., Lyndonville, N.Y. 14098

Moseley Associates, Inc., 111 Castilian Drive, Goleta, CA 93017

Charles F. Rockhill (805) 968-9621

Motorola Communications, and Electronics Inc., 1301 E. Algonquin Rd., Schaumburg, IL 60196

Motorola Semiconductor Products Inc., Box 20912, Phoenix, Ariz. 85036

Mu-Del Electronics, Inc., 2426 Linden Lane, Silver Spring, MD 20910

Multiplier Industries Corp., 464 South 10th Ave., Mt. Vernon, NY 10550

Multi-Track Magnetics, Inc., #3 Industrial Ave., Upper Saddle River, NJ 07458

Mura Corp., 177 Cantiague Rock Rd., Westbury, NY 11590

N

NEC America, Inc., Broadcast Equip. Div., 130 Martin Lane, Elk Grove Village, Ill. 60007

N.O.V.A. Corp., 5801 Uplander Way, Culver City, CA 90230

Nady Systems Inc., 1145 65th St., Oakland, CA 94608

Nagra Magnetic Recorders, Inc., 19 W. 44th St., Room 715, New York, N.Y. 10036

The Narda Microwave Corp., 75 Commercial St., Plainview, N.Y. 11803

Neal Ferrograph U.S.A., Inc., 652 Glenbrook Rd., Stamford, CT 06906

L. E. Nelson Corp., 6757 Groveview Lane, Las Vegas, NV 89103

Neumade Products Corp., 720 White Plains Rd., Scarsdale, N.Y. 10583

Neutrik Products, 77 Selleck St., Stamford, CT 06902

Rupert Neve, Inc., Berkshire Industrial Park, Bethel, CT 06801

Anthony Langley, Mktg. Mgr. (203) 744-6230

Newman/Lustig & Associates, 1050 N. State, Chicago, IL 60610

Nidus Systems Co., 11465 West 48th Ave., Wheat Ridge, CO 80033

North Hills Electronics, Inc., Alexander Pl., Glen Cove, N.Y. 11542

North Wind Power Co., Box 315 BD, Warren, VT 05674

Norton Associates Inc., 10 Ditomas Court, Copaigue, N.Y. 11726

Nortronics Co., Inc., Recorder Care Div., 8101 Tenth Ave. N., Minneapolis, Minn. 55427

Nova Electric Mfg. Co., 263 Hillside Ave., Nutley, NJ 07110

Fred A. Nudd Corp., Box 1743 Rt. 104, Ontario, N. Y. 14519

Frederick Nudd, V.P. (315) 524-2531

Nurad, Inc., 2165 Druid Park Dr., Baltimore, MD 21211

Nytone Electronics Corp., 2424 South 900 West, Salt Lake City, UT 84119

O

Oak Communications Inc., 16935 W. Bernardo Dr., Rancho Bernardo, CA 92127

O'Connor Eng. Labs. Inc., 100 Kalmus Drive, Costa Mesa, Calif. 92626

Oktel Corp., 490 Division St., Campbell, Calif. 95008

B. J. Okey, President (408) 374-1811

Onan Corp., 1400 73rd Avenue NE, Minneapolis, Minn. 55432

One Pass Video, 900 Third St., San Francisco, CA 94107

Opamp Labs, Inc., 1033 N. Sycamore Ave., Los Angeles, Calif. 90038

Optical Radiation Corp., 6352 N. Irwindale Ave., Azusa, CA 91702

Orange County Elec. Int'l., Inc., 534 Berry St., Winnipeg, Man., Canada R3H 0R9

Orban Assoc. Inc., 645 Bryant St., San Francisco, Calif. 94107

Jesse Maxenchs-Broadcast; Mark Mougel-Pro/Audio (415) 957-1067

Osawa & Co. (USA), Inc., 521 Fifth Ave., New York, N.Y. 10017

Allen Osborne Associates, 5195 N. Douglas Fir Rd., Calabasas, CA 91302

Osram/Macbeth Sales Corp., Box 7062, Newburgh, NY 12550

Otari Corp., 1559 Industrial Rd., San Carlos, CA 94070

Steve Krampf, Michael Bernard (415) 592-8311

P

PWH Electronics Ltd., Box 435, Toronto, Ont. Canada M6H 4E3

Pace Int'l. Corp., 3727 S. Robertson Blvd., Culver City, CA 90230

Pacific Recorders & Eng. Corp., 11100 Roselle St., San Diego, Calif. 92121

Packaged Lighting Systems, Box 285 - Grant St., Walden, N.Y. 12586

Paladin Corp., 31332 Via Colinas #106, Westlake Village, CA 91361

Panasonic Company, One Panasonic Way, Secaucus, N.J. 07094

Panasonic Co., Professional Audio Div., 50 Meadowland Pkwy., Secaucus, NJ 07094

Panasonic Co., Video Systems Div., One Panasonic Way, Secaucus, N.J. 07094

I. Iizuka, Gen. Mgr. (201) 348-7685

REGIONAL SALES CONTACTS:

Panasonic Co., Video Systems Div., Northeast Area, 50 Meadowlands Pkwy., Secaucus, N.J. 07094 (201) 348-7627 Michael Dollacker, Regional Sls. Mgr.
Panasonic Co., Video Systems Div., Southeast Area, #3 Meca Way, Norcross, Ga. 30093 (404) 923-9700 Leroy Wright, Regional Sls. Mgr.
Panasonic Co., Video Systems Div., Midwest Area, 425 E. Algonquin Rd., Arlington Htgs., Ill. 60005 (312) 364-7936 Richard Grams, Regional Mgr.
Panasonic Co., Video Systems Div., Southwest Area, 1825 Walnut Hill Lane, Irving, Tex. 75062 (214) 258-2828 Terry Conner, Regional Sls. Mgr.
Panasonic West, Inc., 8383 Wilshire Blvd., Beverly Hills, CA 70211 (213) 655-1111 Bob Karadizian, Regional Sls. Mgr.

Panoak Lighting Systems, 6809 East 40th St., Tulsa, OK 74145

Parsons Mfg. Corp., 1055 O'Brien Dr., Menlo Park, CA 94025

Paso Sound Products Inc., 14 First St., Pelham, N.Y. 10803

Patrick Computer Systems, Inc., 588 Roseberry St., Winnipeg, Man., Canada R3H 0T1

Pennbeth Marketing Inc., 906 Grand Ave., Suite 730, Kansas City, MO 64106

Pentagon Industries, Inc., 4751 N. Olcott Ave., Chicago, Ill. 60656

Permafilm Int'l. Corp., 305 East 46th St., New York, NY 10017

Perma Power Electronics, Inc., 5615 Howard Ave., Chicago, IL 60648

Perrott Eng. Labs, Inc., 1020 N. Fillmore, Arlington, VA 22201

Petersen Mfg. Co., Inc., DeWitt, NE 68341

Peterson Enterprises, Inc., 1840 Pickwick Ave., Glenview, IL 60025

Phasecom Corp., 6365 Arizona Circle, Los Angeles, CA 90045

Phelps Dodge Communications Co., Rt. 79, Marlboro, N.J. 07746

Saul Esocoff, Mgr. (201) 462-1880

Philadelphia Resins Corp., 20 Commerce Dr., Montgomeryville, PA 18936

REGIONAL SALES CONTACTS:

Philadelphia Resins Corp., 3030 Bridgeway, Sausalito, CA 94965 (415) 332-4670 George T. Kollock
Philadelphia Resins Corp., 148 Wisconsin Ave., Suite 208, Waukesha, WI 53186 (414) 542-8088 Eric A. Dow
The Heckerman Corp., 814 W. Hyde Park Blvd., Inglewood, Calif. 90302 (213) 678-2264 Fred Heckerman
Sea-Land Industries, 2301 Dock St., Tacoma, WA 98402 (206) 572-7010 Jim Sims
Breit's Tower Service, Dinner Key Marina, Miami, Fla. 33133 (305) 858-3143 Charles E. Breit

Philips Broadcast Equip Corp., 91 McKee Dr., Mahwah, N. J. 07430

William E. Amos, V.P. Mktg. (201) 529-3800

REGIONAL SALES CONTACTS:

Philips Broadcast Equip. Corp., Northeast Region, 91 McKee Dr., Mahwah, N.J. 07430 (201) 529-3800 Joseph Nigro
Philips Broadcast Equip. Corp., 3300 Northeast Expy., Suite 1G, Atlanta, GA 30341 (404) 458-0171 Jim Sims
Philips Broadcast Equip. Corp., 15611 Fish Point Rd., Prior Lake, MN 55372 (612) 447-6036 Jeffrey Clarine
Philips Broadcast Equip. Corp., Central Region, Norelco House, 7530 Frontage Rd., Skokie, Ill. 60077 (312) 679-8600 Harry Gladwin
Philips Broadcast Equip. Corp., Northwestern Region, 3760 Cahuenga Blvd., North Hollywood, Calif. 91604 (213) 766-8185 Jerry Kraus and Michael Hartt
Philips Broadcast Equip. Corp., Southeast Region, 801 Howard Grove Rd., David Sonville, MD 20135 (301) 956-3065 Robert Mahoney
Philips Broadcast Equip. Corp., Southwestern Region, #1 E. Woodglen, Woodlands, Copper Canyon, Tex. (817) 455-2214 Michael Mackin

Philips Test & Measuring, Instruments, Inc., 85 McKee Dr., Mahwah, N. J. 07430

W N Phillips Inc., WNP Electronics, 356 Bacon St., Lake City, MI 49651

Stanley Johnson (616) 839-7181

Product Listings Begin on Page 116

Photo Research, Div. of Kollmorgen Corp., 3000 N. Hollywood Way, Burbank, CA 91505

Piclear, Inc., 180 E. Prospect Ave., Mamaroneck, NY 10546

Pinzone Communications Products Inc., 10142 Fairmount Rd., Newbury, Ohio 44065

B. Pinzone Jr., President (304) 296-4493

Plastic Reel Corp. of America, 46 Passaic St., Wood Ridge, NJ 07075

Polyline Corp., 1233 Rand Rd., Des Plaines, IL 60016

Ray Kaiser, President (312) 298-5300

Porta-Pattern Telecommunications Industries Ltd., 6822 Santa Monica Blvd., Los Angeles, CA 90038

Portac Inc., 108 Aero Camino, Goleta, CA 93017

Potomac Instruments, Inc., 932 Philadelphia Ave., Silver Spring, MD 20910

David G. Harry (301) 589-2662

Power-Optics, Inc., Box 266, Fairview Village, PA 19409

Procart, 7012 27th St. West, Tacoma, WA 98466

Prodelin Inc., Box 131, Hightstown, N.J. 08520

Projection Systems, Inc., 66 Clinton Rd., Fairfield, NJ 07006

Projector Recorder Belt Corp., 200 E. Clay, Whitewater, WI 53190

ProTech Audio Corp., Box 638, Lake Ronkonkoma, NY 11779

Pulse Techniques Inc., 1411 Palisade Ave., Teaneck, N.J. 07666

Pyramid Loudspeaker Corp., 131-15 Fowler Ave., Flushing, NY 11355

Q

QEI Corp., Rt. 73, Kresson, N. J. 08053

QRK Broadcast Electronics, 1568 N. Sierra Vista, Fresno, Calif. 93703

QSC Audio Products Inc., 1926 Placentia Ave., Costa Mesa, CA 92627

QSI Systems, Inc., 993 Watertown St., West Newton, Mass. 02165

Q-TV, 33 West 60th St., New York, N.Y. 10023

Quad-Eight Electronics, 11929 Vose St., North Hollywood, Calif. 91605

Quam-Nichols Co., 234 E. Marquette Rd., Chicago, IL 60637

Quantum Audio Labs, Inc., 1905 Riverside Dr., Glendale, Calif. 91201

Quick-Set Inc., 3650 Woodhead Drive, Northbrook, Ill. 60062

Quintek Inc., 4721 Laurel Canyon Blvd., No. Hollywood, CA 91607

R

R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, IL 60035

RCA American Communications, 400 College Rd. E., Princeton, NJ 08540

RCA Broadcast Systems, Front & Cooper Sts. Bldg. 2-2, Camden, N.J. 08102

RCA Distributor & Special Products Div., 2000 Clements Bridge Rd., Deptford, N.J. 08096

RCA Electro Optics and Devices, New Holland Ave., Lancaster, PA 17604

RHG Electronics Laboratory, Inc., 161 E. Industry Court, Deer Park, NY 11729

RKO Tape Corp., 3 Fairfield Crescent, W. Caldwell, NJ 07006

RTS Systems, Inc., 1104 W. Chestnut St., Burbank, CA 91506

Rack Techniques Corp., Box 473, Batavia, IL 60510

Radio Systems Inc., 5131 W. Chester Pike, Edgemont, PA 19028

Radiometer Elec. U.S. Inc., 795 Sharon Dr., Suite 222, Cleveland, OH 44145

Radiotechniques, 402 Tenth Ave., Haddon Hgts., NJ 08035

Radmar, Inc., 1282 Old Skokie Rd., Highland Park, IL 60035

Ramko Research Inc., 11355 'A' Folsom Blvd., Rancho Cordova, Calif. 95670

Jack M. Ducart (916) 635-3600

REGIONAL SALES CONTACTS:

Comex Corp., Dulles Int'l. Airport, P.O. Box 17011, Washington, DC 20041 (703) 471-4215 Jack Rickel
Electrex Co., 18680 N.E. 2nd Ave., Miami, FL 33179 (305) 945-6483 Ben Ostrovsky
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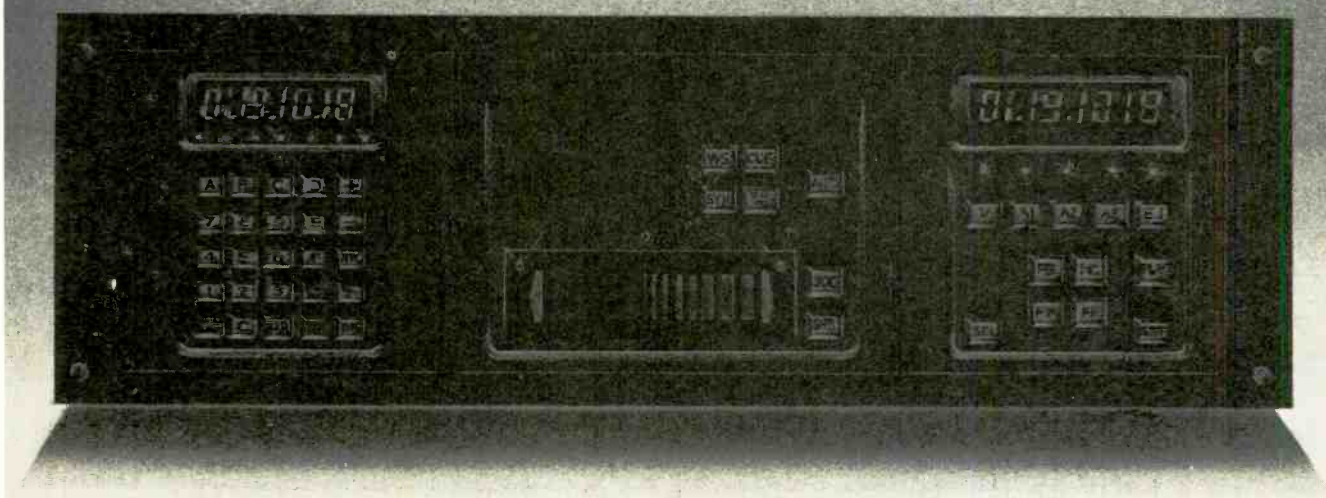

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Salt Lake City, UT (801) 466-6522
Atech, Shawnee, KS (913) 268-9644
St. Louis, MO (314) 428-7447
Sesco, San Antonio, TX (512) 733-1032
Houston, TX (713) 688-9656
Dallas, TX (214) 231-9364
Baton Rouge, LA (504) 928-4951
Tulsa, OK (918) 622-3868
Greensboro, NC (919) 855-1394
Atlanta, GA (404) 458-6423
Huntsville, AL (205) 881-8768
Hallandale, FL (305) 458-1506
Carvel Engineering Sales, Schumburg, IL (312) 885-8800
Glendale, WI (414) 352-6630
Edina, MN (612) 835-7929
Powell-Pendergraph, Bethesda, MD (301) 656-4535
Richmond, VA (804) 264-2341
Power Conversion & Control, Englewood Cliffs, NJ (201) 569-0015
Carter, McCormic, Peirce, Carmel, IN (317) 844-4175
Farmington Hills, MI (313) 477-7700
Dayton, OH (513) 222-7700
Monroeville, PA (412) 372-4415
Cleveland, OH (216) 779-5100
Ossmann Instruments, East Syracuse, NY (315) 437-6666
Rochester, NY (716) 473-5720
Vestal, NY (607) 785-9947
Power Conversion Systems, Londonderry NH (603) 434-2371
Wellesley, MA (617) 235-7884
John P. Bagoy & Associates, Anchorage AK (907) 274-8531
Industrial Electronics, Honolulu, HI (808) 533-6095

Torpey Controls & Eng. Ltd., 2220 Midland Ave. Unit 98, Scarborough, Ont., Canada M1P 3E6

Toshiba Int'l. Corp., Broadcast Electronic Systems, 292 Gibralter Dr., Sunnyvale, CA 94086

Townsend Associates, Inc., Box 1122, Westfield, Mass. 01085

Tracor Inc., 6500 Tracor Lane, Austin, TX 78721

Transist-O-Sound Inc., 728 Yosemite Dr., Indianapolis, IN 46217

Transtector Systems Div., Konic International Corp., Box 11159, Zephyr Cove, NV 89448

Transylvania Power Co., 260 Marshall Dr., Walnut Creek, CA 94598

Tri-Ex Tower Corp., 7182 Rasmussen Ave., Visalia, CA 93277

Tri Tec Systems Inc., 1324 Motor Parkway, Hauppauge, NY 11787

Tri-Tronics Prof. Elec., Inc., Highway 210 N., Box 1067, Lillingron, NC 27546

Triple Crown Electronics, Inc., 42 Racine Rd., Rexdale, Ont., Canada M9W 2Z3

Triple I, Inc., 4605 N. Stiles, Oklahoma City, OK 73154

Triple S Mfg. Corp., 361 Crosby Ave., Paterson, NJ 07502

Trompeter Electronics, Inc., 8936 Comanche Ave., Chatsworth, CA 91311

Tweed Audio USA Inc., 4545-E. Industrial 5E, Simi Valley, CA 93063

U

UHF Associates, 90 Transport Ave. #4, Rohnert Park, CA 94928

UMC Electronics Co., Broadcast Products Div., 460 Sackett Point Rd., North Haven, Conn. 06473

UNI-SET Corp., 449 Ave. A, Rochester, NY 14621

URSA MAJOR, Inc., Box 18, Belmont, MA 02178

REGIONAL SALES CONTACTS:

ACI Filmways, 7138 Santa Monica Blvd., Hollywood, CA 90046 (213) 851-7172 Fred Ampel
Bananas At Large, 802-4th St., San Rafael, CA 94901 (415) 457-7600 J.D. Sharp
Suntronics, 1620 W. Foothill Blvd., Upland, CA 91786 (714) 985-0701 Ron Sundell
Unicorn Productions, Inc., 1135 Pearl St., Suite 7, Boulder, CO 80302 (303) 443-9822 Mickey Houlihan
Audiotechniques, 652 Glenbrook Rd., Stamford, CT 06906 (203) 359-2312 Mike Faulkner
Audio Image, 3685 N. Federal Highway, Pompano Beach, FL 33064 (305) 943-5590 Bob Henion
Syscom Sound Professionals, 117 Robin Rd., Altamonte Springs, FL 32701 (305) 831-7345 Allan P. Smith
Audiomedia Associates, 4657 Michoud Blvd., Suite 5, New Orleans, LA 70189 (504) 586-0140 Corey G. Meyer
Maryland Sound Industries, 4900 Wethedsville Rd., Baltimore, MD 21207 (301) 448-1400 Bob Goldstein
Terry Hanley Audio, 272 Elm St., Cambridge, MA 02139 (617) 661-1520 Terry Hanley
Hy James Enterprises, 2839 Boardwalk, Ann Arbor, MI 48104 (313) 994-0934 Henry Root
Sound & Communications, Inc., 5466 N. State St., Jackson, MS 39206 (601) 982-2080 Algie Broome
Dyma Engineering, Inc., 213 Pueblo Del Sur, Taos, NM 87571 (505) 758-2686 Carroll Cunningham
Reliable Music, 1001 S. Independence Blvd., Charlotte, NC 28202 (704) 375-8662 David Bustle
Haskell Recording, 150 Sixth Ave., Troy, NY 12180 (518) 235-8979 Edward Delaney
Martin Audio Video Corp., 423 West 55th St., New York, NY 10019 (212) 541-5900 Courtney Spencer
Studio Consultants, 321 West 44th St., New York, NY 10036 (212) 586-7376 Doug Simon
PI Corp., 13329 Pearl Rd., Cleveland, OH 44136 (216) 238-0644 David Yost
Audio Architects, Inc., 112 Space Park S., Nashville, TN 37211 (615) 331-3247 Allen Rumbaugh
Southwest Professional Audio, 308 West 6th St., Austin, TX 78701 (512) 477-3706 Greg Klinginsmith
Westbrook Audio, Inc., 11836 Judd Court, Suite 336, Dallas, TX 75243 (214) 699-1203 Paul Westbrook
Cable Brothers, Ltd., 7915 Argyll Rd., Edmonton, Alta. Canada (403) 465-9731 Gary S. Lines
J-Mar Electronics, 6 Banigan Dr., Toronto, Ont. Canada M4H 1E9 (416) 421-9080 Elizabeth Woods
Klarion Enterprises Pty., Regent House/63 Kingsway, South Melbourne 3205 Australia 61-3801 Brian Horman
Naybies Electro Acoustics Sprl., Avenue de l'Armee 88, Bruxelles B-1040 Belgium 02-734-31-38 Guy Van der Hofstadt
Ingeson Ltda., Calle 22, No. 6-27, Apartado Aereo 4007, Bogota Colombia 43-60-44 Manuel Drezner
Audiophill ApS, 49 Howitzvej, 2000 Copenhagen F Denmark 01-34-16-22 Ole Lund Christensen
Feldon Audio Ltd., 126 Great Portland St., London WIN 5PH England 01-580-4314 Roger Cameron
Audiotron, Kiskontie 7, 00280 Helsinki 28 Finland 410688 Peter Strahlman
Audio-Service S.A., 36, Rue de l'Abbe-Carton, 75014 Paris France 542-34-56 Claude Bermudez
3M France, Boulevard de l'Oise, 95006 Cergy-Pontoise cedex France (1) 031.61.61 Serge Lobbe
R. Barth KG, Grillparzerstr. 6a, 2000 Hamburg 76 Germany (040) 2-29-88-83 Hartwig Puetz
Thum & Mahr Audio, Langenfelder Str. 148-150, D-5090 Leverkusen 17 Germany 02173-41600 Peter Thum
Pieter Bollen Geluidstechniek bv, Hondsruglaan 83A, 5628 DB Eindhoven Holland 040-424455 Pieter Bollen
Studer Revox (Far East) Ltd., 5th Fl. Parklane Bldg., 233-235 Queens Rd. Central, Hong Kong 5-459688 David F. C. Ling
Audio Products Int'l., Via G. Spontini, 3 20131 Milano Italy 39-2-272-951 Roberto Beppato
Electori Co., Ltd., Mondo Bldg., 1-19-3 Kamiochiai, Shinjukuku, Tokyo Japan (03) 950-6266 Mike Suzuki
MEXICO: IER, 1205 Prospect St., Suite 510, La Jolla, CA 92037 (714) 459-3691 Luis Carrillo
Pro-Technic A.S., Lyder Sagens Gate 19, Oslo 3 Norway (02) 46-05-54 Martin Viktorin
Valentim de Carvalho Ci Sarl, Rua Nova do Almada 95-99, 1200 Lisboa Portugal 367051/4 Salvador Caiado
Auvi Private Ltd., Unit 5-316, 5th Floor, Merlin Plaza, Beach Road, Singapore 0719 Singapore 2937155 P.H. Ang
Mike Llewellyn-Jones, Ap. Postal 8.178, Madrid Spain 637-07-52
Elfa Radio & Television AB, Industrivagen 23, 17117 Solna Sweden 08-7300700 Tor Hedlund
Audiocom, Kreuzgasse 82, CH-3210 Kerzers Switzerland 031-95-57-42 Peter Heuberger
Linfair Eng. & Trading Ltd., 7 Jen Ai Road, 7th Fl. Sec. 2, Taipei Taiwan 3214454 Linfair Chang

US JVC Corp., Professional Video Div., 58-75 Queens Midtown Exp., Maspeth, N.Y. 11378

Dan Roberts (212) 476-8300

REGIONAL SALES CONTACTS:

US JVC Corp., 2250 Lively Blvd., Elk Grove Village, IL 60007 (312) 364-9300 Chuck Bocan
US JVC Corp., 1011 W. Artesia Blvd., Compton, CA 90220 (213) 537-6020 Don Thorkelson

Product Listings Begin on Page 116

US JVC Corp., 3400 South Loop E., Houston, TX 77021 (713) 741-3741 Ed Spalding

UTE Microwave, Inc., 3500 Sunset Ave., Asbury Park, NJ 07712

Ultra Audio Pixtec, Box 921, Beverly Hills, CA 90213

Unarco-Rohn Div., of Unarco Ind., Inc., Box 2000, Peoria, Ill. 61656

Unimedia Corp., 22525 Kingston Ln., Auburn, Calif. 95603

Union Connector Co., Inc., Box H, Roosevelt, N. Y. 11575

United Media, Inc., 4075 Leaverton Court, Anaheim, CA 92807

Robert J. Ricci (714) 630-8020

United Recording Electronics Industries, 8460 San Fernando Rd., Sun Valley, Calif. 91352

United Research Lab Corp., 16 East 52nd St., New York, NY 10022

George Adams, President (212) 751-4663

Unitel, 80 Rue d'Arcueil, 94250 Gentilly, France

Up-Right Scaffolds, 1013 Pardee St., Berkeley, CA 94710

Utah Scientific, Inc., 2276 South 2700 West, Salt Lake City, Utah 84119

Lyle O. Keys (801) 973-6840

Utility Tower Co., Box 12369, Oklahoma City, OK 73157

V

VIF International, Box 1555, Mountain View, CA 94042

VIZ Mfg. Co., 335 E. Price St., Philadelphia, PA 19144

Robert J. Liska, Dir. of Mktg. (215) 844-2626

VMI-Visual Methods Inc., Box 644, Westwood, NJ 07675

VSC Corp., 185 Berry St., San Francisco, CA 94107

Vacuum Tube Industries, 35 Pequit St., Canton, Mass. 02021

Valad Electric Heating Corp., 160 Wildey St., Tarrytown, N.Y. 10591

Thomas Valentino Inc., 151 West 46th St., New York, N.Y. 10036

Valley People, Inc., 2820 Erica Place, Nashville, TN 37204

Valtec Corp., Communication Fiberoptics, 99 Hartwell St., West Boylston, MA 01583

VanLadder, Inc., Box 1557, Spencer, Iowa 51301

Vanner, Inc., 2136 Eakin Rd., Columbus, OH 43223

Van San Corp., 16735 E. Johnson Dr., City of Industry, CA 91745

Varian Associates, Inc., Electron Device Group, 611 Hansen Way, Palo Alto, Calif. 94303

Vector Electronic Co., Inc., 12460 Gladstone Ave., Sylmar, Calif. 91342

Versa Count Engineering, 553 Lively Blvd., Elk Grove Village, Ill. 60007

Vidaire Electronics Mfg. Corp., 150 Buffalo Ave., Freeport, NY 11520

Video Aids of Colorado, 1930 Central Ave., Boulder, CO 80301

Joe Woods (303) 443-4950

REGIONAL SALES CONTACTS:

Video Components, 601 S. Main St., Spring Valley, NY 10977 (914) 356-3700 Dick Turchen

Video Associates Labs, 2304 Hancock Dr. #1-F, Austin, TX 78756

Video Cassette Services, Inc., 711 West 17th St., J6, Costa Mesa, CA 92627

Video Data Systems, 205 Oser Ave., Hauppauge, N.Y. 11787

Steve Seiden (516) 231-4400

REGIONAL SALES CONTACTS:

Video Data Systems, Lakeway Apts., Room 111, Greenville, TX 75401 (214) 454-8985 Debra Dunegan
Video Data Systems, 54 Harvard Rd., Fair Haven, NJ 07701 (201) 747-5122 Tony Keator
Video Data Systems, 3835 Willowbrook Dr., Douglasville, GA 30135 (404) 942-8669 Dave Allen
Video Data Systems, 5435 Dunbarton Dr., Salt Lake City, UT 84117 (801) 266-5054 Bob Hall
Video Data Systems, R.R. 1, Box 235, Lodi, WI 53555 (608) 592-3272 Vern Bertrand

Video Rentals, Inc., 100 Stonehurst Court, Northvale, NJ 07647

Video Research Corp., Interstate Industrial Park, Riviera Beach, Fla. 33404

Video Specialties, Box 136, Solana Beach, CA 92075

Videomagnetics, Inc., 155 San Lazaro Ave., Sunnyvale, Calif. 94086

Wm. Beckers, President (408) 737-8300

Videomax Div., Orrox Corp., 3303 Scott Blvd., Santa Clara, Calif. 95050

Videomedia, Inc., 250 North Wolfe Rd., Sunnyvale, CA 94086

Videotek, Inc., 125 N. York St., Pottstown, PA 19464

Vidicraft Inc., 3357 Southeast 22nd, Portland, OR 97202

Vikron, Inc., Box 737, St. Croix Falls, WI 54024

The Virginia Co./24th Frame, 303 Depot St., N.W., Box 2167, Christianburg, VA 24073

Viscount Industries Ltd., 105 East 69th, Vancouver, B.C., Canada V5X 2W9

Ray Renning (604) 327-9446

REGIONAL SALES CONTACTS:

Columbia Telecommunications Inc., 2241 W. Burnside, Portland, OR 97210 (503) 223-4546
Audio Video Craft, 7710 Melrose Ave., Los Angeles, CA 90046 (213) 655-3511
Canter Redman Technologies Corp., 321 West 49th St., New York, NY 10036 (212) 245-5505
Harmon Industries Inc., 3134 Cleveland Ave., Ft. Myers, FL 33901 (813) 936-4168
Adcom Electronics Ltd., 6291 - 17 Dounan Rd., Mississiauga, Ont., Canada L40 1H2 (416) 677-9040 Gary McKoen
Communitronics Corp., 1907 S. Kingshighway, St. Louis, MO 63110 (314) 771-7160
National Electronics, 2137 Commercial Dr., Vancouver, BC, Canada V5N 4B3 (604) 253-0811 Pat Paiment
Audio Video Systems Ltd., 616 Dutchess St., Saskatoon, Sask., Canada S7K 4J2 (306) 244-2600 Rick Orr

Vital Industries Inc., 3700 NE 53rd Ave., Gainesville, Fla. 32601

Linda Buickel (904) 378-1581

REGIONAL SALES CONTACTS:

Vital Industries, Inc., Midwest Div., 2644 N. 7th St., Terre Haute, Ind. 47804 (812) 466-3212 Morrell Beavers
Vital Industries, Inc., Northcentral, Box 74, Prior Lake, MN 55372 (612) 447-4453 Mike Barsness
Vital Industries, Inc., Northeast Div., Box 255, Greenville, NY 12083 (518) 966-5180 Robert McAll
Vital Industries, Inc., Northeast, 338 E. Lake Rd., Williamson, NY 14589 (325) 589-9289 Barry Enders
Vital Industries, Inc., South Central, Box 912, Arlington, Tex. 79010 (817) 467-0051 Gordon Peters
Vital Industries, Inc., Southeast Div., Fox Hill Rd., Lynchburg, Va. 24503 (804) 384-7001 Eric King
Vital Industries, Inc., West Coast Div., 1680 Vine St., Suite 1204, Hollywood, CA 90028 (213) 463-7393 Jim Moneyhun
Vital Industries, Inc., West Coast, 1255 Post St., Suite 609, San Francisco, CA 94109 (415) 561-9130

Vulcan Binder & Cover, Box 29, Vincent, AL 35178

W

WIDL Video, 5245 W. Diversey, Chicago, IL 60639

Wallach & Associates Inc., Box 18167, Cleveland, OH 44118

Wang Voice Comm. Inc., Executive Dr., Hudson, NH 03051

Ward-Beck Systems, Ltd., 841 Progress Ave., Scarborough, Ont., Canada M1H 2X4

Waters Mfg. Inc., Longfellow Center, Wayland, MA 01778

Robert Waters (617) 358-2777

Wavetek Rockland, Inc., Rockleigh Industrial Park, Rockleigh, NJ 07647

Weathermation, Inc., 190 N. State St., Suite 328, Chicago, IL 60601

Weather Services Corp., 131 A. Great Rd., Bedford, MA 01730

Western Electronic Products Co., 107 Los Molinos, San Clemente, Calif. 92672

Western Tele-Communications, Inc., Box 22595, Wellshire Sta., Denver, CO 80222

Western Union, Broadcast Services, One Lake St., Upper Saddle River, NJ 07458

Westinghouse Elec. Corp., Semiconductor Div., Youngwood, PA 15697

Westinghouse Electric Corp., Ind. & Govt't Tube Div., Westinghouse Circle, Horseheads, N.Y. 14845

Westrex, 2629 W. Olive Ave., Burbank, CA 91505

Wide Band Engineering Co., Inc., Box 21652, Phoenix, Ariz. 85036

Wide Range Electronics, 2119 Schuetz Rd., St. Louis, MO 63141

Otto Rauhut; Arthur Brigham (314) 567-5366

Wilcox-Lange, Inc., 3925 N. Pulaski Rd., Chicago, IL 60641

Wilkinson Electronics, Inc., Box 738, *Trainer, PA 19013 (215) 497-5100*

REGIONAL SALES CONTACTS:

Dyma Engineering, Box 1697, Taos, N.M. 87571 (505) 758-2686 Carroll Cunningham

Lebow Labs, Inc., 424 Cambridge St., Allston, MA 02134 (617) 782-0600 James Ritteman
S.A.V.C.O., Box 427, Richardson, Tex. 75080 (214) 234-1841 Nathan Hughes
Broadcast Consultants Corp., 21 N. Wirt St., Leesburg, Va. 22075 (703) 777-8660 David Green
Electronic Industries, Inc., 19 E. Irving Ave., Oshkosh, Wis. 54901 (414) 235-8930 Bud Tedlie

Winsted Corp., 8127 Pleasant Ave. So., Minneapolis, Minn. 55420

Wireworks Corp., 380 Hillside Ave., Hillside, NJ 07205

Wolf Coach Inc., 200 Bartlett St., Northboro, Mass. 01532

World Tower Co. Inc., Box 405, Mayfield, KY 42066

Bob Cook (502) 247-3642

REGIONAL SALES CONTACTS:

Cox Cable of Okla. City, P.O. Box 82729, Oklahoma City, OK 73148 Mike Gardner
Sintronic Corp., 212 Welsh Pool Rd., Lionville, PA 19353 (215) 363-0444 Joe Novick
Harris Corp., Rt. 1, Box 27, Pike Road, AL 36064 Will Bone
Harris Corp., 332 Ivy Lane, Racine, WI 53402 Robert Gorjonce
Harris Corp., 11 Ridgecrest, Latham, NY 12110 Robert Hallenback

World Video Inc., Box 117, Boyertown, PA 19512

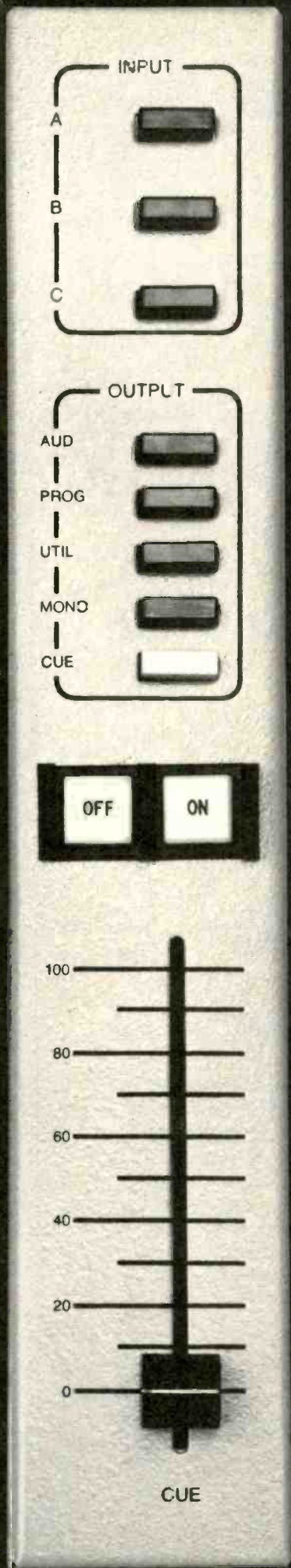
Y

Yamaha International Corp., 6600 Orangethorpe Ave., Buena Park, Calif. 90622

Yardney Electric Corp., 82 Mechanic St., Pawcatuck, CT 06379

Z

Product Listings Begin on Page 116



CUSTOM CONSOLES

Broadcast mixers are our only product. Each one is custom built, with your call letters assigned the day production begins. After installing your new Broadcast Audio mixer you will actually *hear the difference.* THD and IM distortion are negligible; frequency response is absolutely flat well beyond the audio spectrum.

Sensible engineering design, thoughtful operator conveniences and reasonable prices are good reasons for choosing Broadcast Audio. We have 3 models, base priced from $6,450 to $8,950 and will deliver in 3 weeks or less. Why wait?

BROADCAST AUDIO CORPORATION

11355 Pyrites Way Rancho Cordova, CA 95670 (916) 635-1048

Circle (135) on Reply Card

"I'VE NEVER USED A WIRELESS MICROPHONE THAT WORKS THIS WELL!"

Hand-held professional VHF or UHF transmitter with portable field-use receiver. Comes with your choice of dynamic mic elements. S/N ratio greater than 100dB.

These are the actual words that hundreds of professional end-users and dealers have used to describe their HME experience.

Who are our users?

- **Academy-award winning Hollywood mixers**
- **Network audio engineers**
- **Sound men from Broadway and Las Vegas productions**

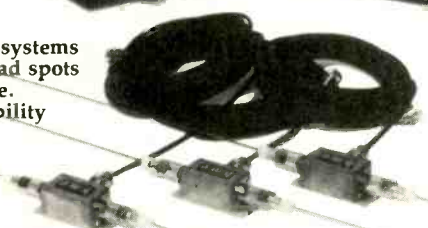
We'll send you a users list with product literature on request.

Once they *tried* our systems and *compared* them to the other wireless microphones, they bought HME. Call Dale Scott and ask for a demo. We know you'll buy an HME system too.

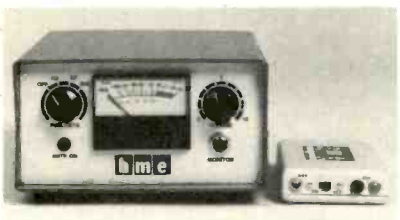
Professional 4-channel mic mixer. Portable convenience and versatility, studio quality sound. AC and battery powered.

Wireless intercom system is full duplex with side tone, compatible with all wired intercom systems. Wireless cueing systems available also.

Triple antenna diversity systems eliminate more radio dead spots than any other technique. Non-switching for reliability and economy.



Professional pocket transmitter systems in VHF High-Band and UHF frequencies. Dynamic expansion (over 100 dB) or soft limiting available.



- **Signal-processed audio — dynamic range greater than 100dB**
- **Professional quality audio — less than 1% THD**
- **All systems use standard 9V alkaline batteries — LED's advise battery condition**
- **Separate amplifier for headset monitor — output is not affected by plugging in headset**
- **Aerospace-grade design and manufacturing**
- **Immediate delivery from hundreds of dealers — worldwide**
- **Designed and manufactured in U.S.A.**

hme

Professionals who try HME . . . buy HME! HM ELECTRONICS, INC.

6151 FAIRMOUNT AVE., SAN DIEGO, CA 92120, PHONE (714) 280-6050 TELEX: 697-122.

Circle (136) on Reply Card

broadcast product dealer/distributors

For your added convenience, **Broadcast Engineering** has designed this Broadcast Product Dealer/Distributors section to provide close-to-home purchasing assistance. Use it, in conjunction with other sections in the 1980 Buyers' Guide, to plan new facilities, and equipment expansion or upgrading. For broadcast product dealer/distributors, this directory identifies: address and telephone, products handled and territory served.

Listings are arranged alphabetically by state. Firms listed do not include all dealer/distributors serving an area, but only those who returned **BE**'s listing form.

Both a typical dealer/distributor listing, and the geographical area and product classification code keys are included on this page to assist you. We think you will find this section, in addition to the updated Product Directory and Broadcast Product Manufacturers' Addresses section, makes this issue the most useful and comprehensive purchasing aid for the broadcast industry.

Typical listing

(1) **Jones Broadcast Sales,**
2912 W. 10 St.,
(2) Kansas City, Mo. 64105
(816-842-1234)
(3) IA, KS, MO, OK, 1, 2, 5, 7, 9

(1) firm name, street address
(2) city, state, zip code, telephone
(3) geographical area served and products handled (see code keys)

This firm covers Iowa, Kansas, Missouri and Oklahoma, and sells audio equipment, video equipment, tape, film equipment, and service and repair.

Key to geographical area code

AK	Alaska	KS	Kansas	NV	Nevada	WI	Wisconsin
AL	Alabama	KY	Kentucky	NY	New York	WV	West Virginia
AR	Arkansas	LA	Louisiana	OH	Ohio	WY	Wyoming
AZ	Arizona	MA	Massachusetts	OK	Oklahoma		
CA	California	MD	Maryland	OR	Oregon		(Abbreviations for Canadian provinces)
CO	Colorado	ME	Maine	PA	Pennsylvania	ALTA	Alberta
CT	Connecticut	MI	Michigan	PR	Puerto Rico	BC	British Columbia
DC	District of Columbia	MN	Minnesota	RI	Rhode Island	MAN	Manitoba
DE	Delaware	MO	Missouri	SC	South Carolina	NB	New Brunswick
FL	Florida	MS	Mississippi	SD	South Dakota	NF	Newfoundland
GA	Georgia	MT	Montana	TN	Tennessee	NS	Nova Scotia
GU	Guam	NC	North Carolina	TX	Texas	ONT	Ontario
HI	Hawaii	ND	North Dakota	UT	Utah	PEI	Prince Edward Island
IA	Iowa	NE	Nebraska	VA	Virginia	QUE	Quebec
ID	Idaho	NH	New Hampshire	VI	Virgin Islands	SASK	Saskatchewan
IL	Illinois	NJ	New Jersey	VT	Vermont	YUK	Yukon Territory
IN	Indiana	NM	New Mexico	WA	Washington		

Key to product numerical code

1 AUDIO EQUIPMENT (including recorders, microphones, mixers, consoles, cart machines, turntables, processing devices, etc.)
2 VIDEO EQUIPMENT (including cameras, videotape recorders, production switchers, monitors, lights, etc.)
3 TEST AND MEASUREMENT EQUIPMENT (audio and video)
4 TRANSMITTERS, ANTENNAS AND TRANSMISSION SYSTEMS (including towers, ATS, STL, MDS, etc.)
5 TAPE (including video and audio recording tape, etc.)
6 VACUUM TUBES (including video camera, transmitter, TWT, etc.)
7 FILM EQUIPMENT (including cine cameras, processing equipment, film projectors, etc.)
8 VANS AND ACCESSORIES
9 SERVICE AND REPAIR
10 SYSTEM DESIGN (including studio installation, etc.)
11 USED EQUIPMENT (including leasing, rent, etc.)

ALABAMA

Gray Communications, 209 Oxmoor Circle, Suite 708, Birmingham, AL 35209 (205-942-2824) AL 2, 5, 8, 9, 10

Leeco Mid-South, Inc./Lee Associates Mid-South, Inc., 817 Wheeler Ave., Huntsville, AL 35801 (205-533-5896 AL, FL, GA, LA, MS, TN 3

Gray Communications, 4367 Downtowner Loop N, Mobile, AL 36609 (205-343-0662) AL, MS 2, 5, 8, 9, 10

ALASKA

NVS Systems, Inc., 4609 Business Park Blvd., Anchorage, AK 99503 (907-279-5571) AK 1, 2, 3, 4, 5, 7, 10

ARIZONA

Fisher-Burke Professional Audio, Box 2468, Phoenix, AZ 85003 (602-257-0225) U.S.A. 1, 3, 5, 10

Jensen Tools Inc., 1230 S. Priest Dr., Tempe, AZ 85281 (602-968-6241) U.S.A. 9
See advertisement on page 220

ROH'S Inc., 4553 E. Broadway, Tucson, AZ 85711 (602-795-8573) AZ, NM 1, 2, 5, 9, 10

ARKANSAS

Custom Products, 107 E. Calhoun, Magnolia, AR 71753 (501-234-7399) AR, LA, MS, OK, TN, TX 1, 3

CALIFORNIA

Broadcast Communications Devices, Inc., 2990 E. LaJolla St., Anaheim, CA 92806 (714-630-8150); (213-628-9590) AZ, CA, NV, NM, OR, WA 1, 2, 3, 4, 5, 10

Martel Electronics, Inc., 970 E. Orangethorpe #A, Anaheim, CA 92801 (714-871-7102) U.S.A. 1, 9

Optek, 1390 N. McCan, Anaheim, CA 92806 (714-630-8280) AK, AZ, CA, CO, HI, NV, OR, WA 2, 4

Telaudio Centre, Div. of Audio Int'l., Inc., Box 921, Beverly Hills, CA 90213 (213-276-2726) U.S.A. and Canada 1, 2, 3, 9, 10

Christy's Editorial Film Supply, 135 N. Victory Blvd., Burbank, CA 91502 (213-845-1755) Worldwide 7

Pioneer Marketing Corp., 1021 N. Lake St., Burbank, CA 91502 (213-843-0530) U.S.A., Europe, Far East, South America 7

Tri Tronics Inc., 2921 W. Alameda Ave., Burbank, CA 91505 (213-843-2170 or 800-232-2141) AZ, CA, NV, NM 1, 2, 3, 5, 6, 8, 11
See advertisement on page 232

Meyer, Ross & Fleming, Inc., 1485 Rollins Rd., Burlingame, CA 94010 (415-348-6800) CA, HI, NV 1, 2, 3, 5

Richard W. Burden Associates, 20944 Sherman Way, Canoga Park, CA 91303 (213-340-4590) AZ, CA, ID, NV, OR, UT, WA 1, 3, 4, 9, 10

JSH Electronics, Inc., A member Co. of VSI Electronics, Box 2898, Culver City, CA 90230 (213-559-6900) U.S.A. 6

System Associates, 5801 Uplander Way, Culver City, CA 90230 (213-641-2042) U.S.A. and Canada #5, #11; AZ, CA, NV #2 2, 5, 11
See advertisement on page 246

ACI/Filmways, 7138 Santa Monica Blvd., Hollywood, CA 90046 (213-851-7172) AZ, CA, CO, GU, HI, ID, MO, NV, NM, OR, WY, Canada-BC 1, 3, 5, 10

Birns & Sawyer, Inc., 1026 N. Highland Ave., Hollywood, CA 90038 (213-466-8211) U.S.A., Canada, Int'l. 1, 7, 11

Broadcast Video Systems, Inc., 1438 N. Gower St., Hollywood, CA 90028 (213-460-2949) AK, AZ, CA, HI, NV, OR, WA 2, 3

J & R Film Co., 6820 Romaine St., Hollywood, CA 90038 (213-467-1296) Worldwide 1, 5, 11

Olesen, 1535 Ivar Ave., Hollywood, CA 90028 (213-461-4631) Worldwide 2, 7

Studio Film & Tape Inc., 6670 Santa Monica Blvd., Hollywood, CA 90038 (213-466-8101) U.S.A. and Canada 3, 5

A-Vidd Electronics Co., 2210 Bellflower Blvd., Long Beach, CA 90815 (213-598-0444) or (714-821-0870) Southern CA 2, 5

Kallman Associates, Inc., 2525 Hyperion Ave., Los Angeles, CA 90027 (213-660-4900) AZ, CA, NV 2, 10

Kenneth R. Meades, Box 60433, Los Angeles, CA 90060 (213-771-0636) CA 1, 9, 10, 11

Video Systems Network, Inc., 12530 Beatrice St., Los Angeles, CA 90066 (213-871-0677) North America 1, 2, 3, 5, 6, 7, 8, 9, 10, 11

Westlake Audio, 6311 Wilshire Blvd., Los Angeles, CA 90048 (213-655-0303) Worldwide 1, 3, 5, 10

Audio Services Corp., 4210 Lankershim Blvd., No. Hollywood, CA 91602 (213-980-9891) U.S.A. 1

Broadcast Cartridge Service, Box 1790, N. Hollywood, CA 91604 (213-245-7708) U.S.A. 5

Accurate Sound Co., 114 Fifth Ave., Redwood City, CA 94063 (415-365-2843) U.S.A. and Canada 1, 5, 10, 11

MARCOM, 3590 Central Ave., Suite 208, Riverside, CA 92506 (714-684-7502) AK, AZ, CA, HI, NV, OR, WA 1, 2, 3, 4, 10, 11

Network Recording Products, 4429 Morena Blvd., San Diego, CA 92117 (714-272-2011) U.S.A. 1, 5

Schudel, Inc., 6973 Consolidated Way, San Diego, CA 92121 (714)-578-1770) Worldwide 1, 2

Sound Genesis, 2001 Bryant St., San Francisco, CA 94110 (415-285-8900) AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA 1, 3, 5, 9, 10, 11

Sound Dynamics, Inc., Box 32055, San Jose, CA 95152 (408-926-3588) LA(213-221-3588) SF(415-668-3588) CA, OR, WA 1, 4, 9

Broadcast Communications Devices, Inc., 3350 Scott Blvd., Bldg. #48, Santa Clara, CA 95051 (408-496-6525) AZ, CA, NV, NM, OR, WA 1, 2, 3, 4, 5, 10

David Lint Associates, Inc., 3350 Scott Blvd., Bldg. #5, Santa Clara, CA 95051 (408-727-0964) AZ, CA, NV, OR, WA 1, 2, 4, 5, 7, 9, 11

Videotape Products, Inc., Box 1077; 1414 Sixth St., Santa Monica, CA 90406 (213-451-1604) Worldwide 5

MARCOM, Box 66507, Scotts Valley, CA 95066 (408-438-4273) AK, AZ, CA, HI, NV, OR, WA 1, 2, 3, 4, 10, 11

Davis Electronics Co., Box 128, Sierra Madre, CA 91024 (213-355-6909) CA, HI 4, 9, 10

Broadcast Marketing Associates, (Formerly United Media), 155 B San Lazaro Ave., Sunnyvale, CA 94086 (408-736-3600) AK, CA, HI, ID, NV, OR, WA 1, 2, 3, 5, 7, 8, 10

Sound Investment Enterprises, Box 4139, Thousand Oaks, CA 91359 (213-991-3400) AZ, CA, CO, HI, NV, NM, OR, TX, UT, WY 1, 3, 5

COLORADO

Colorado Magnetics, Box 713, Colorado Springs, CO 80901 (303-596-0684) AZ, CA, CO, FL, ID, KS, MO, MT, NE, NV, NM, ND, OH, OK, OR, SD, TX, UT, WA, WY 1, 3, 5

Film/Video Equipment Service Co., 1875 S. Pearl St., Denver, CO 80210 (303-778-8616) AZ, CO, KS, MT, NE, NV, NM, ND, SD, UT, WY 1, 2, 7, 11

Western Tele-Communications, Inc., Box 22595, Wellshire Station, Denver, CO 80222 (303-771-8200) AZ, CA, CO, ID, KS, MT, NE, NV, NM, ND, OR, SD, UT, WA, WY 4, 8, 10, 11

H P Marketing Co., 2530 W. Church Ave., Littleton, CO 80120 (303-794-8367 or 800-525-8620) AZ, CO, ID, MT, NM, El Paso TX, UT, WY 1, 2, 3

(See page 200 for key to listings)

Didier/Denver, Inc., 11465 West 48th Ave., Wheat Ridge, CO 80033 (303-422-6666) CO, ID, KS, MT, NE, NM, ND, SD, UT, WY 1, 2, 3, 4, 6, 10

CONNECTICUT

National Video Services, 3 Pembroke Rd., Danbury, CT 06810 (203-792-3862) CT, ME, MA, NH, NJ, NY, PA, RI, VT 2, 9, 10

Redding Radio, Div. of SJ Industries Inc., Box 344, Fairfield, CT 06430 (914-561-4769) U.S.A. and Canada 1, 5

Denson Electronic Corp., Box 85, Rockville, CT 06066 (203-875-5198) U.S.A. and Canada 2

DISTRICT OF COLUMBIA

Brenner Cine-Sound, 5215 Wisconsin Ave., N.W., Washington, DC 20015 (202-244-3800) DC, MD, OH, PA, VA, WV 1, 2, 5, 7, 9, 10, 11

Comex Corp., Box 17011, Dulles Int'l. Airport, Washington, DC 20041 (703-471-4215) South America 1, 2, 4, 5, 6, 7, 8

See advertisement on page 236

FLORIDA

Doug Holland Associates, 9035 S.W. 9th St., Boca Raton, FL 33433 (305-428-7120) FL, GA, IL, IN, IA, KY, LA, MD, MI, NE, NJ, NY, NC, OH, PA, SC, TN, TX, VT, VI, VA, WV, WI 1, 4, 5, 9, 10, 11

Pro Audio General Store, Inc., 1378 NW 100th Ave., Coral Springs, FL 33065 (305-752-0330) AL, FL, GA, LA, MS, NC, SC 1, 5

Broadcast International, Inc., 1229 N.E. 37th St., Ft. Lauderdale, FL 33334 (305-564-4422) U.S.A. and Int'l. 1, 3, 4, 5, 6, 11

Lauderdale Electronic Labs, 16 S.W. 13th St., Ft. Lauderdale, FL 33315 (305-764-7755) Orders only (800-327-3793) U.S.A. and Canada 1, 3, 5, 6

Gray Communications, 718 Northwest 10th Ave., Gainesville, FL 32601 (904-376-2435) FL 2, 5, 8, 9, 10

Bunts Auto Electric, Box 378, Homosassa, FL 32646 (904-628-3222) FL 8

Electrex Co., 18680 Northeast 2nd Ave., Miami, FL 33179 (305-651-5752) U.S.A. and Latin America 1, 2, 3, 4, 5, 6, 10

Image Devices Inc., Box 610606; 1825 N.E. 149th St., Miami, FL 33181 (305-945-1111; 800-327-5181) AL, AR, FL, GA, KY, LA, MS, NC, OK, PR, SC, TN, VA, ONT, QUE 1, 2, 3, 5, 7, 8, 9, 10, 11

Lita Broadcasting Distributors, Box 440752, 7355 N.W. 54th St., Miami, FL 33144 (305-887-1223) FL, Central & South America, Caribbean 1, 2, 3, 4, 5, 6, 11

Midwest Telecommunications, 3331 Northwest 82nd Ave., Miami, FL 33122 (305-592-5355) AL, FL, GA 1, 2, 3, 4, 5, 9, 10

Stage Equipment & Lighting, Inc., 12231 N.E. 13th Court; Box 61000F, Miami, FL 33161 (305-891-2010) AL, FL, GA, Caribbean, Central & South America 2, 9, 10, 11

Crescendo Associates, 3597 Southwest 69th Terr., Miramar, FL 33023 (305-961-0886) AL, FL, GA, MS, NC, SC, TN 1, 10

Global Video Communications Corp., 744 W. Church St., Orlando, FL 32805 (305-843-8982 or 423-8299) Southeast U.S.A. and Latin America 2

Gray Communications, 1605 S. Bumby Ave., Orlando, FL 32806 (305-896-7414) FL 2, 5, 8, 9, 10

Crescenodo Associates, 330 Quil Pointe Lane, Ponte Verde Beach, FL 32082 (904-372-0881) AL, FL, GA, MS, NC, SC, TN 1, 10

Media Concepts, Inc., 559 49th St. S., St. Petersburg, FL 33707 (813-321-2122 or 821-2122) U.S.A. and Int'l. 1, 2, 5, 9, 10

Audio Visual Services, Inc., 5484 Jet Port Industrial Blvd., Tampa, FL 33614 (813-884-1461) U.S.A 1, 5, 7, 9, 10, 11

Gray Communications, 5401 Southern Comfort Blvd., Tampa, FL 33614 (813-885-1411) FL, PR 1, 2, 5, 8, 9, 10, 11

GEORGIA

Image Devices Inc., 1651 Phoenix Blvd., Box 490250, Atlanta, GA 30349 (404-996-0000) AL, AR, FL, GA, KY, LA, MS, NC, OK, PR, SC, TN, VA, ONT, QUE 1, 2, 3, 5, 7, 8, 9, 10, 11

Siboney Audio Visual Products, Inc., 1760 Tully Circle, N.E., Atlanta, GA 30329 (404-329-9200) AL, GA, TN, TX 1, 2, 5, 7, 9, 10, 11

Technical Systems Reps Inc., 2065 Peachtree Industrial Ct., Suite 215, Chamblee, GA 30341 (404-457-0426) AL, FL, GA, NC, SC, TN 1

Quality Media Corp., Box 7008, Columbus, GA 31908 (800-241-7878; in GA 404-324-1271) U.S.A. and Canada 1, 2, 3, 4, 5, 6, 7, 8, 10, 11

See advertisement on page 141

Gray Communications, 3684 Clearview Ave., Doraville, GA 30340 (404-455-3121) GA 2, 5, 8, 9, 10

C. Harrison Associates, 6290 McDonough Dr., Suite E, Norcross, GA 30093 AL, FL, GA, MS, NC, SC, TN 2, 4

Broadcast Communication Associates, Box 2606, Peachtree City, GA 30269 (404-487-9559) U.S.A. and Canada 1, 3, 4, 5, 10, 11

See advertisement on page 45

HAWAII

Broadcast Services Inc., 2877 Kalakaua Ave., Honolulu, HI 96815 (808-521-6311) HI 1, 4, 6, 9, 10, 11

Hawaii Broadcast Associates, Box 1344, Honolulu, HI 96807 (808-538-3749) HI 4

ILLINOIS

Center Video Center, Inc., 5800 W. Fullerton Ave., Chicago, IL 60639 (312-637-1600) IL, IN, WI 1, 2, 3, 5, 9, 11

Theodore Pappas Associates Inc., 5218 W. Diversey Ave., Chicago, IL 60639 (312-685-2338) IL, IN, KY, WI 1, 3

Victor Duncan, Inc., 200 E. Ontario, Chicago, IL 60611 (312-321-9406) U.S.A. and Canada 1, 2, 3, 5, 6, 7, 9, 10, 11

See advertisement on page 163

WIDL Video, 5245 W. Diversey, Chicago, IL 60639 (312-622-9606) Worldwide 1, 3, 5, 8

Swiderski Electronics, Inc., 1200 Greenleaf Ave., Elk Grove Village, IL 60007 (312-364-1900) IL, IN, IA, MI, WI 1, 2, 3, 5, 6, 7, 8, 9, 10, 11

Columbia Video Systems, The Columbia Bldg., Laurel & 2nd, Highland Park, IL 60035 (312-433-6010) IL, IN, JA, MI, WI 2, 3, 5, 7, 10

GO Video Sales, 1195 S. Wilson Dr., Lake Forest, IL 60045 (312-295-6726) North IL, Northwest IN, Davenport IA, East WI 2

Tech Theatre Inc., 4724 Main St., Lisle, IL 60532 (312-971-0855) Worldwide 2, 10

Roscor Corp., 6160 Oakton, Morton Grove, IL 60053 (312-966-3010 or 539-7700) IL, IA, KY, MI, OH, WI 1, 2, 3, 5, 8, 9, 10, 11

Joseph Electronics, 8830 Milwaukee Ave., Niles, IL 60648 (312-297-4200) IL, IN, WI, Nat'l. Mail Order 1, 2, 3, 4, 5, 6, 7

MTI Teleprograms Inc., 4825 N. Scott St., Suite 23, Schiller Park, IL 60176 (312-671-0141) Worldwide 7

INDIANA

Jon Powell Associates, Inc., 3500 DePauw Blvd., Suite 3000; Box 68635, Indianapolis, IN 46268 (317-844-5060) IN 1, 2, 5, 7, 12

Allied Broadcast Equipment, 635 South E St., Richmond, IN 47374 (317-962-8596) U.S.A., Canada, Central America, Great Britain and Philippine Islands 1, 3, 4, 5, 6, 9, 10, 11
See advertisement on page 229

IOWA

Iowa Audio Visual, 2740 30th St., Des Moines, IA 50310 (515-279-3672) IA, MN, NE, ND, SD 1, 2, 3, 5, 6, 7, 9, 10, 11

KANSAS

Business Communications, Inc., 1140 Cambridge Circle Dr., Kansas City, KS 66103 (913-342-4000) IA, KS, MO 11

Steve Smith Audio-Visual, Inc., 623 Kansas Ave.; Box 1216, Topeka, KS 66601 (913-235-3481) KS, Western MO including St. Joseph and K.C. 1, 2, 5, 9, 10, 12

Radio Supply Co., Inc., 131 Laura; Box 1220, Wichita, KS 67201 (316-267-5213) KS, OK 1, 2, 3, 5, 6, 9

KENTUCKY

Bruce L. Dawson & Associates, Box 115, Prospect, KY 40059 (502-228-4898) IN, KY, Southern OH 2, 4

LOUISIANA

Gray Communications, 910 N. Bon Marche, Suite 'E', Baton Rouge, LA 70806 (504-924-2298) AR, LA 1, 2, 3, 4, 5, 7, 8, 9, 10, 11

Wm. B. Allen Supply Co., Inc., 1601 Basin St., New Orleans, LA 70116 (504-525-8222; 800-535-9593; LA only 800-462-9520) Nationwide 1, 2, 3, 4, 5, 6

Audiomedia Associates, Box 29264, New Orleans, LA 70189 (504-586-0140) AL, AR, FL, LA, MS 1, 3, 4, 5, 9, 10
See advertisement on page 222

Gray Communications, 5441 Pepsi St., New Orleans, LA 70173 (504-733-7265) AR, LA 1, 2, 3, 4, 5, 7, 8, 9, 10, 11

MAINE

MG Associates, Box 4245 Station A, Portland, ME 04101 (207-774-5290) ME, NH 2, 3

MARYLAND

Music Sound Distributors, 6730 Santa Barbara Court, Baltimore, MD 21227 (301-796-3984) U.S.A. and Canada 1, 2, 5

Theatre Service & Supply Corp., 1792 Union Ave., Baltimore, MD 21211 (301-467-1225) U.S.A. 1, 2, 7, 9, 10, 11

Peirce-Phelps, Inc., 10215 Fernwood Dr., Bethesda, MD 20034 (301-530-9580) DC, MD, VA 1, 2, 3, 5, 7, 8, 9, 10, 11

Professional Products Inc., 4964 Fairmont Ave., Bethesda, MD 20014 (301-657-2141) DC, MD, VA 1, 2, 3, 4, 5, 6, 7, 9, 10, 11

Midwest Corp., Communications Systems Div., 4700-G Boston Way (Washington D.C.), Lanham, MD 20801 (301-577-4903) North America 1, 2, 4, 5, 8, 9, 10

Broadcast Controls, 9155 Brookville Rd., Silver Spring, MD 20910 (301-587-3505) Worldwide 1, 10

Wiltronix, Inc., 16850 Oakmont Ave., Washington, MD 20880 (301-258-7676) DE, DC, KY, MD, PA, VA, WV 1, 2, 3, 10

MASSACHUSETTS

Professional Recording & Sound, Inc., 1616 Soldiers Field Rd., Boston, MA 02135 (617-254-2101) CT, ME, MA, NH, RI, VT 1, 3, 5, 10, 11

Professional Video Systems Inc., 1616 Soldiers Field Rd., Boston, MA 02135 (617-254-2101) CT, ME, MA, NH, RI, VT 2, 3, 4, 5, 8, 9, 10

Lake Systems Corp., 55 Chapel St., Newton, MA 02160 (617-244-6881) CT, ME, MA, NH, RI, VT 1, 2, 3, 5, 8, 9, 10, 11

M. P. Video, Inc., 45 Kenneth St., Newton, MA 02161 (617-965-5405) CT, ME, MA, NH, RI 1, 2, 3, 5, 9, 10, 11

Landy Associates, Inc., 39 Union Ave., Sudbury, MA 01776 (617-443-5708) CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT 1, 2, 3, 5, 7, 10, 11

QSI Systems, Inc., 993 Watertown St., West Newton, MA 02165 (617-969-7118) U.S.A. 2, 3, 5

Fleet Electrical Service, 324 Southwest Cutoff, Worcester, MA 01604 (617-755-8666) CT, ME, MA, NH, RI, VT 8

MICHIGAN

Thalner Electronic Labs, Inc., 7235 Jackson Rd., Ann Arbor, MI 48103 (313-761-4506; Area (313) ONLY 800-552-5275) MI, OH 1, 2, 3, 4, 5, 6, 8, 9, 10, 11

Audio Distributors, Inc., 2342 S. Division Ave., Grand Rapids, MI 49507 (616-452-1596) U.S.A. 1, 3, 4, 5, 10, 11

Victor Duncan, Inc., 32380 Howard St., Madison Hgts., MI 48071 U.S.A. and Canada 1, 2, 3, 5, 6, 7, 9, 10, 11

O'Hara Associates, 36500 Weideman, Mt. Clemens, MI 48043 (313-791-7140) MI 3

V F Sales Inc., 869 S. Main, Plymouth, MI 48170 (313-453-8720) MI 1, 3, 5

Sound Solutions Inc., 7641 19 Mile Rd., Sterling Heights, MI 48078 (313-739-7020) IL, IN, MI, OH 1, 2, 3, 4, 5, 10

MINNESOTA

Emmons Associates, Inc., 1121 Riverwood Dr., Burnsville, MN 55337 (612-890-8920) IA, MN, ND, SD, WI 1, 2, 4, 9, 11

AVC Systems, Inc., 1517 E. Lake St., Minneapolis, MN 55406 (612-729-8305) IL, IN, IA, MI, MN, NE, ND, SD, WI 1, 3, 5, 9, 10, 11

Todd Communiations Inc., 7360 Ohms Lane, Minneapolis, MN 55435 (612-835-3080) IA, MN, NE, ND, SD, WI 1, 2, 3, 4, 5, 7, 9, 10, 11

Clark R. Gibb Co., 11100 Bren Rd. W., Minnetonka, MN 55343 (612-938-5434) MN, ND, SD, WI 1, 3, 5

T. R. Pitts Co., 458 W. Sanborn St.; Box 57, Winona, MN 55987 (507-452-2629) All - MD, MN, SD, WI; Parts of - IL, IA, ME, MI 1, 2, 3, 4, 5, 8, 9, 10

MISSISSIPPI

Central School Supply, 310 Airport Rd., Jackson, MS 39208 (601-932-1901) AL, LA, MS, TN 1, 2, 4, 5, 6, 7, 9, 10, 11

Transvolt, Inc., 1840 Capitol Towers, Jackson, MS 39201 (610/362-2697) AL, AR, DC, FL, GA, KY, LA, MD, MS, MO, NC, OK, SC, TN, TX, VA, WV 9, 10, 11

MISSOURI

Television Engineering Corp., 580 Goddard Ave., Chesterfield, MO 63017 (314-532-4700) IL, IA, KS, MI, MN, MS, MO, NE, OH, TN 1, 2, 5, 7, 8, 9, 10
See advertisement on pages 221, 243

Electric Parts & Service Co., 140 Progress Parkway, Maryland Hgts., MO 63403 (314-878-4900) Southern IL, MO 8

(See page 200 for key to listings)

Delcom Corp. of St. Louis, 2349 Grissom, St. Louis, MO 63141 (314-432-1164) AR, MO, OK 2, 3, 5, 9, 10

Lines Video Systems, 219 S. Jefferson, Springfield, MO 65806 (417-862-5533 out of state 800-641-4674) AR, IL, KS, KY, MO, OK, TN 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

MONTANA

Holm-James Distributors Inc., 4th Ave. S. at 6th St., Box 2487, Great Falls, MT 59403 (406/761-2420) MT, Northern-WY 1, 2, 3, 5, 6, 9, 10

NEVADA

Cinema Services, 3050 Sheridan St., Las Vegas, NV 89102 (702-876-4667) AZ, NV, NM, UT 2, 7, 11

NEW HAMPSHIRE

Associated Systems, Box 333, Londonderry, NH 03053 (603-434-0731 or 4533) CT, ME, MA, NH, NY, RI, VT 1, 2, 3

New England Wholesale Supply, 57 Harvey Rd., Londonderry, NH 03053 (603-434-0323) ME, MA, NH, VT 1, 2, 5, 9, 10, 11

NEW JERSEY

Landy Associates, Inc., 1890 E. Marlton Pike, Cherry Hill, NJ 08003 (609-424-4660) CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT 1, 2, 3, 5, 7, 10, 11

Thor Electronics Corp., 321 Pennsylvania Ave., Linden, NJ 07036 (201-486-3300) Worldwide 6

Koppe Raden Corp., 10 Stuyvesant Ave., Lyndhurst, NJ 07071 (201-460-0800) Caribbean, Central America, South America 1, 2, 3, 4, 5, 6, 7, 8

Cinecraft Int'l., Inc. Export Agents, 11 Caesar Place, Moonachie, NJ 07074 (201-939-0875) Worldwide 1, 7, 9, 11

Dimension 3 Recording Co., Box 326, New Milford, NJ 07646 (201-265-5599) USA and Canada 5

Comprehensive Video Supply Corp., 148 Veterans Dr., Northvale, NJ 07647 (800-526-0242; NJ only 201-767-7990) Worldwide 1, 2, 3, 5, 7, 9

H. M. Holzberg Associates, Inc., Box 322, Totowa, NJ 07511 (201-256-0455) CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT 1, 2, 3, 4, 5, 7, 8, 10

NEW MEXICO

Magnetic Media, 1213 N. Lea, Roswell, NM 88201 (505-622-6393) Southern NM 2, 3, 5, 9, 10

DYMA Engineering, Inc., Box 1697, Taos, NM 87571 (505-758-8686 or 2686) AZ, CA, CO, KS, NV, NM, OK, TX, UT 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

NEW YORK

Ceco Communications Inc., 2115 Avenue X, Brooklyn, NY 11235 (212-646-6300) Worldwide 6
See advertisement on pages 40-41

Audio-Video Corp., 55 Delaware Ave., Delmar, NY 12054 (518-439-7611) CT, MA, NY, North-PA, VT 1, 2, 3, 5, 9, 10, 11

Temtron Electronics Ltd., 15 Main St., East Rockaway, NY 11518 (516-599-6400; 800-645-2300) U.S.A. 5, 6

Jules Racine & Co., Inc., 85 Executive Blvd., Elmsford, NY 10523 (914-592-4760) U.S.A. 3

Long Island Mobile Power, 158 Long Island Ave., Holtsville, NY 11742 (516-475-2055) NY 8

London Electric, 27-16 Fortyfirst Ave., Long Island City, NY 11101 (212-786-1800) U.S.A. 1, 2, 3, 5, 8, 9, 10

Team Electronics, Inc., 24-16 Queens Plaza South, Long Island City, NY 11101 (212-937-9200) U.S.A. and Canada 1, 2, 5, 6, 7

Boynton Studio Inc., Melody Pines Farm, Morris, NY 13808 (607-263-5695) U.S.A.; in Canada-BC, MAN, NB, NS, ONT, PEI, QUE, SASK 1, 5, 8, 11

Henry Grossman Associates, 519 South 5th Ave., Mount Vernon, NY 10550 (914-664-5393 or 337-4260) CT, DE, DC, FL, ME, MD, MA, NH, NJ, NY, PA, VT, VA 1, 2, 3, 4, 5, 6, 7, 10

Richard W. Burden Associates, 342 Lexington Ave., Mount Kisco, NY 10549 (914-666-3730) U.S.A. 10

Adwar Video Corp., 100 Fifth Ave., New York, NY 10011 (212-691-0976) Worldwide 1, 2, 3, 5, 6, 9, 10, 11

Barbizon Electric Co., Inc., 426 West 55th St., New York, NY 10019 (212-586-1620) AL, CT, DE, DC, FL, GA, IL, IN, KY, ME, MD, MA, MI, MS NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, WI 2

Calvert Electronics Inc., 220 East 23rd St., New York, NY 10010 (800-221-6844) Worldwide 6
See advertisement on page 131
Contact Larry Broome

The Camera Mart, Inc., 456 West 55th St., New York, NY 10019 (212-757-6977) CT, ME, MA, MI, NH, NJ, NY, OH, PA, VT 2, 7

Levit Electronics, Inc., 200 Park Ave. S., New York, NY 10003 (212-777-5517) Worldwide 6
See advertisement on pages 52, 222

Martin Audio/Video Corp., 423 West 55th St., New York, NY 10019 (212-541-5900) DC, MA, NJ, NY, VT 1, 2, 3, 5, 9, 10

The Ken Schaffer Group, Inc., 10 East 49th St., New York, NY 10017 (212-371-2335) Worldwide 1, 3

Sonocraft Corp., 360 West 31st St., New York, NY 10001 (212-760-9300) NJ, NY 1, 2, 5, 7, 9, 10

Studio Film & Tape Inc., 630 9th Ave., New York, NY 10036 (212-977-9330) U.S.A. and Canada 3, 5

Tape City, Inc., 404 Park Ave. S., New York, NY 10016 (212-679-1606) CT, NJ, NY, Mail Order in U.S.A. 1, 2, 5, 9, 11

United Research Lab Corp., 16 East 52nd St., New York, NY 10022 (212-751-4663) U.S.A., Canada and Int'l. 1, 9

Video Tape Exchange Div. of Cine Film Exchange Inc., 855 Avenue of the Americas, New York, NY 10001 (212-695-6644) Worldwide 5

Listec TV Equipment Corp., 39 Cain Dr., Plainview, NY 11803 (516-694-8963) U.S.A. 1, 2

R F Gain, Ltd., 100 Merrick Rd., Rockville Centre, NY 11570 (516-536-8868; 800-645-2322) Worldwide 6

Northeast Broadcast Lab., Inc., 15 Charles St.; Box 1176, S. Glens Falls, NY 12801 (518-793-2181) CT, ME, MA, NH, NY, RI, VT 1, 3, 4, 5, 8, 9, 10, 11

Video Components, Inc., 601 S. Main St., Spring Valley, NY 10977 (914-356-3700) U.S.A. 2

Hammond Industries Inc., 155 Michael Dr., Syosset, NY 11791 (516-364-1900) U.S.A. and Canada 1, 3

Motion Picture Enterprises, Inc., Box 276, Tarrytown, NY 10591 (212-245-0969) Worldwide 2, 5, 7

Micron Audio Products, 210 Westlake Dr., Valhalla, NY 10595 (914-761-6520) U.S.A. 1, 4

Mineroff Electronics, Inc., 946 Downing Rd., Valley Stream, NY 11580 (516-825-4702) U.S.A. 1

Singer Products Co., Inc., 875 Merrick Ave., Westbury, NY 11590 (516-333-2000) Worldwide except U.S.A. and Canada 1, 3, 4

NORTH CAROLINA

Doug Cook & Associates, Box 7244, Charlotte, NC 28217 (800-543-3000) Ohio-582-1364 OH, W.-PA, WV 1, 2, 3, 4, 10

Electronic Merchandising Enterprises, Inc., 112 Buena Vista, High Point, NC 27260 (919-869-3335) East-KY, NC, SC, East-TN, VA, WV 1, 2, 3, 4

Southern Coastal Marketing, 10120 Crestwood Dr., Mattens, NC 28105 (704-847-5687) NC, SC, VA 1, 2, 3, 4, 5, 9

Jim Cason Electronics, 5213A Trentwood Dr., New Bern, NC 28560 (919-638-5956) Southeastern U.S. 9, 10

Midwest Corp., Communications Systems Div., 900 Peterscreek Pkwy., Winston-Salem, NC 27103 (919-725-0671) North America 1, 2, 4, 5, 8, 9, 10

Technical Video Systems, 245 Executive Park Blvd., Winston-Salem, NC 27103 (919-768-9536) GA, NC, SC, TN, VA, WV 1, 2, 3, 5, 8, 9, 10, 11

NORTH DAKOTA

Audiovisual Inc. Formerly Known As OMF Audiovisual, Inc., 1818 E. Broadway, Bismarck, ND 58501 (701-258-6360) MN, MT, ND, SD 1, 2, 3, 5, 7, 9, 10, 11

OHIO

Klopf A/V Co., 3381 Successful Way, Dayton, OH 45414 (513-236-5500) IN, KY, MI, OH 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

OKLAHOMA

Walter S. Brewer Co., Inc., 5424 S. Zunis Pl., Tulsa, OK 74105 (918-749-9894) Worldwide 2, 10

(See page 200 for key to listings)

Delcom Corp., 6019 East Ave., S., Tulsa, OK 74145 (918-494-9500) AR, MO, OK 2, 3, 5, 9, 10

OREGON

United Radio Supply Inc., Box 14040, Portland, OR 97214 OR, WA 3, 6

Videosonics Inc., 821 Southeast 14th Ave., Portland, OR 97214 (503-232-4632) ID, MT, OR, WA 1, 2, 5, 7, 8, 9, 10, 11

PENNSYLVANIA

Communiation Medias, Tilghman at Jefferson Sts., Allentown, PA 18102 (215-437-0607) North America 1, 3, 4, 5, 6, 7, 8, 9, 10, 11

P.A.G.E. Co., Road 8, Box 41, Allentown, PA 18104 (215-395-5875) PA 8

LPB Inc., 28 Bacton Hill Rd., Frazer, PA 19355 (215-644-1123) CA, CT, DE, DC, GA, ME, MD, MA, NJ, NY, NC, OH, PA, RI, SC, VA, WV 1, 3, 4

Gallagher Equipment Co., Box 582, Honey Brook, PA 19344 (215-942-4111) PA 8

Dimension Five Sound Co., 100 North 17th St., Philadelphia, PA 19103 (215-568-1545) DE, DC, NJ, NY, OH, PA, VA 1, 3, 5, 9, 10

Lerro Electrical Corp., 3125 N. Broad St., Philadelphia, PA 19132 (215-223-8200) DE, DC, MD, NJ, PA 1, 2, 5, 8, 10
See advertisement on page 179

Micro TV, Inc., River Park House, 3600 Conshohocken Ave., Philadelphia, PA 19131 (215-879-0900) U.S.A. and Canada 2

Peirce-Phelps, Inc., 2000 North 59th St., Philadelphia, PA 19131 (215-879-7171) DE, NJ, PA 1, 2, 3, 5, 7, 8, 9, 10, 11

Steinberg Electronics Inc., 2520-22 N. Broad St., Philadelphia, PA 19132 (215-223-9400) (800-523-0894) U.S.A. and Int'l. 1, 2, 3, 5, 6

Brenner Cine-Sound, 431 Smithfield Ave., Pittsburgh, PA 15222 (412-765-3800) DC, MD, OH, PA, VA, WV 1, 2, 5, 7, 9, 10, 11

Val-Tronics, Inc., Penn Park Bldg., Pittston, PA 18640 (717-655-5937) U.S.A. 1, 3, 4, 5, 6

Dimension Five Sound Co., 24 N. 3rd St., Womelsdorf, PA 19567 (215-589-2546) DE, DC, NJ, NY, OH, PA, VA 1, 3, 5, 9, 10

RHODE ISLAND

Electro-Acoustic Designs, Inc., Box 419, Kingston, RI 02881 (401-789-1329) Worldwide 1, 9, 10
See advertisement on page 245

WRH Productions, 5 Industrial Way, Riverside, RI 02915 (401-434-6272) CT, ME, MA, NH, NY, RI, VT 1, 4, 5, 10, 11

TENNESSEE

Broadcast Equipment & Supply Co., Box 3141, Bristol, TN 37620 (615-878-2531) U.S.A. 1, 4, 5

Gray Communications, 6339 E. Brainerd Rd., Chattanooga, TN 37421 (615-894-6860) TN 2, 5, 8, 9, 10

Centel Systems, Inc., 3610 Democrat Rd., Memphis, TN 38118 (901-365-1361) AR, MS, TN 1, 2

Phase Audio, Inc., 151 N. Angelus, Memphis, TN 38104 (901-726-1900) U.S.A. 1, 3, 9, 10
See advertisement on page 234

Audicon, Inc., 1200 Beechwood Ave., Nashville, TN 37212 (615-256-6900) AL, AR, DE, DC, FL, GA, KY, LA, MD, MS, MO, NC, SC, TN, TX, VA, WV 1, 3, 9, 10, 11

Gray Communications, 225 Spence Lane, Nashville, TN 37210 (615-883-9175) TN 2, 5, 8, 9, 10

TEXAS

Broadcast Systems Inc., 8222 Jamestown Dr., Austin, TX 78758 (800-531-5232) U.S.A. 1, 2, 3, 4, 7, 8, 9, 10

Jenel Corp., Consulting & Engineering, 9550 Forest Lane, Suite 400, Dallas, TX 75243 (214-343-1229) U.S.A. 10

MZB&Assoc., 4203 Beltway, Dallas, TX 75234 (214-233-5535) AR, LA, NM, OK, TX 1, 2, 3, 4, 7

E. Smalling III, Consulting Engineer, 10307 Bernardin, Dallas, TX 75243 (214-234-5894) U.S.A. 10

Victor Duncan, Inc., 2659 Fondren Dr., Dallas, TX 75206 (214-369-1165) U.S.A. and Canada 1, 2, 3, 5, 6, 7, 9, 10, 11

Professional Audio Services, Box 1953, Ft. Worth, TX 76101 (817-536-6254) AL, AZ, AR, CO, FL, GA, HI, IL, KY, LA, ME, MI, MN, MS, MO, NE, NV, NM, OH, OK, PA, TN, TX, UT, VI, WA, WY 1, 3, 5, 9

The Gene Sudduth Co., Inc., 845 39th S.E., Paris, TX 75460 (214-785-5764) AR, LA, OK, TX 1, 2, 3

UTAH

RIA, Inc., 50 E. Malvern, Salt Lake City, UT 84115 (801-486-8822 or 484-1701) AZ, CO, ID, MT, NV, UT, WY 1, 2, 3, 4, 5, 7, 9, 10, 11

VIRGINIA

Broadcast Equipment Exchange, Box 1238, Arlington, VA 22210 (703-525-0400) U.S.A. and Int'l. 11

Broadcast Consultants Corp., Box 590, Leesburg, VA 22075 (703-777-8660) North America 1, 3, 4, 5, 6, 7, 8, 9, 10, 11

System Wireless Ltd., 11250-14 Roger Bacon Dr., Reston, VA 22090 (703-471-7887) Nationwide 1

Hoppman Corp., Box 1463, Springfield, VA 22151 (703-321-8800) U.S.A. 1, 2, 7, 10

Midwest Corp., Communications Systems Div., 1395 Airrail Ave., Virginia Beach, VA 23455 (804-464-6256) North America 1, 2, 4, 5, 8, 9, 10

WASHINGTON

MARCOM, 19940 N.E. Ballinger Way, Suite B, Seattle, WA 98155 (206-364-9911) AK, AZ, CA, HI, NV, OR, WA 1, 2, 3, 4, 10, 11

WEST VIRGINIA

Midwest Communications Systems, 300 First Ave., Nitro, WV 25143 (304-722-2921) KY, OH, PA, WV 1, 2, 3, 4, 5, 6, 9, 10, 11

WISCONSIN

Electronic Industries Inc., 19 E. Irving Ave., Oshkosh, WI 54901 (414-235-8930) U.S.A. 1, 3, 4, 5, 6, 9, 11
See advertisement on page 175

Video Images, 12200 W. Adler Lane, West Allis, WI 53214 (414-475-0111) WI 1, 2, 5, 7, 9, 10, 11

CANADA

Broadcast Video Systems, Ltd., 1050 McNicoll Ave., Agincourt, Ont., Canada M1W 2L8 (416-497-1020) AL, AR, CO, CT, DE, DC, FL, GA, ID, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NH, NJ, NM, NY, NC, ND, OH, OK, PA, RI, SC, SD, TN, TX, UT, VT, VA, WV, WI, WY, all of Canada 2, 3

Glentronix (1977) Ltd., 160 Duncan Mill Rd., Don Mills, Ont., Canada M3B 1Z5 (416-444-8497) U.S.A. and Canada 1, 2, 3

Comad Communications, 91 Kelfield St., Unit 5, Rexdale, Ont., Canada M9W 5A3 (416-245-1734) Canada 1, 2, 4, 5, 9, 10

Caldwell A/V Equipment Co., 1080 Bellamy Rd. N., Scarborough, Ont., Canada M1H 1H2 (416-438-6230) Canada 1, 2, 3, 4, 5, 6, 9, 10

Black & McDonald, 101 Parliament St., Toronto, Ont., Canada M5A 2Y7 (416-225-0175) Canada 4

Lumitrol, Ltd., 5 Walker Ave., Toronto, Ont., Canada M4V 1G3 (416-921-6060 or 921-6688) Canada 2, 10

Auvinic Ltd., 1280 Lachaine, Laval, Que., Canada H7C 2N7 (514-661-5120) Canada 1, 2, 3, 5, 10

Battery & Electric Service Co., 3695 Cote Vertu, Montreal, Que., Canada H4R 1R4 (514-332-5821) Que. 8

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A block of rooms and suites have been reserved at the New York Sheraton Hotel at a special reduced ITA Seminar rate. Reservations must be made on a special reservations request form which can only be obtained from ITA, and which will be mailed to you with the acknowledgement of your Seminar registration fee.

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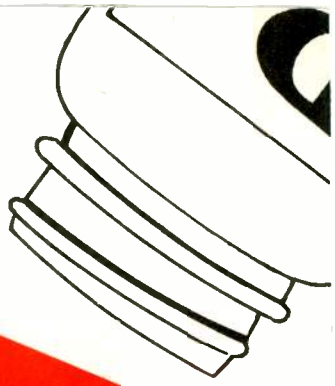
For registration information, contact Diane DiMella, ITA, 10 West 66th Street, New York, NY 10023, (212) 787-0910.



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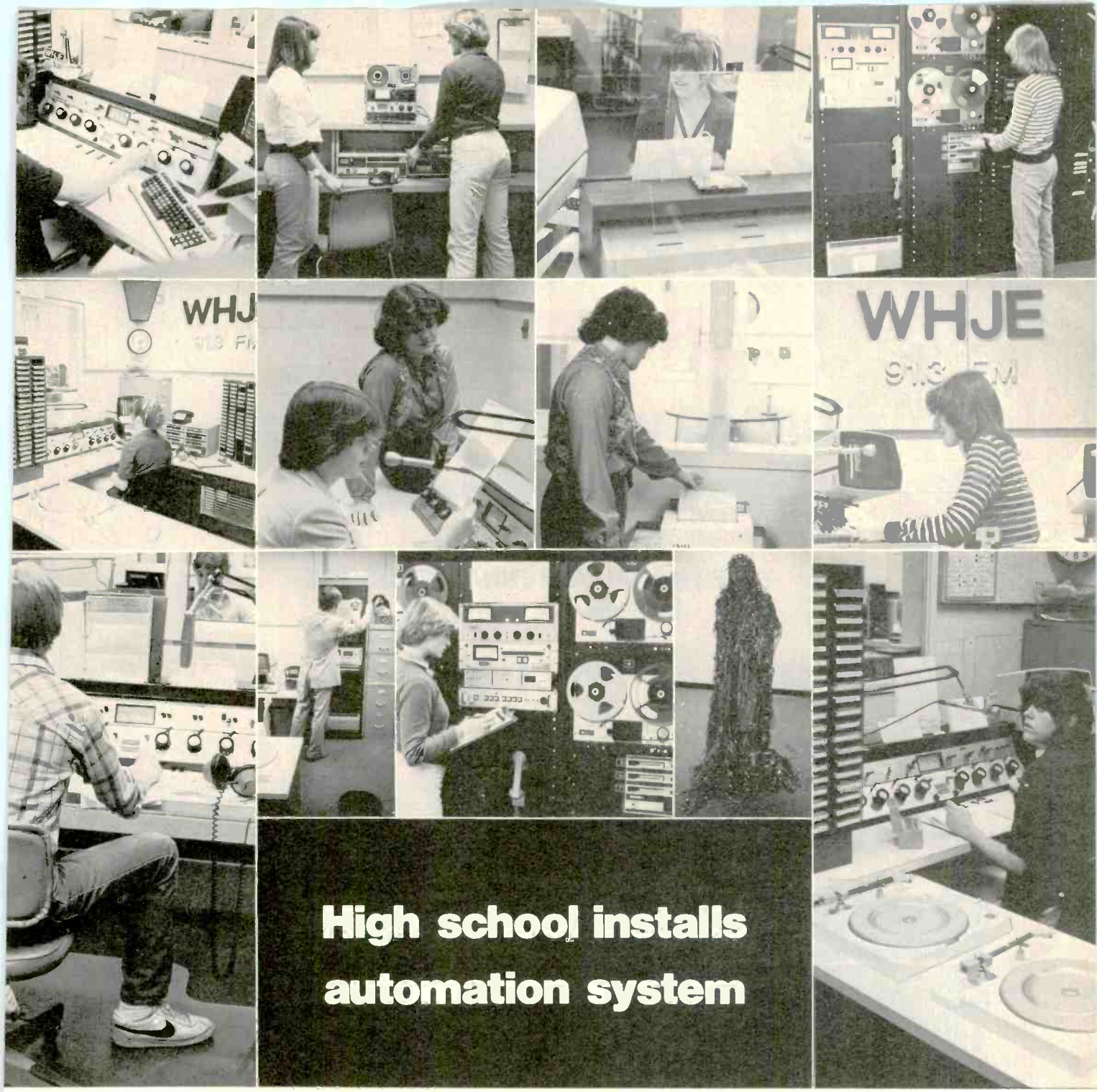


High school installs automation system

In February, WHJE-FM, the student-operated FM station at Carmel Clay High School, Carmel, IN, ordered a Harris automation system to better prepare its students for careers in radio broadcasting.

"We think there's a trend toward automation in radio broadcasting, so we wanted to provide the students with practical experience in the classroom," said Robert Nibarger, WHJE general manager.

According to Nibarger, approximately 60 students studying radio and TV broadcasting will use the new Harris 9002 to learn how to set formats, read printouts and work with all aspects of radio automation.

In addition, the new equipment will allow the station to increase its on-air time from 15 hours to 18 hours a day, every day.

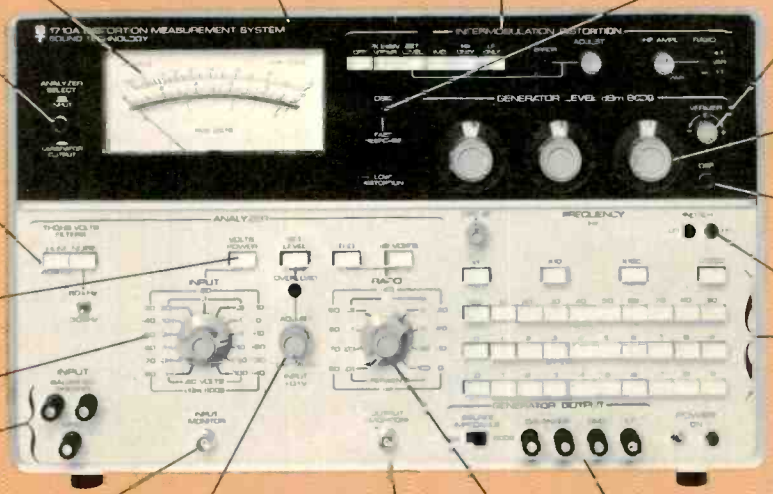
"We wanted to be on the air every day, 365 days a year," Nibarger said. "But we didn't want to have students in the school on Sundays. Therefore, automation was the best solution."

Once only 250W, the 15-year-old noncommercial station now transmits with a Harris FM-1K, 1000W FM transmitter. WHJE is the only FM station in Carmel and the only radio station serving the community of 20,000 people after sunset.

The automation equipment includes two terminals, one for the school's radio studio and one for the production room. The station also uses Harris consoles, Harris Criterion 90 tape cartridge machines and other audio equipment. In addition to the radio studios, Carmel Clay has two television studios for both color and b&w.

Carmel Clay High School, attended by 2300 students, is a few miles south of Indianapolis.

High-quality distortion analyzer for broadcast measurements



Two of the above features are so outstandingly valuable that we especially invite your attention to them.

One is the fast, easy measuring you get with pushbutton-selected distortion-measuring circuits (signal source and measuring circuits are simultaneously selected with the **same** pushbuttons). Pushbuttons make it so simple to measure quickly and to repeat measurements.

Secondly, you can drive virtually any type of circuit from the signal source output — whether balanced, unbalanced, off-ground or whatever. That's because the signal source output circuit is fully **isolated and balanced.**

There is no output transformer to introduce noise or distortion.

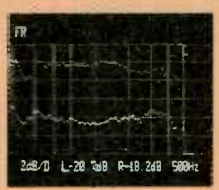
Besides these outstanding conveniences, you can have the Sound Tech 1710A with an option that enables you to measure **intermodulation distortion.**

Send for full information on an instrument recognized everywhere as the standard of the audio field.

How to check your tape recorder in 10 minutes

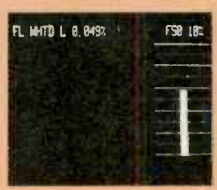
Checking your audio tape recorder is ultra-simple. Just connect the recorder to this new computerized Tape Recorder Test System. By pushing panel buttons you can measure:

- **Frequency response**
- **Harmonic distortion**
- **Wow and flutter**
- **Noise**
- **Speed accuracy and drift**
- **Channel separation**
- **Head azimuth accuracy (position a head in 10 seconds)**



Two channel frequency response

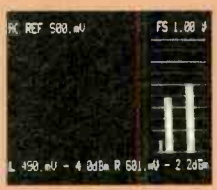
Third harmonic distortion vs. level



Flutter: 0.049% shown

Head azimuth accuracy

Noise: two channels; −53.4 dB shown



Voltage (yes, it's a voltmeter, too)

SOUND TECHNOLOGY

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CAMPBELL, CALIFORNIA 95008
(408) 378-6540

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To: **SOUND TECHNOLOGY** 1400 Dell Ave. Campbell, Ca. 95008

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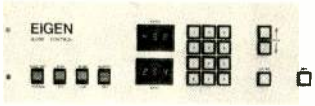

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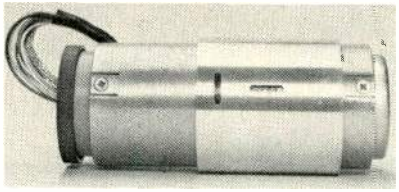

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MODEL PP-1 PHONO PREAMP

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The standard PP-1 has extensive RF suppression and comes equipped with XLR output connectors. The PP-1 may be ordered with a transformer coupled output, transformerless output, or an unbalanced "Hi Fi" output.

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Circle (223) on Reply Card

wnPhillips

Dependable transient voltage suppressors for Radio & TV stations, Cable TV systems and recording studios. Protects computer controlled character generators and video cameras from AC line overvoltages and transients. Units available from stock. Free Catalog, CONTACT: WNP ELECTRONICS, 356 Bacon Street, Lake City, Michigan 49651, TEL. (616) 839-7181.

Circle (224) on Reply Card

SOLID STATE TOWER FLASHERS

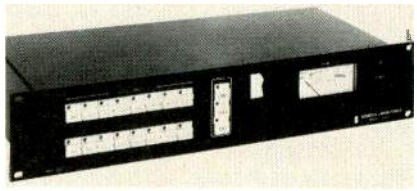
A new series has been added to SSAC's line of "B-Kon-Flash". The new devices with a load current rating of 300 Amperes Inrush will operate up to four beacons at 230 VAC, two beacons at 120 VAC. Also available are auxiliary units for synchronous operation of additional beacons on separate lines or for alternating flashing of beacons.

Lamp Life is increased by approximately 10 X due to Zero Voltage Switching. Device measures 2 x 2 inches and is completely encapsulated. Price in 1-9 quantity, $41.52 each, FOB Factory. For more information call John Arnold at (315) 622-1000.

SSAC Inc.
PO Box 395, Liverpool, NY 13088

Circle (225) on Reply Card

SCANTEX



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We offer whatever degree of technical help our clients decide to use.
Picture is AFD-200, Audio Follow Dissolver, the most powerful tool next to your video production switcher.

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SoundScriber

Logging Tape Recorders

Over 40 years of service to the broadcast industry. We offer high-quality, low-cost logging tape recorders especially suited for the broadcast field. 24 hours of recording on a single 3¾" reel, can use 2" videotape as a recording medium, direct mounting in a 19" rack and more. U.S. and overseas.

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TEPCO

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BIRD

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New air-cooled rhombic-shaped Loads 1.5kW to 10kW sizes

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Self-contained Moduload® Systems (no external water) 10kW to 80kW sizes all for 50 ohm lines

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Circle (229) on Reply Card

Digital effects update

In the July issue of **BE**, p. 38, appeared a comparison table of features for currently available digital video effects systems. Some important information on the Vital SqueeZoom Digital Manipulation Unit, not available at press time, appears in the updated table below.

PARAMETERS \ FIRM & MODEL NO.	Vital VMU-1
Basic unit price (2 channel)	$159K +
Delivery (typically, ARO)	90-120 days
Basic Unit Features—	
Variable compression	yes
Fixed 4:3 aspect ratio	yes
Variable aspect ratio	yes
Automatic chromakey tracking	no
Border generator	no
Effects memory	yes
Freeze	yes
Automatic switcher tracking	yes
Additional Features—	
Tumble and roll	yes
Number additional channels	3, opt.
Noise reduction	no
Picture expansion	yes
Rotation of picture	no
Computer created effects (fish-eye lens effect)	no
Routing switching system	yes
Preprogrammable sequences	yes
Operational features—	
Type switcher interface too	any make
Warranty period	2 yrs.
Product training school	yes
Mechanical size:	
panel:	12.06" x 22.65"
control head frame:	56" x 19"

new products

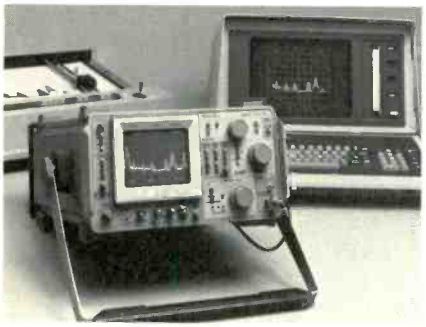
Helicopter ENG tracking antenna

The **Sky Scan** system from **Microwave Associates** centers on an automatic tracking antenna, designed to acquire an aircraft more quickly and to follow the aircraft's microwave transmission despite multipath reflection or strong adjacent channel interference. The antenna uses a monopulse-type feed system similar to that used for spacecraft tracking. This system employs Scan Coding, which is able to discriminate between actual signal direction and multipath signals.

Circle (250) on Reply Card

Automatic distortion analyzer

Tektronix has introduced the AA 501 Automatic Distortion Analyzer/SG 505 Oscillator system. The AA 501 harmonic distortion analyzer is used with its companion signal source, the SG 505, an extremely low distortion oscillator. The AA 501/SG 505 system reduces measurement time and eliminates the need for continual manipulation of manual controls. An option allows measurement of intermodulation distortion on signals conforming to SMPTE, DIN or CCIF standards.



Circle (251) on Reply Card

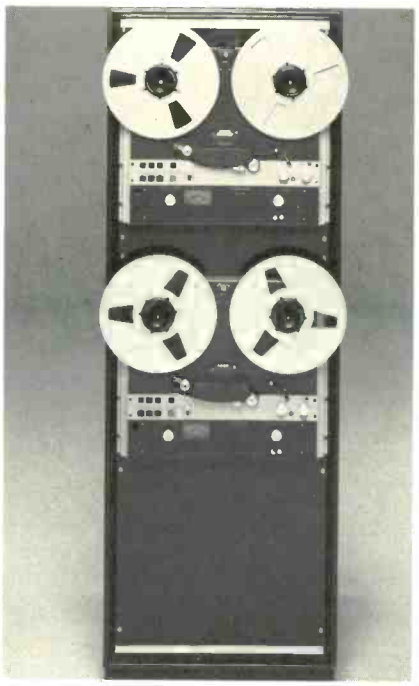
Newsroom automation systems

The **Newscan** automated newsroom system features user-created color graphics, continuing support options, complete in-house election tabulation and reporting capabilities, assignment editor/scheduling, script preparation, newscast preparation/producer's rundown and direct weather input from NWS/FAA.

Circle (252) on Reply Card

24-hour logging system

The SP74 broadcast logging rack that requires reloading once every 24 hours is announced by **Neal Ferrograph USA.** Based on a four-channel 15/16 IPS version of the Ferrograph SP7 open reel recorder, the two-machine logger provides four continuous recording channels that are assigned in the typical AM/FM station to two stereo FM channels, one AM channel, and one time code channel.



Circle (253) on Reply Card

Switchable HF filter/Wattmeter system

The model 5030 HF Filter/Wattmeter System from **Bird** is designed to increase productivity in metrology labs, manufacturing and users' facilities with frequent measurement and testing requirements. This self-contained high-power system with a minimum of 60dB attenuation of harmonics and spurious signals has

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

Beaveronics, Inc.

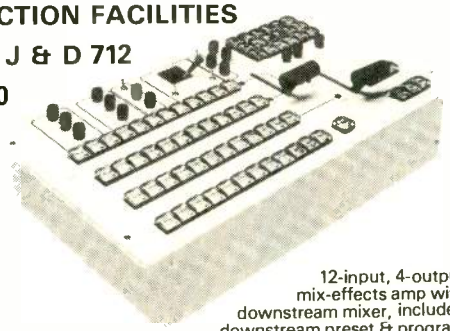
STUDIO PRODUCTION VIDEO SWITCHING SYSTEMS

(Also available in PAL and PAL-M versions)

FOR REMOTE & SMALL PRODUCTION FACILITIES

MODEL J & D 712

$7,400.00



12-input, 4-output 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 Background
- Built-in Black Burst Generator
- Built-in Colorizer
- Built-in RGB Chroma keyer
- Four Switching busses
- Downstream Preset and Program Busses with cut bar
- 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

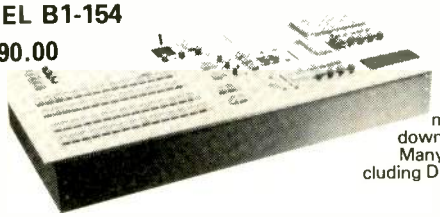
Options:

Downstream Keyer

FOR MODERATE SIZE FACILITIES

MODEL B1-154

$12,990.00

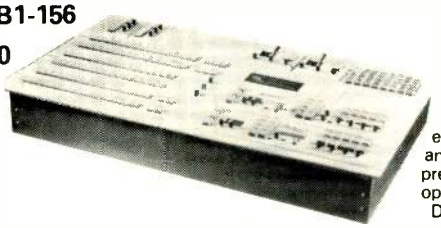


15-input, 4-bus mix/eff/key amp with downstream mix/key amp Many optional features including DSK & quad-split, etc.

FOR SOPHISTICATED FACILITIES

MODEL B1-156

$21,795.00



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

MODELS 154 & 156

STANDARD FEATURES

1. **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**
   - 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.)

4. **Mix-Effects Units (Includes Keying Function)**
   - **One** (1) used in Model B1-154
   - **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 output).
   - **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.
   - **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) **$1,975.00**
• Keys in titles, inserts, or fades to black with or without insert • Color matte background • Key sources: (1) Mix/Effect, (2) Chroma Key, (3) External • Push to Preview (Monitor)

DSK Border **$1,950.00**
• **Border**—black edge around insert • **Shadow**—black edge on right side and bottom of insert

Quad Split **$1,900.00**
Provides four (4) variable size quadrants from eight possible sources with variable width border.

Aux Busses—(Model 156 only) **$2,100.00**
Two remote outputs are available—remote control panel and amps required.

2nd **Mix/Effects Unit** in lieu of **Mix/Key** amp in 154 ..... **$2,650.00***
Mix/Key amp fed by preview and program busses in 156 ..... **$3,500.00***

*Except those indicated with an asterisk.

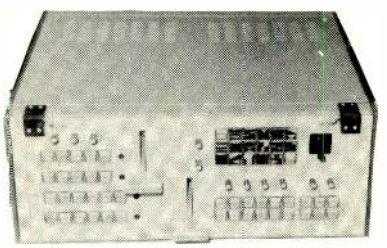
All Beaveronics Switching Equipment Carries a Two Year Warranty

ENG Switcher Model J & D 705

$7,990.00

- Master control switchers AFV with audio breakaway
- Routing switchers with AFV
- Specialized custom switches
- Selected terminal equipment

FEATURES:
- BUILT IN COLOR BLK AND BKG
- SELF-CONTAINED SYNC GEN
- INDEPENDENT COLOR BLK OUTPUTS TO CAMS
- SELF-CONTAINED CASE
- 5 INPUTS INCLUDING BLK AND BKG
- 32 - PATTERN MIX/EFF/KEY WITH POSITIONER
- MIX/EFF/KEY RE-ENTRY INTO SEPARATE MIX BUSSES
- PREVIEW FEATURES
- FRONT PANEL SINGLE ADJUSTABLE

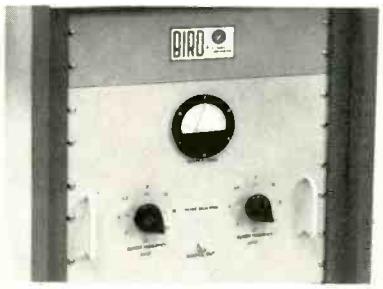


Write or phone for details.

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

Prices and Specifications Subject to Change Without Notice.

Circle (141) on Reply Card



eight discrete passbands between 1.5 and 35MHz.

Circle (254) on Reply Card

Reverberation system

The Master-Room XL-210 from **Micmix** is a self-contained 3½-inch rack-mount unit that features two completely independent stereo channels that are easily switchable to monaural operation. Input and output connections are via ¼-inch phone jacks on both the front and rear panels.

Circle (255) on Reply Card

Large-screen color monitor

A large-screen color monitor has been announced by **Amtron.** The AM-26, with more than 340 square inches of screen surface, combines Sony's single-gun Trinitron color system with switchable A/B inputs, switchable underscan, internal/external sync and separate RGB gun switches (plus background and gain controls).

Circle (256) on Reply Card

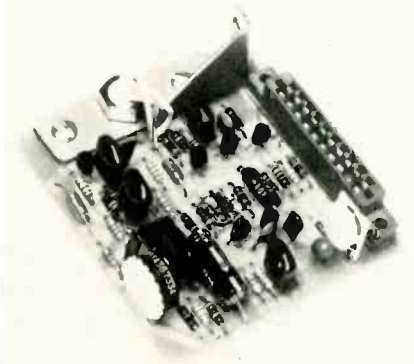
Automated system

An automated system for radio stations, designed to provide computerized analysis of the song preferences of a station's target audience, has been made available by **Smoke Signal Broadcasting.** The floppy-disc system, including video terminal and printer, is fully integrated, permitting immediate access and analysis of data. Manuals on research procedures and computer usage are written in the basic language.

Circle (257) on Reply Card

Composite synchronous interface

The composite phase lock loop is a P.C. video board from **TSD**



Display Products that makes all TSD display monitors plug-to-plug compatible with the display monitors of most major manufacturers. It is designed with a BNC connector that interfaces directly with the user's equipment. RS170, RS375, RS412 and RS420 interfaces can be accepted.

Circle (258) on Reply Card

Time code reader

EECO has introduced its SMPTE/EBU time code reader. Featuring exclusive tach-pulse operation, it reads standard SMPTE/EBU edit code used for electronic indexing of video and audiotapes. Within the microprocessor-based system, time code data is verified and processed on time. Each valid time code frame is updated before output to ensure correct output time data associated with the reference frame pulse.

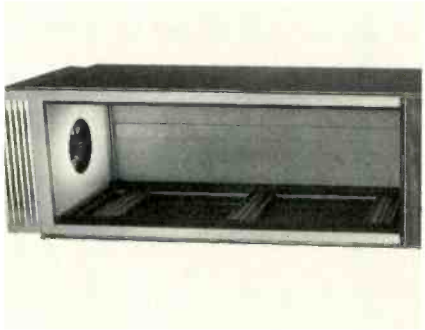
Earth station antennas

Prodelin has announced a line of segmented fiberglass earth station antennas with reflectors ranging from 4 feet to 5 meters. These petalized antennas feature high strength and lighter weight. The new reflectors are rated for winds up to 125 mph. They feature rear polarization adjustment, unpressurized feed and U/L approved fire retardant in the fiberglass.

Circle (260) on Reply Card

New products

Cooling base



The **Stantron Cooling Base** provides approximately 530 CFM free air delivery, and attaches to the bottom of the Stantron modular electronic cabinet. This method of assembly eliminates the necessity of using the available panel space.

Circle (261) on Reply Card

Battery-light kits

Four high-capacity battery-light kits designed to provide longer-life portable lighting for TV and film cameras are available from **Cine 60**. One of the kits provides a 40-minute lifetime for the battery-powered

light; another model provides an 80-minute lifetime. The lamp head may be mounted directly on the TV or film camera or it can be held separately. Power is supplied by a nickel-cadmium battery belt worn by the user.

Circle (262) on Reply Card

Coax termination kit

PA 4000, PA 4001 and PA 4010 coax termination kits have been introduced by **Paladin**. The Corex

coaxial wire stripper strips dielectric, braid and center conductor simultaneously to prepare the cable for immediate termination.

Circle (263) on Reply Card

Distribution amplifier

Excalibur Electronics has announced the model DA 1-5 distribution amplifier. The unit has one transformer-coupled input and five direct-coupled balanced outputs.

The specifications are 50Hz to 15kHz frequency response, under 0.15% harmonic and intermodulation distortion and +15 dBm maximum output level. Maximum gain is 20 dB.

Circle (264) on Reply Card

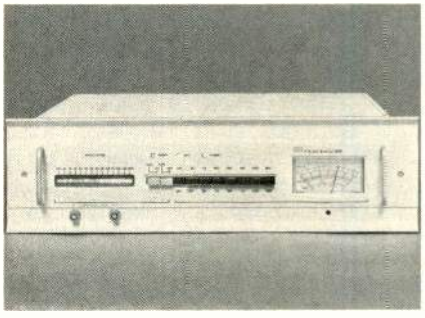
Broadcast audio system

The Lines-Plus remote broadcast audio system from **Kahn Communications** incorporates a portable transmitter and a rack-mounted receiver. This equipment requires the use of two telephone lines and provides improved frequency response at 50 to 5000Hz with a narrow cut at 2500Hz, two-way signaling and improved line reliability. The portable transmitter unit weighs 10 pounds, including the case.

Circle (265) on Reply Card

FM exciter

The model FX-30 Exciter from **Broadcast Electronics** is capable of more than 30W output. A digitally programmed frequency synthesizer permits field frequency changes in



10kHz increments without requiring new crystals. The temperature-compensated reference oscillator allows immediate on-frequency operation of the exciter without temperature-controlled oven warmup.

Circle (266) on Reply Card

station-to-station

Antenna mast for remote van

By Fredrick Chapman,
consultant,
Orange, TX

Many stations use a van or trailer for remote DJ shows and other out-of-station broadcasts. The telephone line has been replaced with the more modern FM remote transmitter. In many instances, close to the station, a rooftop whip antenna is all that is needed at the remote point. Other times, a mast with a Yagi antenna must be used. This latter arrangement usually is a mish-mash of tubes and collapsible TV antenna masts and requires help to set it up.

A simple answer is to mount the antenna mast permanently on the bus, van or trailer in a vertical position with the antenna already clamped on and even a lead-in cable connected. The Yagi can then be used for all remotes, eliminating the cost of a rooftop whip.

A three-section telescoping TV mast sold by most TV stores will do the job. I used the 27.5-foot mast, which sells for about $30. For the unmechanical, follow the procedure below to cut the mast to an acceptable length (that assumes you can't carry the full 10-foot height of the telescoped mast mounted on your unit.) Figure the maximum height for the telescoped mast. In our case the bottom of the mast was to rest on the rear bumper of a VW minibus and the maximum length (height) for the mast itself (to avoid damage to the mounted Yagi) was 6 feet.

The system can be assembled as follows:

(1) Remove the guy collars and discard. Retain the clamp rings with their screw clamps;

(2) Extend the inner section 6 inches above the middle pipe and clamp it. Extend the middle pipe, with the inner section in place, 3 inches above the outer pipe and clamp it;

(3) Measure the total required length from the tip of the inside mast pipe down along the outer pipe. Cut through all three pipes at this point;

Station-to-station

(4) Now unclamp the middle pipe from the outer and pull it out more than 3 inches and reclamp;
(5) At the bottom of the outer pipe, drill a hole all the way through, 2 inches from the cut end and run a 3/8-inch bolt through the pipe and lock it in place with a nut. Be careful not to tighten the nut too far or you will deform the pipe and jam the middle tube.

When the mast is upright and the clamps are released, the middle and inner pipes will rest on the bolt with about 6 inches of handhold available on each pipe.

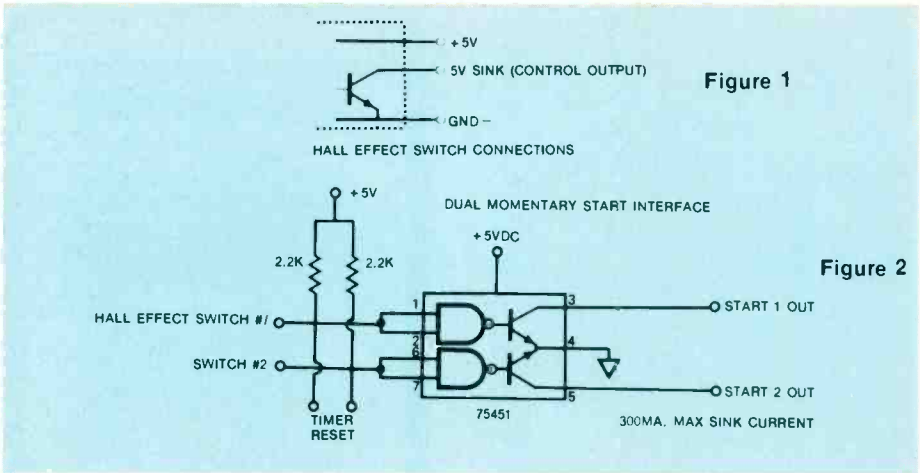
The whole pipe assembly should be clamped on the left rear side of the vehicle where the driver can easily see it. The complete assembly of inner and middle tube can easily be raised from a short ladder, or, if the mast remains tall, from the roof

of the van. Run up the inner pipe first, then the middle one. The 17 feet of antenna height is usually more than enough for any but the most distant broadcasts.

Hall effect switches in remote controls

By Gary Wachter,
technical director,
KTSA/KTFM, San Antonio, TX

High reliability is a major factor in any broadcast facility. This also means a minimum of mechanical interfaces. For instance, mechanical push-buttons can be replaced with solid-state switches for control of cart machines and turntables. Micro



Station-to-station

Switch has recently introduced the AML 11 series switch, which is well suited for this application. This switch contains a hall generator, trigger circuit and amplifier. The TTL-compatible output changes states as a permanent magnet plunger moves adjacent to the hall generator. The switch has a wire spring that creates an audible click for operator verification, but it can be removed for quiet studio use. Bulb life is also significantly increased because the bulb does not travel with the plunger but remains stationary.

The output transistor (Figure 1) in the switch is capable of sinking 8mA at 5V, which is sufficient for driving logic. To pull a larger relay, a 75451 Dual Peripheral AND driver IC was used (Figure 2). The 75451 has a current sink capacity of 300mA, more than enough to start most cart machines.

A turntable interface with separate start/stop buttons is illustrated in Figure 3. The 74LS00 forms a flip-flop that sends a momentary pulse through the 74LS02 NOR gate to sequentially start and stop the turntable. A 4N33 optoisolator iso-

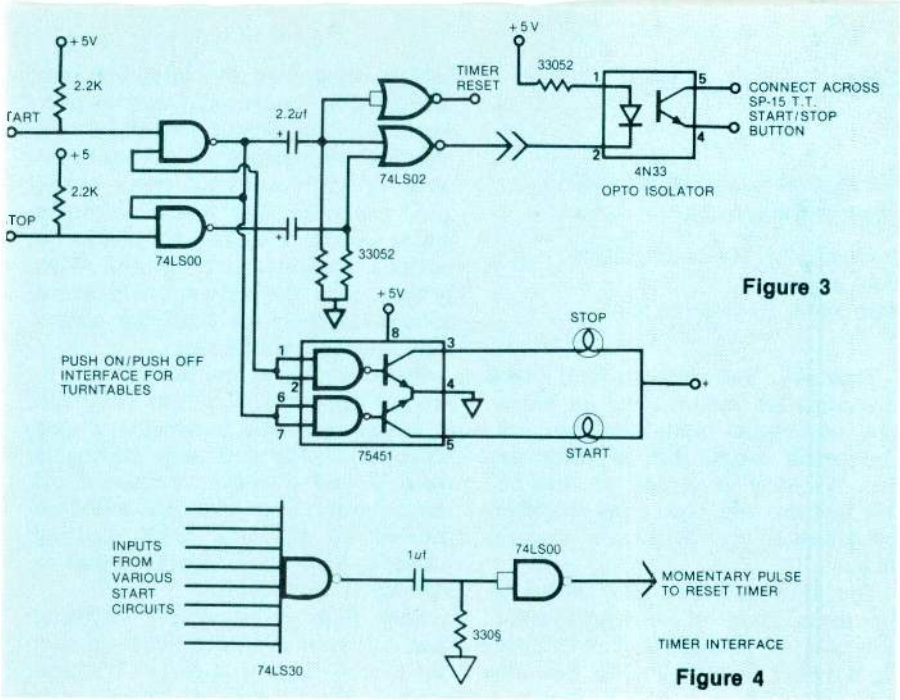


Figure 3

Figure 4

Station-to-station

lates the control circuits from the Technics SP-15 turntable. The 75451 is used to drive the turntable status lamps.

The 8 input NAND gate in Figure 4 combines all of the start pulses from the various interfaces and resets a timer. Any unused inputs on the 74LS30 should be combined and connected to an active input.

In a high noise environment in which glitches are doing the switching for you, place a 0.1 μF capacitor across the input of the affected logic input.

This control interface has been operating flawlessly since December.

Station-to-station

Plexiglass spruces up custom panels

By Frederick M. Baumgartner,
chief engineer,
WBSD-FM, Burlington, WI

Typically, the *one of a kind* piece of equipment has involved an aluminum box, paint and label makers. The result works but is unattractive. We have developed an alternative process for producing durable, inexpensive yet attractive control faces.

The aluminum box still serves as the main body of our equipment. However, a plexiglass sheet covering artwork is attached to the control face.

We begin by sketching the control face layout. Control and indicator layout is critical. Several layouts are often scrapped before one is found that is functional and aesthetic. Similar controls should be organized in vertical and horizontal lines. Clutter results in operator error. Only control knobs and switch levers should extend beyond the surface of the control face.

Next comes the artwork. Rub-on letters work well for lettering, are inexpensive, impressive and readily available. For straight lines, use a rule and etch-resist tape. Even typewriting and marking pens make good graphics. Tag board seems to make the best base and comes in various weights and colors. With proper care the artwork will serve as the template for both the aluminum box and plexiglass.

Step three is to use the artwork to lay out the aluminum box. Although it seems good to leave the paper wrapper on the box until cutting is done, I find it better to take it off immediately and use an indelible marker on the box itself. Cutting holes is the usual matter, and a nibbler is most useful.

Step four is to mount anything that involves a screw head coming out of the control surface. If these screws can be avoided, it will save steps and a piece of plexiglass. When all noncontrol and nonindicator hardware is installed, make a plexiglass or wood piece that includes all the holes for controls and a hole for all the mounting screw heads (Figure 2). This sheet should fit firmly over the aluminum box without any areas bowed upward by hardware.

Plexiglass is brittle, yet it can be worked almost like wood or alumi-

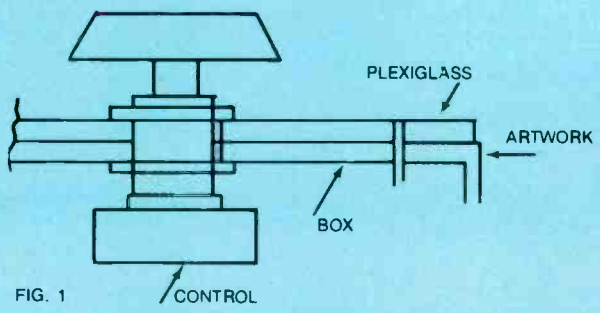


FIG. 1

Station-to-station

num. When drilling a hole, mark the center with a small soldering iron. A drill press is good, but a steady hand will suffice. Use high-speed drills and high drilling speeds. For large holes a spade-type wood bit works well, and always use plywood under the plexiglass when drilling.

Use a clamp or a second person to hold the plexiglass for holes bigger than ½ inch. Sandpaper and small files work best for irregularly shaped holes. Edges can be cleaned with sandpaper (about 200 grit), but be prepared to use a lot because the sandpaper gets clogged with the plastic.

Step five makes the plastic cover ready. Again use the template (artwork) to mark holes for controls, jacks, etc. Mark these with a pencil on the protective paper covering the plexiglass. Do not remove this paper

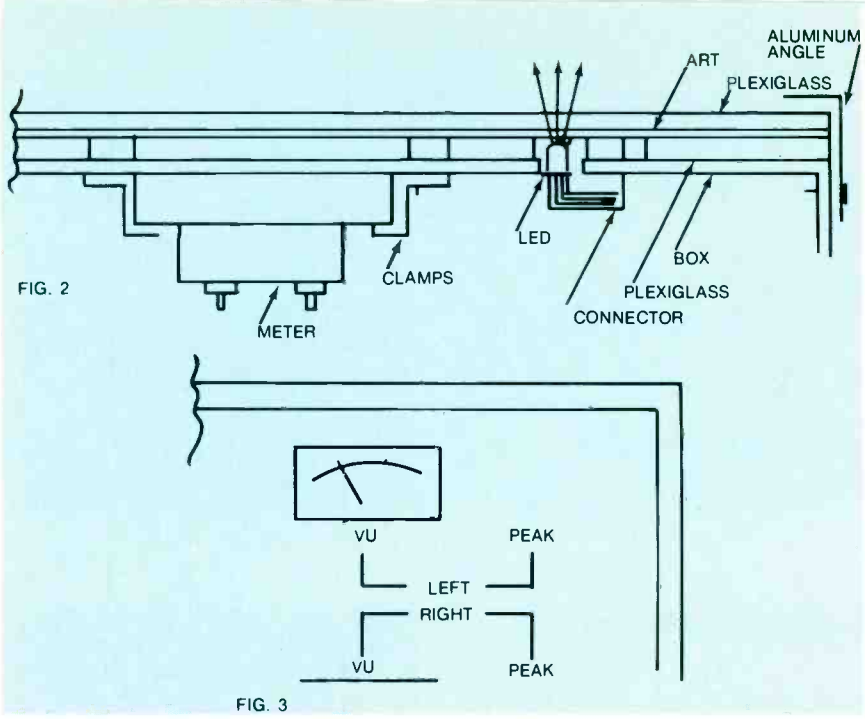


FIG. 2

FIG. 3

Station-to-station

until after the cutting is done.

To finish the project, place plexiglass and artwork on the aluminum box. Mount all the controls through the box and plexiglass sheets. Securing the plexiglass can be done one of two ways. The quickest is to use self-tapping screws every 4 to 6 inches around the perimeter of the plexiglass. Drill a small pilot hole through the plexiglass artwork and aluminum box in those places a mounting screw should go. Redrill each hole only through the plexiglass with a drill large enough for the shank of the screws. An alter-

native is to use an aluminum flashing, varieties of which can be found at most glass stores. This looks better but costs more.

Indicators are mounted under the plexiglass (Figure 4). Lamps can be installed either next to meters or at the edge of the plexiglass to illuminate the control face. Be sure lamps are very small and vented well enough to prevent glass warping. LEDS are mounted either under the aluminum box or in the middle plexiglass layer.

Black strips around openings improve the readability of any indicator. An especially attractive indicator can be made by placing a translucent film over a graphic plate over the lamp; only when the light is on will the indicator be visible.

This process is easy, quick, inexpensive and a lot more professional than the common "box with buttons and lights."

Tektronix 529 vertical output mod

By Kenneth Dixon,
maintenance supervisor
WHA-TV, Verona, WI

My original article (**BE**, p. 74, December 1978, "Transistors solve problems for the S29") has received excellent response. However, some people have had problems with older scopes using a particular transistor. The following suggestions will take care of the problem.

Several cases of excessive heating, and sometimes destruction, of Q-164 and Q-264 have been reported. These instances have been with scopes using 2N2369 transistors for Q-164 and Q-264.

Tektronix started using 2N2219 transistors in place of the 2N2369s in 529 scopes after serial no. 7823. The same change was made in the RM529 scopes after serial no. 10759.

I recommend that the older scopes using the 2N2369s be updated with 2N2219As. Making this change should take care of the heating problem. Even greater power dissipation may be obtained by using 2N3439 transistors to replace Q-164 and Q-264 as well as to replace the 7788 tubes. However, I still prefer use of the 2N2219A.

NRBA

National Radio Broadcasters' Association

1705 De Sales Street, NW
Washington, DC 20036

American radio expo

The NRBA's seventh annual convention, American Radio Expo will be held October 5-8 at the Bonaventure Hotel, Los Angeles, CA. Informative sales, management, promotion, programming and engineering workshops and seminars are planned.

Discrimination case

Three white disc jockeys, who were dismissed by New York's WKTU-FM and replaced by three black announcers, are charging discrimination. The disc jockeys claim their dismissal was linked to the July 1979 Arbitron Survey, which reported WKTU's competition, WBLS-FM taking over the number one position, apparently because of their greater appeal to black audiences.

The case is currently being investigated by the New York City Commission on Human Rights. If it is found that race was the probable cause of the announcers dismissals, the case would be referred to the Equal Employment Opportunity Commission for further consideration.

The *New York Times* reported that a WKTU spokesperson cited pressure from the FCC as a factor, but not the *direct cause* of WKTU's drive to hire minority group members.

Radio equipment list available

The FCC's 1980 Radio Equipment List is available. The list contains the names of equipment considered by the FCC as acceptable for licensing and covers radio broadcast, auxiliary and special broadcast equipment, private operational fixed (microwave) as well as citizens radio, cable television relay and others.

Copies of the list may be purchased from the Downtown Copy Center, 1114 21st Street, NW, Washington, DC 20037, telephone: (202) 452-1422. The cost is $28 including postage, if payment is mailed with order. Otherwise, the price will be $36 plus postage.

Over 40 million radios

Over 40 million radios were manufactured in 1979, according to the Electronic Industries Association (EIA). The radios were absorbed into the American market at a factory value of over one billion dollars for the third consecutive year. Over 68% had FM reception capabilities.

In the last 33 years EIA figures show Americans have bought over one billion radios (not including the hundreds of millions of radio-phonograph, radio-recorder, and radio-TV combos). Production figures are listed below.

Factory Production of Radios in 1979 [Add 000 Units]

Year	Home Radios	Auto Radios	Total
1969	39,414	11,939	51,353
1974	33,230	10,762	43,992
1979	27,648	12,381	40,029

EEO program questioned

Commissioner Ann Jones questioned the FCC's EEO program at a recent Federal Communications Bar Association luncheon, saying that "despite scant evidence and questionable logic, the commission presses forward with its EEO and minority ownership programs." Jones was equally unsure whether the FCC, in addition to the work of the Equal Employment Opportunity Commission, "should devote nine full-time staff positions to work in this area."

Addressing the commission's EEO guidelines, Jones noted that "if failure to meet guidelines demonstrates in itself the inadequacy of efforts to meet them, then the guidelines are, in effect, quotas. And if they are quotas, I believe we should call them by their right name and think hard about whether they are useful and proper."

Supreme court asked to review format decision

NRBA and seven other organizations have filed a joint brief asking the Supreme Court to overturn last July's Court of Appeals decision requiring the FCC to hold hearings before approving station transfers involving format changes if a significant sector of the community can show a format to be unique and financially viable.

NRBA supports the FCC's policy, which has been that format decisions should rest with the individual licensee. "In requiring broadcasters to present a certain type of programming in place of another," NRBA stated, "the commission would be imposing prior restraint on speech."

business news

Earth station at GOP convention

NBC Television has rented Compact Video's new transportable uplink earth station for its coverage of the GOP convention in Detroit. NBC will use the Compact 42 to transmit the entire GOP convention by AT&T satellite to New York for network transmission. The unit can be set up to transmit in less than an hour by a one-man crew, according to the manufacturer.

New electronic editorial system

The American Broadcasting Company is using a new electronic editorial system at the Republican and Democratic national conventions. The system consists of a computer and data communications network that provide a large amount of information for reporters, newscasters and support personnel. Many of the reporters will have immediate access to the system's large computer memory via terminals. A CRT terminal at the broadcast desk will provide instantaneous answers to almost any questions that might arise, including questions on the background of the most obscure delegate. Many reporters will be carrying small, portable typewriter-like terminals that will also give them access to the system and obtain background information on people and events, which will then be passed on to viewers.

New address

NEC Telecommunications Europe Company Limited announced that its offices are now at NEC House, 164/166 Drummond Street, London NW1 3HP England, telephone: 01-388 6100.

Purchase agreement

Rockwell International and Continental Electronics have announced they are entering into an agreement for the sale of Rockwell's Collins broadcast products business to Continental for an undisclosed amount.

The Collins broadcast products business, part of Rockwell's Electronics Operations, is in Richardson, TX. It manufactures and distributes AM and FM radio transmitters, audio consoles and other related radio broadcast equipment.

Golden West and Robert Wold sign satellite agreement

The first use of satellite transmission to serve subscription television outlets was announced by Golden West Subscription Television and Robert Wold Communications. Golden West has signed with Wold for 73 hours weekly of Westar satellite time to begin late this year. Transmission will be from 6 p.m. to 3 a.m. EST on weekdays, and from 1 p.m. to 3 a.m. EST on weekends.

Sony videotape sales consolidated

Sony Industries' Magnetic Tape Division is now the only source for Betamax videotape in the US consumer market. Previously, marketing activity had been split between Sony's consumer and tape divisions. Videotape will be marketed and merchandised in a manner similar to the division's effort with audiotape, using strong national advertising support together with trade and consumer promotions.

Sony distributes for CBS

Sony Industries' Hi Fi Division will distribute CBS Mastersound recordings through its nationwide network of audio dealers, according to Michael P. Schulhof, president. The marketing effort began at the Summer Consumer Electronics Show in Chicago June 15-18.

The Mastersound series makes extensive use of digital and half-speed mastered recordings for its audiophile products covering pop, classical and jazz music. Seven of the eight digital releases introduced were recorded and edited with Sony PCM equipment.

The Mastersound digital recordings are available both on LPs and cassettes; half-speed are mastered on LPs only. Suggested retail price is $14.98.

Audio Plus Video to open West Coast office

Audio Plus Video International has set up a new sales office in Los Angeles to serve the West Coast. Marty Irwin, executive vice president of the company, named Jacob "Jake" Weisbarth executive director of sales for the Los Angeles office.

Sharp names sales representative

Donald Kunz & Associates, Churchville, PA, has been appointed sales representative for Sharp Professional Video Products. The Kunz organization will be responsible for sales of monitors, security products

Business news

and model XC-320 color cameras in Pennsylvania, Delaware, Virginia, West Virginia, Maryland and the District of Columbia. They also will cover southern New Jersey not including Mercer and Middlesex counties.

Headquarters of Kunz is at 47 Willow Road, Churchville, PA 18966.

A.F. Associates builds mobile video studio

A.F. Assoicates has started work for Total Communications Systems of Pittsburgh. The mobile studio, more than 44 feet long, is the largest ever constructed in the Northeast.

Satellite-to-ground communications

The Orrox board of directors voted to proceed with a manufacturing and marketing development program on antenna systems for use in satellite-to-ground communications.

William H. Orr, chairman and chief executive officer, said that the program would be known as Sat Com/Orrox and that the company had prototype satellite-to-ground television signal converters in the 12-14 GHz bandwidth for demonstration of the low-cost technology in North America and other countries, except Japan, France and the United Kingdom.

On April 20, the company announced it had obtained a patent license from NHK Television Laboratories, Tokyo, for the manufacture and sale of products using this technology. NHK is the Japanese government-operated broadcast television organization with diversified activities in the television field. Orr said funding for the project would be internally generated through the rest of this year.

Dr. Bernard Jacobs, scientist and industrialist, will be in charge of the new Orrox venture.

FCC approves Providence radio station transfers

Outlet Company, a national group broadcasting and retailing business, was notified that the FCC had approved ownership transfers of three greater Providence radio stations, allowing the company to exchange its AM station in the market for an FM station.

The transaction, approved by a 4-2 vote, will allow Outlet Company to acquire WRLM-FM, Taunton, MA, for $1.2 million from Audio-

Air. Outlet's WJAR-AM will pass to Franks Broadcasting Company for about the same price. Franks' WHIM-FM, East Providence, will be acquired by Blackside, a minority-controlled company, for about $900,000.

Theater-size television

Electro & Optical Systems, Scarborough, Ontario, announced it has been appointed exclusive Canadian distributor of the Eidophor large screen television projector system, manufactured by Gretag Ltd. of Zurich, Switzerland.

Electro & Optical Systems plans to offer the equipment for sale as well as for short- or long-term rentals.

Goddard to represent Compact Video

The Goddard Company has been retained to represent Compact Video Sales of Burbank for all local, national and international trade and for consumer public relations.

New distributor for CMX/Orrox

F.W.O. Bauch has been appointed distributor for CMX/Orrox editing systems in the United Kingdom and Ireland. Bauch is at 49 Theobald St., Boreham Wood, Hertfordshire, England, telephone: 01-953-0091.

Hawkins/Rood Communications formed

Veteran broadcasters John Hawkins and Steve Rood have rejoined forces as Hawkins/Rood Communications, specializing in consulting, programming, production and management for radio and television. Hawkins and Rood originally worked together as consultants in the 1960s. In the mid '70s both were part of Creative Media Consultants. The new company's services cover operations, programming, sales, promotion, engineering, advertising, automation, management, personnel, recruitment, research, plus buying and selling stations.

Hawkins/Rood operates its own production studios, turning out automation tapes, syndicated shows and oldies libraries for radio, commercials and promos for radio and TV, location production for television, and audio and videotaping of all types.

Exclusive sales agreement ends

Parasound, San Francisco, and Orange County Electronics International, Winnipeg, announced the end of their exclusive sales and

Business news

marketing agreement. Parasound has handled full-service sales and marketing for Orange County products for the past two years on a worldwide basis.

Parasound plans to extend its efforts to develop new product opportunities that have become available, particularly the representation of the new Fostex line of monitor loudspeakers, amplifiers, microphones and headphones, along with their continued representation of the Synton Electronics Vocoders and the Audicon "Plate."

Orange County is bringing its marketing functions in-house along with the introduction of their new Nova Systems semiprofessional equipment.

Lemo moves

Lemo USA announced that it has completed its move to new 11,000-square-foot headquarters in the Santa Rosa Business Park, Santa Rosa, CA.

Controller sales surpass expectations

Control Video Corporation reports that its new "Intelligent Controller" has surpassed sales expectations, according to Larry Seehorn, company president. CVC's SMPTE reader and writer share the same Intelligent Controller chassis, creating a unit with two readers and two writers. The first Intelligent Controllers are being shipped to station WFAA, Dallas.

Satellite uplink station

The Bonneville Satellite Corporation has announced its decision to construct and operate the first com-

mercial satellite uplink station in Salt Lake City.

The satellite uplink is scheduled to begin transmitting television programming in October, subject to FCC approval, via Bonneville Satellite Corporation's Westar satellite channel, which the company has been leasing full-time since February 15, 1980, from Western Union.

Vital opens Hollywood office/showroom

Christopher S. Donoyan, president of Vital Industries, announced the opening of a showroom, sales and service office on the corner of Hollywood and Vine, Hollywood, CA.

The new office will include a VIX-114-2A production switcher, a PSAS-1 production switcher automation system, two SqueeZoom four-channel video manipulation units and one two-channel SqueeZoom.

Also operational is a VIX-114-10A production switcher, a 10-input single mix/effects system remote and post-production switcher.

Christie Electric moves

Christie Electric has announced its move to a two-story 100,000-square-foot building at 20665 Manhattan Place, Torrance, CA 90501. The new building combines manufacturing, engineering, marketing, warehousing and administrative functions.

Molinare installs Dolby sound

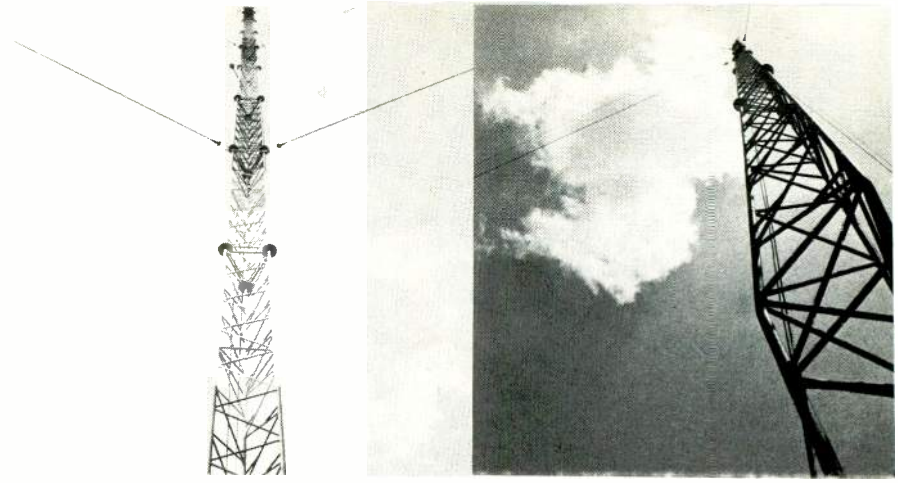
Molinare has installed Dolby Stereo optical sound on its Rank Cintel Mark III telecine. The installation is the first of its kind.

The output of the telecine is normally recorded on the 1-inch C format tape using Dolby A noise reduction on the magnetic tracks. If further post-production work is required, the sound can be relaid on the two tracks of a Studer 16 track tape recorder. Time code is recorded on track 16 and on track 3 of the VTR for synchronization.

Digital multi-track system

Sound Ideas Studios has become the first New York studio to receive a 3M Digital Mastering System, consisting of 4-track and 32-track recorders. Sound Ideas' digital system can be used in either newly rebuilt Studio A or in Studio C, which can handle up to 40 musicians. "Digital

Continued on page 240



Kevlar aramid tower guys

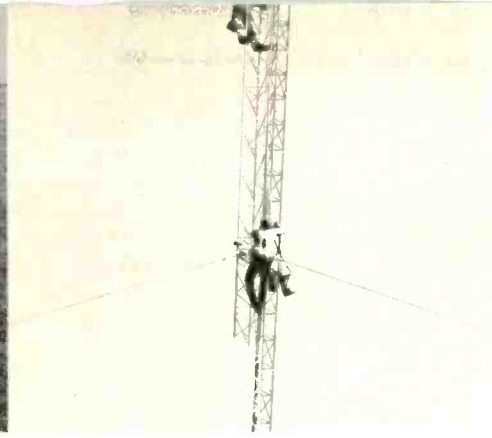
Broadcasters in many parts of the world are troubled by lightning storms that cause white-noise arcing across porcelain insulators. Severe storms frequently create zapping, snapping and crackling. The results of that electro-magnetic interference are complaints about TV reception near broadcast towers.

Another serious problem is steel guys burning at their insulators. This initiates and aggravates metal corrosion. Corrosion, even when it's hidden, weakens steel guys. It can be solved only by expensive re-guying.

Central Florida is especially prone to white-noise arcing and EMI because that portion of the Sun Belt experiences the largest incidence of lightning in the United States.

When a badly corroded, tubular steel tower had to be replaced after 21 years of service, WORL, Orlando, decided to take positive steps to eliminate white noise, EMI and the

Rigger inspects tower in preparation to installing Kevlar aramid fiber guy stabilizers.



Jin pole (foreground) permits rigging crew to use tower structure itself to raise subsequent tower sections.

burning (and hidden corrosion) of steel guys at their porcelain insulators.

WORL has a daytime license and an authorized frequency of 1270kHz; it serves a primarily black audience in Orlando and surrounding portions of central Florida. This station's basic format is music plus news. The 5000W station is owned by Woody Sudbrink of Sudbrink Broadcasting, Fort Lauderdale, FL. Sudbrink Broadcasting also operates WORJ-FM in central Florida, WNWS, a 24-hour all-news AM station in Miami, and AM and FM stations in Honolulu.

No more zapping, snapping, crackling

WORL's new 196-foot tower, erected recently by World Tower of Maysville, KY, employs solid steel-rod, 18-inch-face construction with three levels of flexible, nonmetallic, nonconducting dielectric guys.

Top two tower sections are ready to be raised, with three tower-guy assemblies in place.

Tower guys

"Never again will this AM station be bothered by zapping, snapping and crackling across porcelain insulators," Don Charles, WORL's chief engineer, said, "because the flexible Phillystran HPTG guys don't require any insulators."

The flexible dielectric tower guys were supplied by Philadelphia Resins Montgomeryville, PA; factory-installed terminations simplified on-site rigging and assured 100% socket efficiency. These lightweight, corrosion-resistant guys have strength properties similar to steel rope of equivalent diameter. But unlike conventional metal guys, the flexible nonmetallic Phillystran guys, made of *Kevlar Z9* aramid fibers, are not affected by severely corrosive environments, including salt-laden atmospheres or air-borne effluents from refineries, chemical plants, utilities and auto exhausts.

More than 400 radio and TV towers have Phillystran guys, a unique synthetic rope. But WORL's new tower is the first installation to employ a nonmetallic, dielectric guying system with improved stress-elongation properties for tension-once and walk-away tower installations.

Easy to install

"Our riggers have used Phillystran to guy other towers," said Nate Scholar, president of World Tower. "They raved about the convenience of these lightweight, flexible guys. But, quite frankly we weren't sold 100% because of the need to re-tension the nonmetallic, dielectric guys."

The WORL tower installation is the first to be guyed with high-performance, dielectric guys that incorporate improved stress-elongation properties. This installation, according to Scholar, went very well. His riggers said the Phillystran HPTG is easy to handle. It takes only one hand to take each lightweight, flexible guy to its anchor point.

Elongation under load for the high-performance Phillystran guys is comparable to EHS steel—less than 0.3%.

WORL's new 196-foot tower, with flexible guy assemblies cut-to-length and with factory-installed terminations and 20 feet of steel lead line at each anchor point, was erected in less than seven hours. This is

approximately one-third to one-half the time it would have taken if steel guys with conventional insulators had been used.

WORL's Don Charles cited several significant advantages in addition to the elimination of white-noise arcing, EMI and complaints about TV reception near the broadcast site. The advantages are: no more problems with corroded metal guys, no painting or other expensive tower-guy maintenance and the elimination of frequent, costly re-guying operations.

On an installed-cost basis, the flexible, dielectric guying system compared favorably with steel guys.

WFYR, the Okeechobee, FL, shortwave outlet for Family Stations Inc., also is using Phillystran tower guys of *Kevlar* 29 aramid fibers. The station's field covers about one square mile and 44 towers.

WFYR beams religious messages in eight languages to the Soviet bloc countries, parts of the Middle East and to countries in Europe and South and Central America.

WYFR experimented with Phillystran in late 1974 when it had problems at its former broadcast location on Hatherly Beach, Scituate, MA.

Although applicable under certain conditions, the aramid fiber guys are not a universal answer to tower support. Disadvantages are higher material costs and potential hazards from fire and abrasion. Care in installation may minimize the disadvantages, and the advantages may outweigh the higher material costs, especially under conditions such as those encountered by these operations. □

Business news

Continued from page 235

will recreate especially well in the live, high ambience of Studio C," according to Bob Schaffner, studio manager.

Stations automate

WAML-AM and WEEZ-FM, Laurel, MS, are operating with two Harris program automation systems. WEEZ went on-air in May using a Harris 9003, the most advanced model in Harris' 9000 program automation control series. The second Harris 9003 is being installed at WAML. Both systems will be housed in the same studio room.

SALES CONTRACTS

Ampex

Ampex has received an order for three Ampex BCC-20 portable Digicam cameras, worth more than $250,000, from Tri-Comm Productions.

Datatron

Datatron's video systems division has delivered two of its Vanguard videotape editing systems equipped with a new Slo-mo editing option and MCI/Quantel digital effects generator interfaces to Video Tape Associates, Atlanta, GA. The Vanguard systems have been installed in VTA's new editing suites at their post-production facilities in Atlanta and South Florida. Each suite also includes 10 VPR-2B 1-inch VTRs and MCI/Quantel's DPE-5000, all under control of the Vanguard editor.

Harris

WDVM-TV, Washington, DC, has placed an order for two television transmitters with the Broadcast Products Division of Harris. Both Harris TV-50h, 50kW TV transmitters will replace equipment now at the station.

Continued on page 243

new literature

NTIA study

National Telecommunications and Information Administration—The potential for frequency sharing between the broadcasting-satellite service and the terrestrial fixed service in the 12.2-127GHz band is discussed. The 48-page report, available for $6, is entitled "Sharing of the Band 12.2-12.7GHz Between the Broadcasting-Satellite and Fixed Services."

Circle (270) on Reply Card

Audio Products Catalog

Mura—A 12-page illustrated audio products catalog is divided into separate sections covering stereo headsets, VTR accessories, microphones and audio accessories.

Circle (271) on Reply Card

Technical data sheets

Wireworks—Newly revised and updated technical data sheets detail an extensive range of cabling products and accessories. Individual data sheets profile the Wireworks Microphone Multicable Components Group, Hardwired Microphone Multicables, Professional Microphone Cables and TE-2 Mic Cable Tester.

Circle (272) on Reply Card

Video recorder brochure

Marconi Electronics—A full color brochure describes

New literature

1-inch helical video recording equipment. Featured in this 8-page brochure is the MR-2 1-inch C format recorder designed for the SMPTE and EBU Type C formats, the MTBC2 time-base corrector and the VTR monitoring unit.

Circle (273) on Reply Card

EDG brochure

Varian Associates' Electron Device Group—A brochure listing 60 types of EDG products, cross-referenced by specific markets and applications, is available. EDG products serve the communications (broadcast and satellite) and other electronic fields.

Circle (274) on Reply Card

Applications data

Schaffner—A short-form engineering handbook includes information on power line filters, RFI suppression, RI saturable, earth line, double, multiple and rod cored chokes, pulse transformers, low profile transformer and heat sinks.

Circle (275) on Reply Card

Directory

1980 Satellite Directory—This desktop directory contains information about carriers, the Federal Government and service sources.

Circle (276) on Reply Card

Business news

Continued from page 240

Logica

The Austrian broadcasting authority, Osterreichischer Rundfunk, has ordered from Logica in London a full-scale Logica TX3 teletex computer system for teletex transmission on both its networks.

Marconi

Southern Television has ordered 11 cameras from Marconi Communication Systems. The cameras, including nine studio camera channels, one portable camera channel and one portable head, will be used for Southern's studio re-equipment and updating program.

Television International Operations has acquired three Marconi MR2 videotape recorders.

Pye

Thames Television has ordered three more CD-480 vision mixing units from Pye.

RCA

WPDE-TV, a new commercial television station in Florence, SC, will go on the air this fall with RCA TV studio and transmitting systems valued at approximately $1.5 million.

In a major expansion of its program production capabilities, KSL-TV of Salt Lake City, UT, is adding eight RCA TK-47 automatic studio/field color cameras.

Scientific-Atlanta

Scientific-Atlanta has announced it has received an order from television station WVIT, the NBC affiliate in Hartford/New Britain for a 7-meter-diameter satellite earth station. WVIT, owned by Viacom Broadcasting, will have the capability to receive the increasing amount of satellite programming available to independent and network affiliated television stations.

Scientific-Atlanta signed an agreement to supply digital satellite earth stations to American Satellite Corporation through 1982. The agreement estimates that orders will total $7.5 million to $15 million. Firm orders for approximately $3.3 million of Scientific-Atlanta digital earth station equipment have already been placed by American Satellite.

Thomson-CSF

Thomson-CSF, as prime contractor, together with TELSPACE (a joint venture established between Thomson-CSF and Cit-Alcatel), were recently awarded a contract by O.P.T. (Nigerian P and T authority) for the manufacture and installation of a major satellite telecommunications network. The contract was signed in Paris by Lieutenant Colonel Sory Mamadou Diallo, Niger's P and T Minister.

3M

Record Plant, Los Angeles, has purchased a second 3M digital mastering system, consisting of four-track and 32-track recorders equipped with cross-fade editing capability. Installation is scheduled for August.

Westlake Audio, Los Angeles, has purchased and received a second 3M digital multitrack system, consisting of four-track and 32-track recorders, only nine months after receiving its first system.

KBMA-TV 41: Groundbreaking ceremonies mark new era

On May 21, 1980, the press and the entire staff of KBMA-TV41 gathered in Kansas City to celebrate groundbreaking for the station's new facilities. The event culminated nearly 10 years of intensive planning.

KBMA, of Scripps Howard Broadcasting Company, signed on the air on September 28, 1970. The intervening 10 years of service to a demanding Kansas City audience have been marked with a host of historical milestones in broadcasting for KBMA: growth from a staff of 22 to 60, expansion of facilities from a modest operation to space in four locations plus remote production vans, growth from 10 hours of daily broadcasting to 24, one of the first stations to use satellite up-and-down links.

General manager Bob Wormington and chief engineer Harold DeGood led the way in the groundbreaking ceremonies.

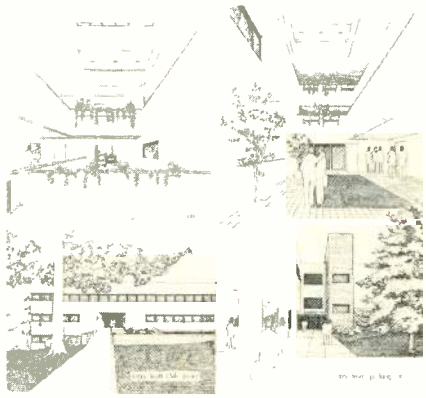
Of the original 22 employees that helped open KBMA in 1970, nine are presently with the organization and were on hand for the ceremonies. Wormington praised Mary Lou Anderson, producer of the first KBMA program aired, a children's program titled *41 Tree House Lane*, for her continued involvement in creative program productions.

In keeping with KBMA's tradition of community service, June 11, 1980, marked a new milestone: the airing of nightly independent news to compete with the networks.

Construction is already under way for the new KBMA facilities, located just east of the Country Club Plaza with ready access to traffic-ways for covering new events.

The firm of Dalton, van Dijk, Johnson & Partners, Cleveland, OH, provided the architectural designs for the building.

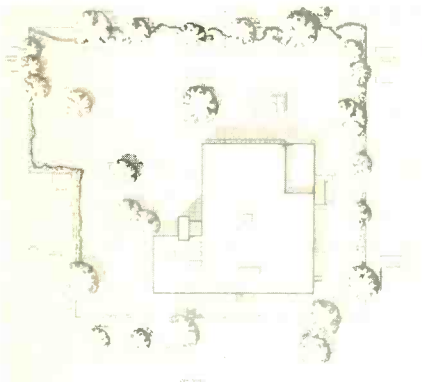
Current schedules call for completion of the facility by the summer of 1981.



KBMA-TV41 site plan, top view. *Courtesy, Dalton, van Dijk, Johnson & Partners.*

As KBMA-TV41 in Kansas City broke ground for its new building, the staff climbed aboard the Caterpillar for a group picture.

KBMA-TV41 breaks ground for its new facilities. Bob Wormington (left), general manager, and Harold DeGood, chief engineer, join forces to dig the first shovels of dirt at the groundbreaking ceremonies.



KBMA-TV41 entrance views from the East and from the West. The atrium provides an attractive entrance area from either direction. *Courtesy, Dalton, van Dijk, Johnson & Partners.*

Operational Highlights for KBMA

- Signed on September 28, 1970, with initial broadcast time from 2:30pm to 12:30am.
- September, 1971: moved sign-on time up to 11:30am.
- September, 1973: increased broadcast period to 7:00am to 1:00am.
- April, 1975: went to 7:00am-3:00am broadcast schedule.
- September 20, 1976: began 24 hr/day broadcasting. (Sign-off on Sunday at 12:30am for equipment maintenance.)
- September 24, 1976: began using satellite receiver dish.
- June 11, 1980: began airing nightly independent news program.

One of the highlights during this period was the coverage of the KC Royals baseball games. From 1972 through 1979 KBMA broadcast these games with their own remote units and staff. KBMA still does pickup out of the Royals stadium for other cities as well as many out-of-town games. □

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2 CY8800 CAMERAS w/10-1 Fujinon elec zooms, AC adaptors, 2 genlocks, cases, all accessories, 1 year old, perf cond., warranty serviced by Hoffman Video, $46,400 list price, $28,000 obo. 2 4400 LU videorecorders, rarely used, clean, perf. cond. w/AC adaptors, each $2800 obo. 1 NTSC and 1 PAL 350 Videoguard units, cost $2150 each, sacrifice $975 each. 213-838-2037. 9-80-1t

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SOUTHEAST TELEVISION STATION has an opening for Studio Supervisor. FCC First Class License required. Studio equipped with RCA tape, Philips and RCA camera, Grass Valley switcher, ¾" Sony, etd. Send inquiries to Dept. 504, Broadcast Engineering, P.O. Box 12904, Overland Park, Kansas 66212. We are an Equal Opportunity/Affirmative Action employer. 6-80-4t

VIDEO ENGINEER-OPERATOR: Job emphasis on maintenance of professional video studio equipment. Some operations involved. Experience required. Resume to Byron Motion Pictures, Inc., 65 K St., N.E., Washington, DC 20002, Attn: Video Mgr. EEO. 8-80-2t

MAINTENANCE WIZARD WANTED: You've been reading want ads over and over and now—here's what you've been looking for! Maintenance Engineers imagine this: a sleek modern videotape production facility that produces national spots for major agencies as well as non-broadcast projects for large corporations. Staffed with young, energetic, dedicated personnel. If you qualify in the maintenance of RCA and Norelco cameras, Ampex 2" and 1" type C videotape, CVS EPIC computer tape editing, Vital production switchers, Vital Squeezoom, and would like to work in the Chicago market, call or write: John Gebhard - Chief Engineer, Telemation Productions, 3204 W. West Lake Avenue, Glenview, Illinois 60025, (312) 729-5215. 8-80-2t

IMMEDIATE OPENINGS. First class VHF Network affiliate operation needs engineer, TV maintenance (studio), radio maintenance (transmitter and studio). Must have 3 years previous experience and 1st phone license. Equal opportunity employer. Contact: Henry B. Ruh, Director of Engineering, WTHI AM-FM-TV, 918 Ohio Street, Terre Haute, Indiana 47808, (812) 232-9481. 8-80-2t

TV MAINTENANCE ENGINEER for TV Production Company. Need to be experienced and able to maintain AVR-2, VR-2000 VTRs, Norelco and RCA Cameras, and Grass Valley Switchers. Contact: Jimmie Fortner, MCI Productions, 2500 Farrington, Dallas, TX 75207, (214) 630-1262. 8-80-2t

TELEVISION HELP WANTED—TECHNICAL: $40,000+ FIRST YEAR GUARANTEED. Our company has grown so quickly in the past 5 years, we are in desperate need of a very special person who knows broadcast equipment intimately and has aggressive sales ability. We are diversifying into other areas and need someone to take over the equipment sales division. Responsibilities include sales of new and used broadcast equipment and further development of equipment sales division as business demands. We are a first rate company and believe in paying top dollar for the right person. Call Bill Kitchen, Quality Media Corp., (800) 241-7878. 9-80-TFN

ARE YOU READY to be the Chief Engineer of a leading directional AM in one of the largest cities on the East Coast? Must have major market experience, hands-on know-how and the ability to manage people and schedules as well as equipment. Send Replies to Dept. 515, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 9-80-1t

TV MAINTENANCE TECH. ENGINEER—Exp. with IVC 9000's, Ampes, Quads. Analogue electronic animation equipment valuable. Career oppty. for someone with broad exp. in maintenance planning and supervision. Salary commensurate with exp. Write in confidence to: President: Dolphin Productions, Inc., 140 East 80th St., New York, N.Y. 10021. 9-80-1t

HELP WANTED (CONT.)

TELEVISION MAINTENANCE ENGINEER

Seeking self-starter and independent worker with minimum of two years Broadcast Maintenance experience to include familiarity with RCA videotape equipment, cameras, and digital logic; salary DOE; submit resume.

Linda Imoden
KLAS-TV
P.O. Box 15047
Las Vegas, NV 89114
Equal Opportunity Employer/Male/Female

TRANSMITTER DESIGN ENGINEER. Degree optional. Skill a must! FCC 1st phone ticket and some prior experience as CE in an AM station required. Design 100% solid state AM broadcast transmitters to 1,000 watts output. Will be best made! resumes to: M. Gottesman, 863-25th Avenue, San Francisco, CA 94121. (415) 751-1974 any evening (PDST). 9-80-1t

WANTED: Chief Engineer with complete knowledge of FCC Rules and Regulations, strong in administrative capabilities for a major market AM/FM radio station in the midwest. We are an equal opportunity employer. Please send all replies to Dept. 514, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 9-80-1t

ENGINEERS, TV Systems Engineers, Electronic Technicians, Technical Supervisors, Maintenance. Immediate openings. Experienced. Full time, Full benefits, plus Pension. Excellent Salary plus commissions. Send resume to Technical Operations, Inc., P.O. Box 840, New Hyde Park, N.Y. 11040, or call Personnel Mgr. (516) 352-2238. 9-80-tfn

HELP WANTED (CONT.)

CHIEF ENGINEER needed to do supervision and installation of New Public TV Studio and 60 KW Transmitter. Salary low 20's, first class phone required. Reply to: Kenneth Gardner, KSMH-TV/Ch. 14, 1011 Fort Street, Hays, Kansas, 67601. 9-80-1t

TRANSMITTER ENGINEER: Minimum two years experience. First Class License required. Prefer high power FM or TV experience. Send resume to Personnel Director, Broadcasting, WSM, Inc., P.O. Box 100, Nashville, TN 37202. An Equal Opportunity Employer. 9-80-2t

TV ENGINEERING SUPERVISOR—Major market CBS affiliate, WNAC-TV Boston, has an immediate opening for the person who can supervise technicians in the installation, maintenance, and operation of television equipment in compliance with company engineering standards and FCC rules and regulations. At least 5 years of TV broadcast experience, ENG, digital background, and FCC First Class License are essential. Previous supervisory experience preferred. For prompt consideration, send resume and salary requirements to Diane Puglisi, Division Personnel Manager, RKO General, Inc., RKO General Building, Government Center, Boston, MA 02114. An Equal Opportunity Employer, M/F/H/Vets. 9-80-1t

CHIEF ENGINEER: I.T.F.S. 4-channel system serving Catholic education in N.Y. area. **DUTIES:** Maintain and supervise transmission, production and field service operation. **REQUIRES:** 1st F.C.C., experience with production and transmission and supervisory ability. **SALARY:** Negotiable (good growth experience). Reply to Dept. 512, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 9-80-1t

CHIEF ENGINEER: Vacation climate all year long. Management oriented chief needed to run well equipped engineering department with all the latest equipment. Some design work. We appreciate our engineers. Contact General Manager, KIII-TV, Corpus Christi, Texas, (512) 854-4733. 9-80-2t

FIELD ENGINEER

Leading internationally known electronics firm seeks two Field Engineers with heavy experience in servicing broadcast and CCTV color cameras.

Duties include periodic technical traning of customers, engineering back-up for salesman on product demonstrations, resolving technical problems pertaining to camera installations in the customers facility and answering telephone inquiries from dealers and product users.

You will be based in the Metropolitan New York or Los Angeles area, Travel-40%, Office-60% of the time. Position reports to Marketing Manager.

Please send resume and salary requirements to Dept. 513 Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212.

HELP WANTED (CONT.)

DESIGN ENGINEER: Public Broadcasting Service presently has an excellent opportunity in our engineering department for a Design Engineer. Requires BSEE or equivalent and a minimum of 2 years experience in design of audio/video and control systems. Knowledge of computer hardware and software preferred. Duties will include procurement and design of unique equipment including preparation of engineering specifications and oversight responsibilities for installation and checkout. We offer competitive starting salary with excellent non-contributory benefits package. Interested individuals should submit letter of interest with salary requirement, resume and the names of three references to: PBS Public Broadcasting Service, Attn: Carole Dickert-Scherr, 475 L'Enfant Plaza West, S.W., Washington, D.C. 20024. EEO/AA EMPLOYER. 9-80-1t

HELP WANTED (CONT.)

POSITION AVAILABLE—POSITION TITLE: **TELEVISION MAINTENANCE ENGINEER.** REQUIREMENTS: First Class FCC license plus experience maintaining professional broadcast equipment, particularly RCA and Sony. The location is Prime Sunbelt, the staff progressive, the station public. Salary commensurate with experience. EQUAL OPPORTUNITY EMPLOYER. Send resume to: Director of Finance, WYES-TV, 916 Navarre Avenue, New Orleans, Louisiana 70124. 9-80-2t

IMMEDIATE OPENINGS FOR TECH SUPERVISOR: Mobile Production Company seeking supervisor for mobile truck. Maintenance required for quad tape, one inch tape, Grass Valley, Norelco PC-70 cameras. Contact: John Crowe, MCI Productions, #10 Greenway Plaza, Houston, Texas 77046, 713/627-9270. 9-80-2t

HELP WANTED: Technicians wanted for maintenance and operation of major television facility. Formal training in electronics and First Phone. Previous TV experience desirable. Send resume and salary requirements to: Jack Verner, 1018 West Peachtree St., Atlanta, GA 30309. An Equal Opportunity Employer. 9-80-1t

LOOKING FOR GOOD ASSISTANT chief engineer, familiar with RCA transmitter—TR 600, TK 630 Sony, Phillips engineer. Contact: Jim Robinson/WECA-TV, 904-893-3127. 6-80-tfn

STUDIO MAINTENANCE ENGINEER: Immediate opening, must have 1st Phone, experience with TCR-100, reel-to-reel quad tape, studio cameras, and associated equipment. Minimum of 2 years broadcast studio equipment maintenance experience. Excellent salary, benefits, and growth potential for qualified person. Young progressive staff. Send resume to: Tom Mikkelsen C.E., WQAD-TV, 3003 Park 16th St., Moline, IL 61265. AA/EOE employer. 7-80-3t

IMMEDIATE OPENING for TV studio maintenance engineer with two years of technical training, including digital and two years experience. First Class FCC license required. Resume to: Gene Rader, Director of Engineering, KBIM-TV, P.O. Box 910, Roswell, NM 88201. An equal opportunity employer. 7-80-3t

CHIEF ENGINEER— For University telecommunications center. To manage technical operations of TV, FM and CCTV facility, including a major facilities upgrade project. Requires BS in related field, FCC first, two to five years' experience in engineering management, and demonstrated leadership ability. Salary to $25,000 depending on qualifications and experience. Send application to Broadcast Engineering, Dept. 507, P.O. Box 12901, Overland Park, KS 66212. An Affirmative Action/Equal Opportunity Employer. 7-80-3t

WANTED

WANTED: Pre-1926 radio equipment and tubes. August J. Link, Surcom Associates, 305 Wisconsin Ave., Oceanside, Ca. 92054, (714) 722-6162. 3-76-tf

HIGHEST PRICES PAID for 112 Phase Monitors and for clean, 12 year old or less, 1 KW and 10 KW AM Transmitters. All duty and transportation pald. Surplus Equipment Sales, 2 Thorncliffe Park Dr., Unit 28, Toronto, Ontario, Canada, M4H 1H2. 416-421-5631. 2-79-tfn

INSTANT CASH FOR TV EQUIPMENT: Urgently need transmitters, antennas, towers, cameras, vtrs, color studio equipment. Call toll free 800-241-7878. Bill Kitchen, Quality Media Corporation (In Georgia call 404-324-1271). 6-79-tfn

WANTED: Panasonic NV-3160, working or not, reasonable. A. Kuschner, 3340 Turtlemound, Melbourne, FL 32935, 305/254-1824. 9-80-1t

WANTED: Radio Transcriptions 16" E.T.'s, any Eddy Arnold, or other Country 16" or 12" Transcriptions. Will consider others. Interested in Radio Station Libraries to purchase, all speeds of records. Boyd Robeson, 2425 W. Maple, Wichita, Kansas 67213. (316) 942-3673, 722-7765 Eve. 9-80-tfn

****URGENTLY NEEDED****12AP4 (1803-P4) picture tubes and parts for R.C.A. TRK-12 antique television. Arnold Chase (203) 521-5280. 9-80-5t