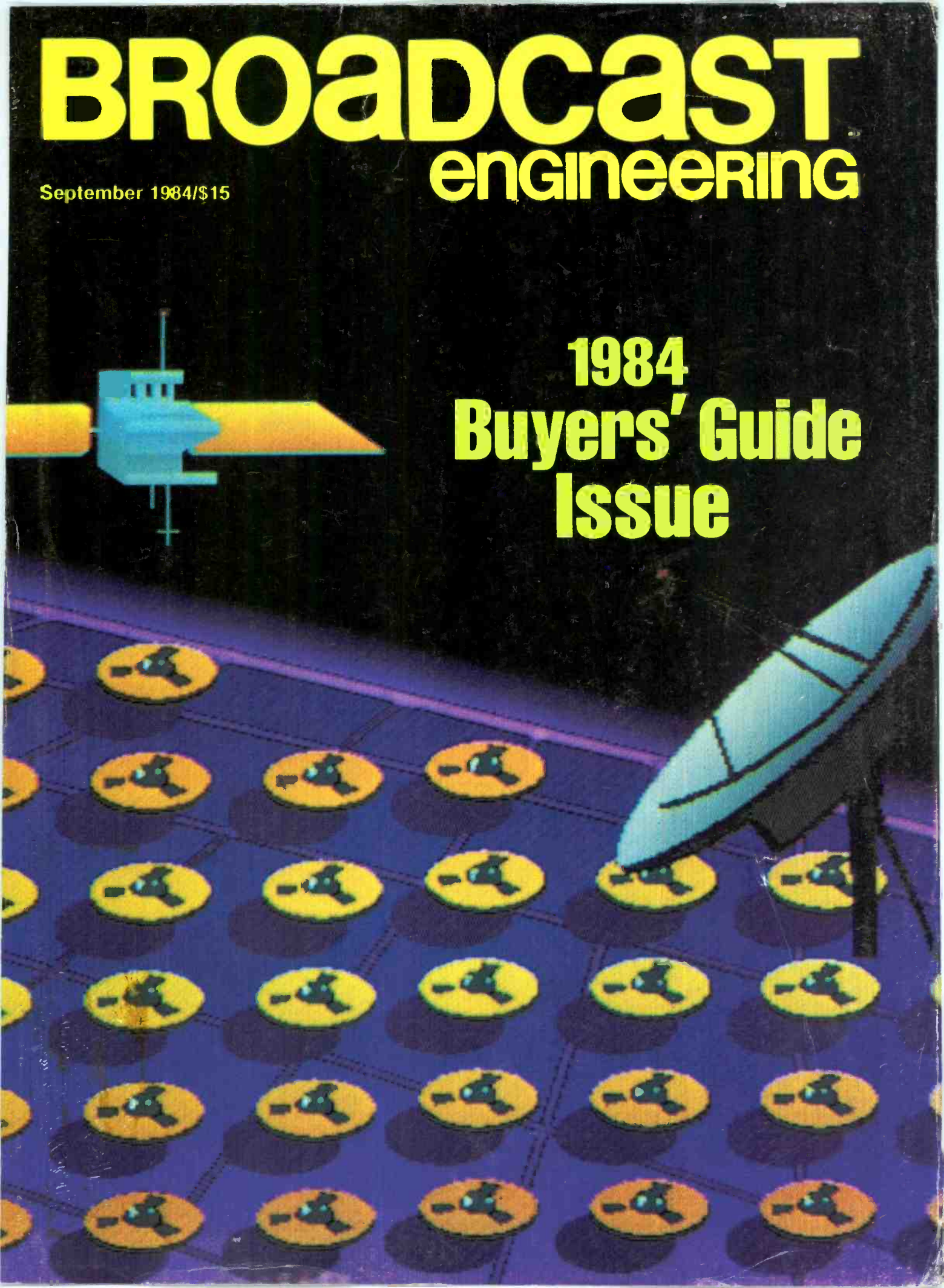
BROADCAST engineering

September 1984/$15



1984 Buyers' Guide Issue

Worth Its Wait In Gold.

For Harrison Reliability

Sure, Harrison has waited to enter the U.S. broadcast market. When you're a stickler for precise engineering and a perfectionist when it comes to quality performance – you've got to take your time to get it right. *Get it just right for you.*

No Compromises

It can be tough getting the right console to match your specifications. About as easy as fitting a square peg in a round hole, right? Harrison Systems has anticipated your need for versatility. A good deal of time and research goes into our consoles in order to bring you the smartest, most efficient technology and service. We've got the system that fits the size and scope of your needs, whether it be:

- Teleproduction
- Video Sweetening and Post-Production
- Video Edit Suite
- Film Sound Post-Production
- On-Air Broadcasting
- Broadcast Production
- Live Sound Reinforcement
- Music Recording and Scoring

At Harrison Systems, we give you choices – not excuses or unnecessary fluff. Our systems are designed to bring you long-lasting, clean performance and reliability.

Harrison Puts You In Good Company

Organizations like Swiss Broadcasting and Belgian Radio and Television have believed in the superior quality of Harrison Stereo Broadcast Audio Consoles for years and have chosen Harrison for multiple broadcast installations. Swedish Television has selected 8 TV-3 consoles and has committed to several more. This year's Winter Olympics in Yugoslavia received the main audio feed from a TV-3.

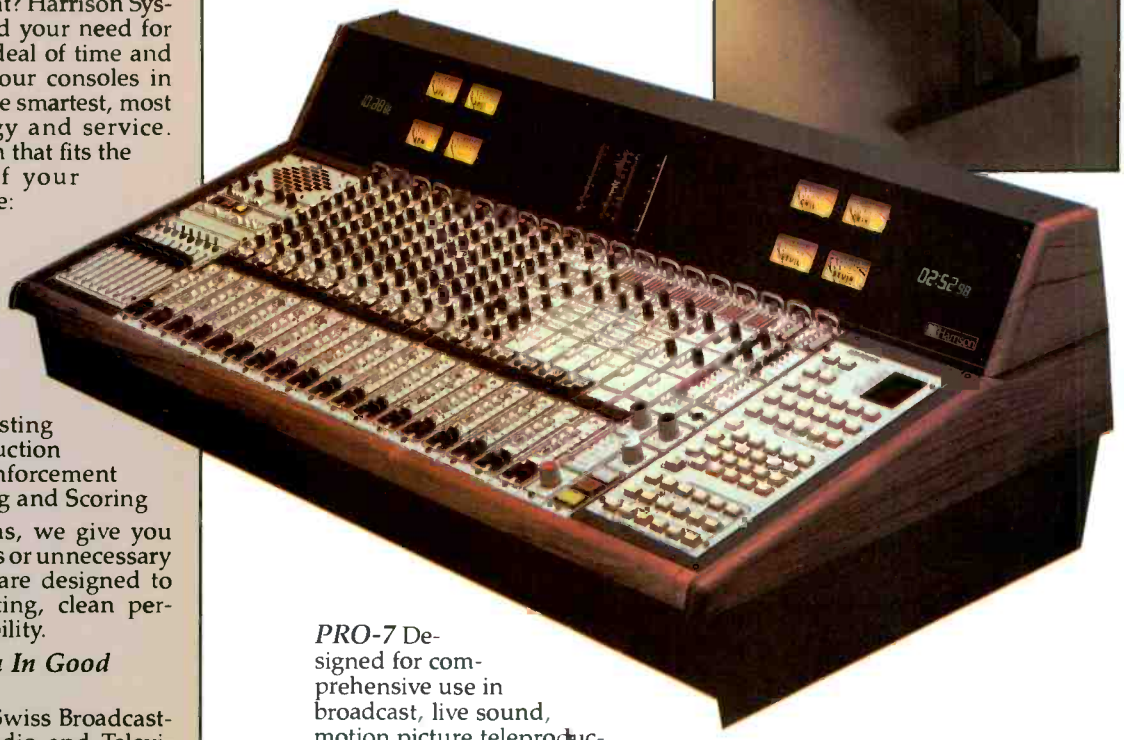
At Last

At Harrison, we take the time to listen to your needs. We design our consoles with the flexibility to fit your operation. And although our standards may be high for our consoles – our prices are very, very reasonable. We think you'll find it's been worth the wait – in golden, Harrison-true performance. Call us for a demonstration and see for yourself.

For Harrison Innovation

Introducing Harrison's TV-3, PRO-7 and TV-4, the broadcast consoles you've been waiting for:

TV-3 For large scale TV audio, remote production, studio production, post-production and sweetening ■ Adapts to wide range of tasks ■ Available in a variety of configurations for customization ■ Plus many options.



PRO-7 Designed for comprehensive use in broadcast, live sound, motion picture teleproduction ■ Two major configurations ■ Simple to operate ■ Cost-effective ■ Independent mix decision capability ■ Long-term performance achieved through thick-film laser-trimmed resistor networks ■ Plus many options.

TV-4 For medium scale on-air production, remote production, studio production, sweetening and post-production ■ Three major, simplified configurations ■ Easy to install ■ High-speed, low noise, low distortion amplifiers allow for best possible electronic performance ■ Plus many options.

Harrison's new VSI Fader Section, which allows for simultaneous interface with automation and video editor/switcher, is available for TV-4 and PRO-7 consoles.

Why wait any longer? Call or write Harrison Systems, Inc., P.O. Box 22964, Nashville, TN 37202; (615) 834-1184, Telex 555133.

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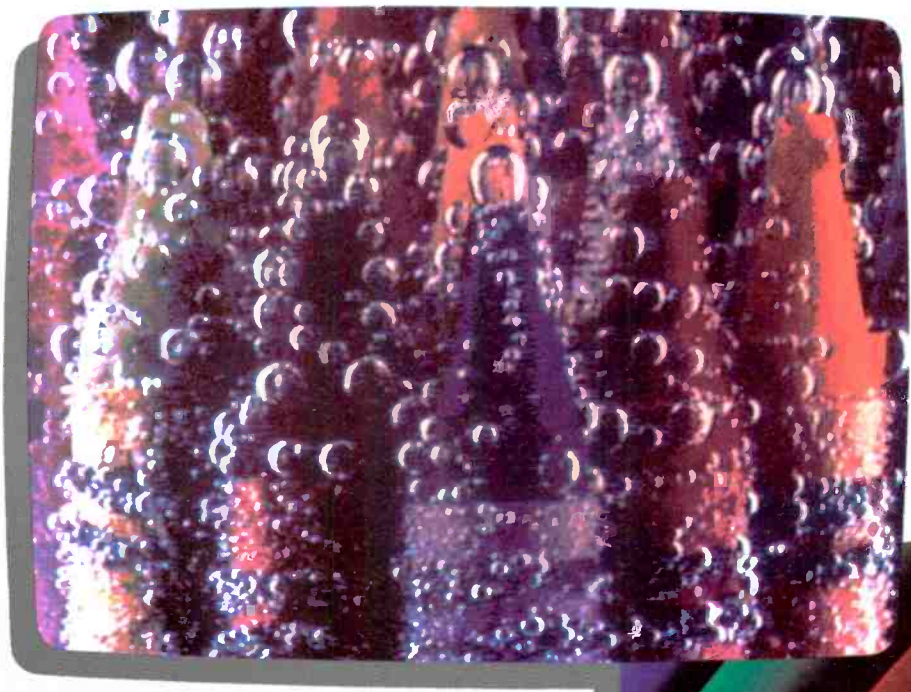
NEW

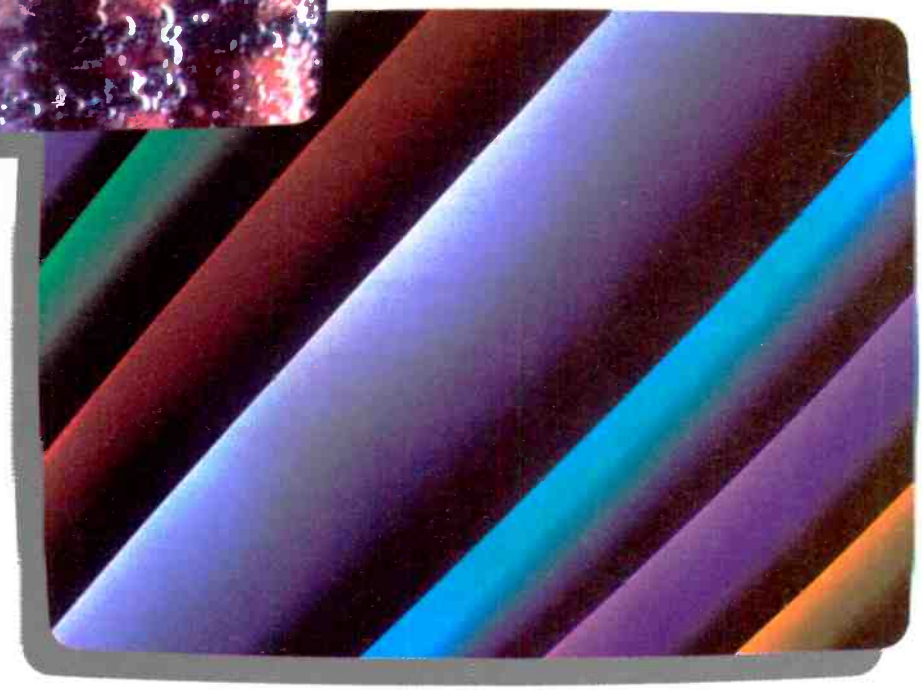
ArtStar™

Exclusive: ArtStar offers simultaneous multiple graphics stations! The result: many times the graphics benefit for your dollars!

Outstanding features — at a breakthrough price!



- RS 170A output or RGB
- C-Net local area network for multiple simultaneous stations
- *Full* automatic "anti-aliasing" for razor-smooth lines
- 256 simultaneous colors from a palette of *over 200,000*
- Control Data disk-pak graphics archive system *standard* with *ArtStar* (25 MB pack; 80 MB pack available)
- Output to film at up to 2048 x 2048 resolution!



ArtStar includes:

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- Stencils, grids, zoom and pan rotations
- Perspective "cut and paste"
- Full color digitizer

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BROADCAST engineering

The journal of broadcast technology

September 1984 • Volume 26 • No. 9

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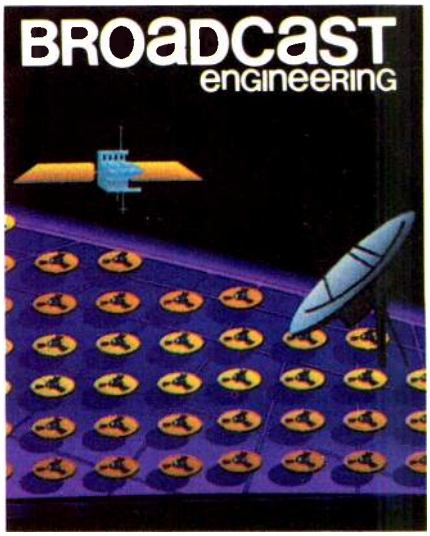


THE COVER this month indicates that satellite and tape distribution continue to play a major role in radio and TV programming. The image required 80K of the 3M BFA Paint System's 800K memory capacity, and was designed by Pam Belding, Belding Design, Minneapolis.

Coming events

Sept. 16-19
Radio Convention & Programming Conference, Los Angeles

Sept. 21-25
International Broadcasting Convention (IBC), Brighton, England

Oct. 8-11
AES 75th Technical Meeting & Exhibits, New York, NY

Oct. 27-Nov. 3
SMPTE 126th Annual Conference, New York, NY

Oct. 28-Nov. 1
Scientific-Atlanta Earth Station Seminar

Dec. 3-5
Radio Television News Directors Association (RTNDA) International Conference, San Antonio, TX

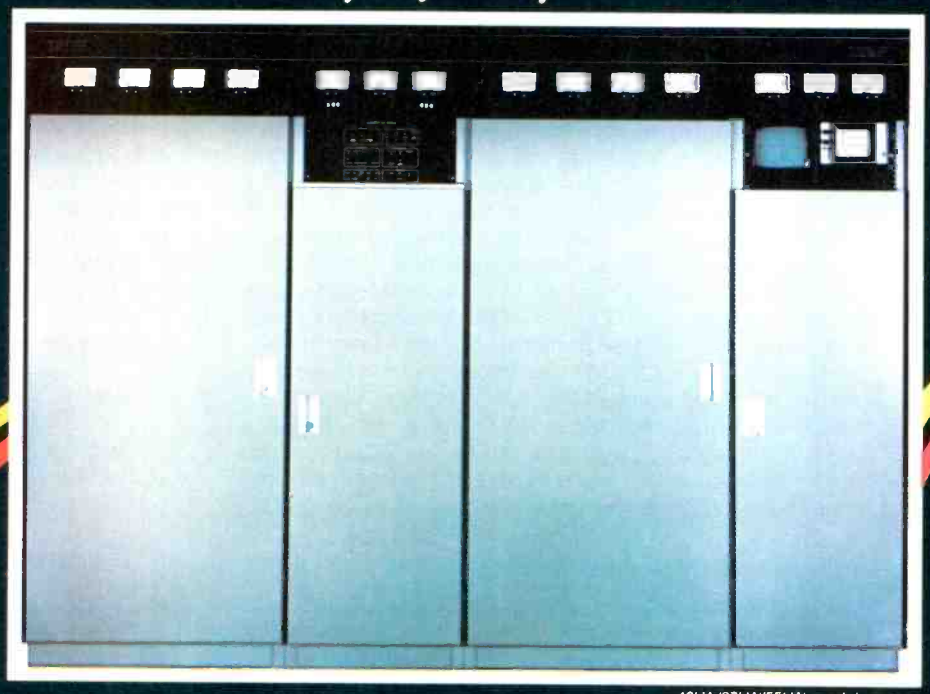
Dec. 5-7
Western Cable Show, Anaheim, CA

NEXT MONTH

- Fifth annual broadcast industry salary survey
- SMPTE convention preview
- Preparing for winter ENG/EJ

Comark's "S" Series UHF Television Transmitters

Simply Superior



10kW/30kW/55kW model shown

Integrating high efficiency, reliability and low cost, each model incorporates state-of-the-art technologies to achieve a unique combination of unparalleled features:

- External cavity, full-band, field proven, klystron power amplifiers, combining highest efficiency and compact size.
- Broadband (no tuning), high power, Exciter System, featuring dual channel (redundant) operation as well as Comark's CM-100S Broadcast Modulator with IF S.A.W. filter.
- Space efficient, mechanical and electrical layouts, fully engineered for maximum EMI/RFI isolation and overall operator convenience.
- Fiber optic telemetry for all floating high voltage metering functions, incorporated into a complete, remote control-compatible, latched fault and status display system.
- Clean, fully isolated, high voltage compartments, with double-filtered air cooling and front access. (No exposed high voltage in klystron areas.)

Comark's "S" Series transmitters are available from 10kW through 220kW with advanced system options, including beam current pulsers, motorized RF switching systems, E.D. and ICPM correction systems, and the services of Comark's 24-hour field operations group.

Simply Superior.

COMARK

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(413) 569-5939

associations

National Association of Broadcasters
1771 N Street, NW
Washington, DC 20036
1-202-293-3570

FCC is asked to drop remote control rules

The NAB has asked the FCC to eliminate the current obsolete remote control rules and replace them with a single, simplified rule.

The NAB stated that instead of modifying existing rules and incorporating several new requirements, only two provisions were needed for transmitter remote control operation: to permit such operation and to restrict the control functions to those mandated by law, national security or public safety. All other aspects should be left to the discretion of the licensee, according to the NAB.

Noting that the present rules were formulated in an era in which there was a concern that broadcasters could lose control of their transmitters and cause interference, NAB said today's advanced technology made these concerns unnecessary. It said these rules were costly and unwarranted and, no matter how flexible, a technical rule could not adequately cover all the remote control variations stations might wish to implement in order to serve the public in the most efficient manner.

FM priority is requested for daytime-only stations

The NAB has asked the FCC to accord priority status to daytime-only AM licensees applying for full-time FM outlets to be made available under the Docket 80-90 "Omnibus Rule Making."

The NAB said preference should be granted even where there were other full-time local radio services available in the community. It said the commission should not require the daytime station to divest itself of the AM facility in order to gain priority, but if it chose to relinquish the station after obtaining an FM license, then a tax certificate should be granted.

The association also asked the FCC to consider granting certain benefits to other classes of stations seeking the new FM allocations. It cited Class A FM licensees seeking to upgrade to a higher class, Class IV AM stations and "stand-alone" AM stations seeking FM outlets.

The agency also was asked not to apply strict *ex parte* prohibitions to the purely policy elements of proceedings aimed at amending the FM table of assignments, saying that the commission may "unnecessarily restrict itself in the gathering of information and facts it needs to make its ultimate decisions on broad policy issues."

FCC gains support in promoting remote pickup

The NAB supports an FCC proposal to amend its rules so that they encourage spectrum efficiency and provide

Continued on page 236

BROADCAST ENGINEERING®

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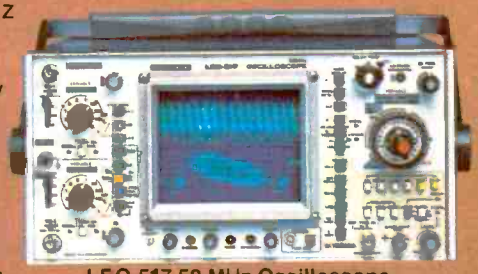
Every important feature for under $2,000.

Precise NTSC sync/test pattern generators.

Leader's LCG-400 series sync/test generators provide accurate reference signals for any off-the-air broadcast or non-broadcast operation. Available in either multi-burst or sweep marker configurations, the LCG-400 provides EIA and full-field color bars as well as staircase, raster (in eight colors), window, convergence and cross-hatch test signals...plus gen-lock capabilities and a host of auxiliary outputs. As a matter of fact, Leader's sync/test generators do virtually everything the $4,000 generators do... except cost as much.

A network-proven 50 MHz oscilloscope.

The Leader LBO-517 oscilloscope makes accurate and detailed measurements. It offers sensitivities of 1 mV to 10 MHz and 5 mV to 50 MHz. Two main and two auxilliary channels can be displayed on main and delayed time bases (8 traces) simultaneously while intensifying the delayed portion. Composite triggering provides *stable* viewing of two asynchronous inputs. Positive, stable triggering on composite video signals, at either H or V rates, is automatic. Leader's new dome-mesh 20 kV CRT assures bright, clearly defined displays, even at the highest or lowest sweep rates. Very competitively priced.


LBO-517 50 MHz Oscilloscope.


LVS-5850 NTSC Vectorscope.

The Leader Vectorscope is unique.

Only the Leader LVS-5850 NTSC Vectorscope offers CRT-generated phase/amplitude targets that are as bright and clear as the vectors themselves. Now you can easily verify NTSC Vectors in darkened control rooms. And, electronically generating the targets eliminates non-linearity errors caused by CRT aging. You can mount it in your existing console, view it from any angle or distance, and be confident that what you see is what you've got.

Two-year warranty. Evaluation units.

A history of high reliability permits Leader to provide a generous two-year warranty (even on the CRT)...backed by factory service depots on the East and West Coasts. Evaluation units are available to all qualified customers.

Call toll-free (800) 645-5104 to request: an evaluation unit, our latest catalog, the name of your nearest "Select" distributor and additional information.

For video engineers who know the difference.

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FCC update

September 1984

By Harry C. Martin, partner, Reddy, Begley & Martin, Washington, DC

Television deregulated

The FCC has eliminated programming guidelines, ascertainment requirements, commercial rules and policies and program logging requirements for commercial TV stations.

Programming guidelines, which previously required VHF and network-affiliated UHF stations to air 10% non-entertainment programming and at least 5% informational and 5% local programming, no longer are necessary, the commission said. The only remaining requirement is a general obligation to provide programming responsive to issues confronting the license community. Licensees may look to the programming of other TV stations, both commercial and non-commercial, in selecting issues to address.

Ascertainment surveys, previously used to determine community problems, no longer will be required. In situations where renewal applications are challenged, the commission will focus its inquiry on the responsiveness of a licensee's programming to local issues rather than on the methodology used in arriving at programming decisions.

With respect to excessive commercialization, the FCC said marketplace forces rather than governmental rules were the more effective restraint. For this reason, the FCC no longer will consider commercial levels in processing uncontested renewal applications, or entertain petitions to deny based on allegations of overcommercialization. In a related move, the FCC's ban on program-length commercials has been rescinded.

Program logging requirements, which are not necessary in this new regulatory scheme, have been eliminated. The commission will rely instead on issues/programs lists, which must be placed on a TV station's public file on a quarterly basis. Each list must contain five to 10 issues to which the station has given particular attention in its programming over the preceding three months, and an account of how each issue was treated.

Non-commercial radio and television deregulated

In another related deregulatory action, the FCC revised its programming policies and eliminated its program log and ascertainment requirements for public radio and TV stations.

Non-commercial licensees still will be expected to serve the significant programming needs of their communities by providing alternatives to the programming of commercial stations. To ensure performance consistent with this general requirement, the commission said public stations would be required to document their performance by maintaining quarterly issues/programs lists.

Noting that ascertainment procedures unnecessarily emphasized the methodology used to determine community problems—rather than the responsiveness of the station to such problems—the commission decided that the remaining ascertainment procedures should be eliminated. Noncommercial licensees will be given the same wide discretion as their commercial counterparts to determine how community issues should be handled.

Public stations were reminded that they still were required to keep records of political candidates' appearances and notations that they had carried out required EBS tests.

Call sign procedures affirmed

In spite of strong protests by broadcast industry trade associations, the commission affirmed its action of December 1983, which revised procedures for assigning call letters to AM, FM and TV stations.

Most significant and controversial among the revisions was the decision to end FCC participation in the resolution of call letter disputes. NRBA and NAB argued that the FCC, rather than the local courts, was the best forum to decide what constituted a potential for public confusion in cases where a station adopted a call sign similar to one already used in the market. The commission disagreed, saying that local forums were likely to be more attuned to what constituted a potential for public confusion.

Also sustained were rule revisions eliminating the requirement that prior notice of call sign applications be given to other stations within 35 miles of the applicant's station and the requirement of a 30-day pre-assignment holding period.

Inquiry into loud commercials ended

The FCC has decided not to impose regulations controlling loudness levels of commercial announcements

Continued on page 188

FCC's first of 50

The Federal Communications Commission, formed as a result of the Communications Act of 1934, marks its 50th anniversary in 1984. The commission was established when President Franklin D. Roosevelt signed the act on June 19, 1934. The first commission, officially organized on July 17, included a broadcast division, with Commissioners Hampson Gary and Thad H. Brown; a telegraph division, with Commissioners Irvin Stewart and George Henry Payne; and a telephone division, with Commissioners Paul A. Walker and Norman S. Case. Eugene O. Sykes was appointed chairman and served as a member of each division.

Some interesting dates during the first year include:

July 24—First experimental TV authorization to General Television Company, Boston.

July 31—First broadcast license denied to KGIX, Las Vegas, NV, for failure to complete construction as required.

August 1—Telephone carriers required to report current services, rates, contracts and stock ownership.

August 21—Current ownership information required from broadcast stations.

August 29—Totals for amateur radio licenses at 46,930.

September 7—Division director appointments: John Killeen, broadcast; Robert T. Bartley, telegraph; and A. G. Patterson, telephone.

September 28—Hearings held on non-profit educational broadcasting allocations.

October 9—State broadcast quotas revised into day (6 a.m.-6 p.m.) and night (6 p.m.-midnight) segments, with minimum daytime power raised to 5kW.

October 30—Allocations for clear and other channels with several stations operating simultaneously at night to be surveyed. A Texas station application denied for lack of financing.

December 12—First amateur license revoked.

December 24—The special temporary authorization renewal for WLW, Cincinnati, refused, ordering the station to reduce power from 500kW to 50kW to avoid interference with Canadian stations.

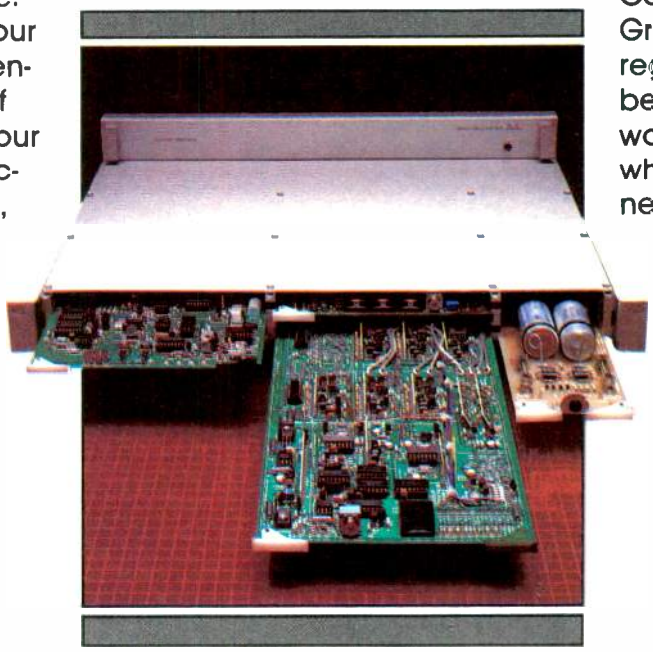
NOT JUST ANOTHER PRETTY PHASE

You need an extremely stable digital sync system with encoded subcarrier for color frame identification. It all starts with our 3252A master and 3256A slaves. You get continuous SC/H phased output, even in the genlock mode, to all sources. It ends with our 3258 SC/H phase meter for proof of performance.

It's no secret that your master sync pulse generator is the heart of your whole plant. If your equipment isn't dancing to the same beat, the results can be devastating.

Let's face it. Almost everything you do is multiple source now. Successful post-production relies on the function and dependability of your sync pulse generator.

In your quest for excellence, why not plug in to our growing technology? Contact the nearest Grass Valley Group regional office listed below. Tell them you want to talk to someone who's in sync with your needs.



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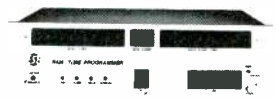


780 SERIES
RAM TIME PROGRAMMERS $1250-1575

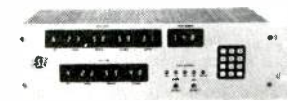
When programming more than eight events, the **780 Series RAM Time Programmers** are the most cost-effective way of dealing with the problem. They are flexible, easy to use, and provide 32 events (expandable to 96) in 5¼ inches of rack space.

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.

STANDARD UNITS

EIGHT DIGITS OF PROGRAMMING CAPABILITY.
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 790
MICROPROCESSOR-BASED PROGRAMMABLE TIMER

$2190

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

The **ES 790** is a 1,000 event, 32 channel, microprocessor-based programmable clock. Events occur as reed relay contact closures (single pole, normally open). These closures may be all momentary, all latching, or 16 of each, at the user's option. A simple modification allows the use of 16 double pole relays, instead of 32 single pole relays.

1,000 time events can be programmed into the memory and they can be entered randomly, as opposed to chronologically.

An internal crystal with battery and battery charger is provided for uninterrupted operation.

ES 790 is enclosed in a rack mounting chassis with a front panel measuring 5¼" high and 19" wide. Depth behind panel 10".

750LSERIES
THUMBWHEEL PROGRAMMER COMPARATORS $330-$410

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.

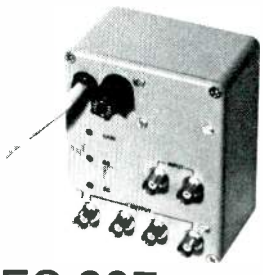
One set of thumbwheels is required for each event. The standard 750 Series units are enclosed in a 3½ inch high relay rack panel and chassis.

STANDARD UNITS

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

ES 206
VIDEO TIME AND DATE GENERATOR $495

The **ES 206** has been designed to allow the addition of Time and Date information to a video signal. Two rear-mounted video jacks permit "looping" the video information through the 206 to add the data.



ES 207
VIDEO DISTRIBUTION AMPLIFIER $175

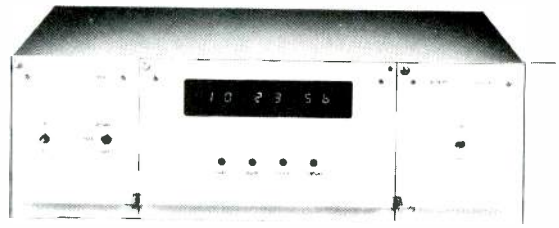
The **ES 207** Video Distribution Amplifier answers the "one more unit" question with a versatile little package that can be tucked anywhere, either temporarily or permanently. Controls are available through the top plate with a miniature screwdriver for video gain, D.C. level and HF equalization. A very wide range of chroma level control can be obtained with the DA. Output video is expected to be set for 0 volts D.C. on the blanking or porch level, with video extending positive and sync negative. Nominal input and output signal level is 1 volt p-p. Typical gain control range is from ½ volt to 1½ volts p-p.

MASTER CLOCKS

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 and 160/1.



ES 160 Mounted in a 5¼" relay rack panel and chassis, displays six digits of information on 4" 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 100 ES 161, 166, 171, 991 or 993 Remote Displays without buffering.
Dimensions: 5¼" High x 19" Wide x 15" Deep. $1103.

ES 160/1 One second per month version of ES 160. $1286.

ES 192L/194L

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 .55" gas discharge.
Dimensions: 2⅛" High x 8" Wide x 6" Deep. $341.

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. $173

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. $210

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.
Dimension. 8" Wide x 2½" High x 6" Deep. $256

ES 165 IMPULSE DRIVER The ES 165 Impulse Clock Driver was designed to provide synchronized power to the ES 168 Impulse Clocks. ES 165 is capable of driving 50 ES 168 clocks and will keep them running accurately through twelve hours of power failure. The ES 165 derives its synchronizing pulse from any one pulse per second source, such as ESE Master Clock and can also accept the once per second, alternating 12 or 24 volt impulses from an existing impulse clock system.

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. $267

ES 167A SERIAL TIME CODE GENERATOR An integral part of ES 160, 190 and 192/194 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 Display. $153

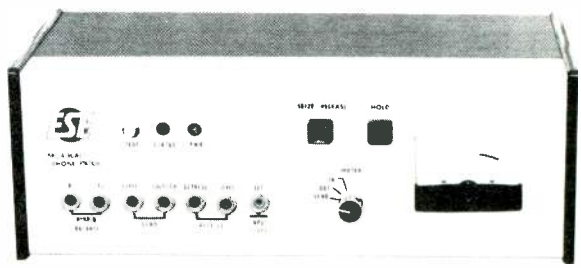
ES 168 IMPULSE CLOCK operates from the 8pps output of the ES 165 Impulse Driver. As many as 50 ES 168's can be connected to a single driver, and they will continue to run during a power outage of at least 12 hours. The clock face is 12" in diameter, with a red sweep second hand and black hour and minutes hands. $135

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 .4" LED's.
Dimensions: 2¼" High x 4½" Wide x 4" Deep. $166

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. $211

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 $341

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 167A.
Dimensions: 5" High x 12" Wide x 3" Deep (Wall Mount) $471



ES 212

The ES **PHONE PATCH** was designed over a period of 10 years, refined in the field. The special needs of broadcasters are met because the signal quality is unexcelled. The patch reproduces telephone audio cleanly and quietly. The sound is not tinny, spitting, compressed, noisy, or narrow. It is as clear, wide, and natural as the phone line will permit.

ES 562/564

SIX DIGIT CLOCK/ TIMER WITH MEMORY $329

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. Six 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 Reset, Timer, Fast/Start, Slow/Stop, Hold and Clock.
Display: Six digits of .55" Planar Gas Discharge Display.

ES 214

DYNAMIC AUDIO LEVEL INDICATOR $119

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, +1dB – Red.
0 dB-yellow, -1, -2, -3, -5, -7, -10, -15, -20, -25 dB – Green.

ES 280

AUDIO TIME CODE GENERATOR/READER $525

The ES 280 is a 10 Digit Audio Time Code Generator/Reader, capable of laying down a serial BCD time code on audio tape in the Generator Mode, and recovering and displaying it in digital form in the Reader Mode. The code has been designed by ESE. It is not a standard code, such as SMPTE or IRIG. The frequencies used to produce the code have been selected to be compatible with cartridge machines as well as other tape recording and playback equipment. Amplitude adjustment assures the right amount of signal for the particular machine being used.

ES 256 "SMART" SMPTE TIME CODE READER. The ES 256 is a bi-directional multi-speed, eight digit SMPTE Time Code Reader which displays Hours, Minutes, Seconds and Frames on .4" red LED's. The ES 256 incorporates a digital error detection system: When a bad frame of time code is detected, the unit will switch to a frame-counting mode.

70 SERIES

CONSOLE MOUNT CLOCKS AND TIMERS

ES 172 SIX DIGIT – 12 HOUR CLOCK: Three setting controls – Fast Advance, Slow Advance and Hold. $166
ES 174 SIX DIGIT, 24 HOUR CLOCK Otherwise identical to the ES 172 $166
ES 370 FOUR DIGIT, ONE HUNDRED MINUTE UP/DOWN TIMER: Six controls – Count Up, Count Down, Stop, Minutes Advance, Seconds Advance, Reset. $211
ES 371 UP/DOWN TIMER: Similar to the ES 370 except with Leverwheel Preset capability for faster setting of the desired time $335
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. $166
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. $202
ES 574: A 24 hour version of ES 572. $202
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. $202
Dimensions: 2 16" High x 4 5" Wide x 4 13" Deep

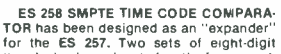
ES 112AL/124AL

DIGITAL CLOCK $173

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 gas dicharge, .55" high.
Dimensions: 2½" High x 8" Wide x 6" Deep.

ES 253 SMPTE TIME CODE READER: is an eight-digit SMPTE Time Code Reader displaying Hours, Minutes, Seconds and Frames $477
ES 254 SMPTE TIME CODE READER. is a bi-directional, multi-speed eight-digit reader, displaying Hours, Minutes, Seconds and Frames on .4" red LED displays. $709
ES 255 is a bi-directional, multi-speed, eight-digit SMPTE Code Reader, that can add the information to a video stream for recording time code on the video portion of a tape, or for displaying it on a monitor. Reading speed is 1/20 to 20 times playback speed. $1045

ES 257 SMPTE TIME CODE READER/COMPARATOR is capable of making two comparisons, as established by the two sets of thumbwheels located on the front panel. By specifying option "B" (four-line parallel BCD, 5V CMOS compatible), additional comparisons may be made by connecting one or more **ES 258** "expander" units.



ES 258 SMPTE TIME CODE COMPARATOR has been designed as an "expander" for the **ES 257**. Two sets of eight-digit thumbwheels are located on the front panel, to allow comparison of two SMPTE code locations.

SMPTE TIME CODE GENERATOR:
ES 261 is a pre-settable, eight-digit SMPTE/Time Code Generator, capable of Drop Frame or Non-Drop Frame operation $788

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. $286
ES 184 – SIX DIGIT, 24 HOUR CLOCK: Otherwise identical to the ES 182 $286
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. $332
ES 381 UP/DOWN TIMER: Similar to ES 380, except that leverwheel preset is used. $437
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. $239.
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.

ES 301/302

100 MINUTE UP/DOWN TIMERS $246/317

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 don 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.

ES 510L

FOUR DIGIT 60 MINUTE TIMER $186

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.

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. $511
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. $358
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. $471
Dimensions: 5" High x 12" Wide x 3½" Deep

ES 232

TIME CALCULATOR

ES 232 is an eight digit, 24 hour, Up/Down Timer/Time Calculator displaying Hours, Minutes, Seconds and Frames (30 frames per second) on bright red .4" LED's. In the Calculator mode, data may be added or subtracted, or stored in memory, or recalled from memory. There are 10 memory locations available. Data may be added to or subtracted from the timer value, while the timer is counting either up or down, but not while the timer is stopped. When stopped, data moved from calculator to time serves to preset the timer. In the timer mode, ES 232 counts up or down, and can be reset while running or stopped. It can be preset to any number in the 24 hour range. While timer is running or stopped, it is possible to enter the value into memory without disturbing the operation. It is also possible to recall a value from memory and add or subtract while timer is counting up or down. ES 232 uses 24 keys, mounted on a desktop case, measuring 5" wide X 6" deep X 2" high.

142 Sierra Street
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Circle (8) on Reply Card

By Jerry Whitaker, radio editor

AM subcarriers approved

The FCC has approved the use of AM carrier signals for any broadcast or non-broadcast function that does not interfere with main-channel programming or the signals of other radio stations. The action gives AM broadcasting the same freedom in subcarrier use that is now enjoyed by FM stations. This new freedom may, however, complicate the wide-scale implementation of AM stereo operation in the United States.

Motorola, developer of the C-QUAM AM stereo system, had urged the commission to proceed with caution in any move to expand the use of AM ancillary signals. The company said it "generally supports the concept that ancillary use of the AM broadcast spectrum be increased, where it does not conflict with other public interest considerations." The company provided documentation to the FCC showing how AM SCA signals could interfere with stereo pilot tones of the various systems now in use.

The commission stated that, although AM stereo may not be compatible with all uses of the AM carrier signal, the situation "was not so severe so as to warrant either a delay in authorizing additional uses for AM carrier signals or a requirement to protect the pilot tones of all AM stereo systems."

Although available for virtually any function, the AM carrier services are still limited to the hours authorized for main channel operation.

PMX demonstration at NAB

In our July NAB roundup issue, we inadvertantly left out a description of the PMX AM stereo demonstrations held at the Continental Electronics booth on the convention floor.

Continental displayed its 302A AM stereo exciter and PMX-SM1 modulation monitor operating with a 5kW transmitter (Continental #315R-1) and four different AM stereo audio processors. The transmitter was operated at full power into a shielded dummy load and a different processor was used each day of the show. Processors lined up for the comparison tests were units from Orban Associates, Circuit Research Labs, Gregg Labs and Inovonics.

A demonstration of utility load management and other signaling or control applications was given using a CRT and associated equipment. Continental reports that the PMX system allows the use of its 5Hz pilot to transmit digital data without interfering with the main channel stereo performance. Test data taken by the company on the exhibit floor showed less than 1% THD in the left and right channels from 50Hz to 7.5kHz while the system was transmitting subchannel data at a 5 baud rate.

WOSU Conference looks at AM stereo

The topic of AM stereo received a fair amount of discussion at the recent WOSU Broadcast Engineering Conference, held July 17-19 at Ohio State University in Columbus. The conference, sponsored jointly by the WOSU stations and **Broadcast Engineering,** featured a detailed engineering paper prepared by two engineers at Broadcast Electronics, and exhibits of AM stereo equipment by Motorola and Delta Electronics.

The engineering paper, written by Stanley Salek and Edward Anthony, discussed the development and operation of the new Broadcast Electronics AM stereo exciter. The paper, titled *"Second Generation Techniques for AM Stereo Exciter Design,"* also outlined transmitter interface considerations and audio processing requirements. Some of the exciter features highlighted in the discussion were the transmitter loss-of-drive protection circuit, remote control interface capability and a frequency lock provision that allows synchronization of the system with WWV. The frequency lock feature is designed to reduce nighttime interference from co-channel stations and platform motion problems that may occur under certain conditions. The circuit can also prevent the generation of false AM stereo pilot signals due to co-channel stations whose total frequency offset is 25Hz.

Both Motorola and Delta had demonstration AM stereo systems in operation at their exhibit booths. Motorola's display featured some of the C-QUAM AM stereo receivers currently available.


BALANCE
The symmetry gained from the equalization of complimentary forces. Symmetry as in the precise blending of sensational chrominance with outstanding signal-to-noise. Symmetry resulting in a video tape of breathtaking balance. Ampex 196.
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THE NEW TEKTRONIX 1750: HEADS OFF PROBLEMS YOU DIDN'T KNOW YOU HAD...UNTIL IT WAS TOO LATE!

Our new 1750 signal monitor gives you a unique, dynamic display of SCH phase relationships.

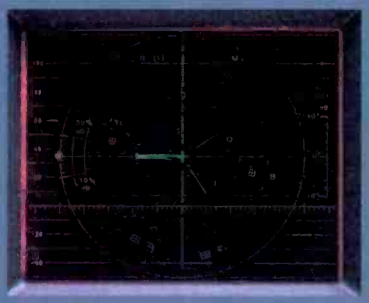
You can see at a glance if a video signal is properly SCH phased...or just as easily, compare two signals for color frame matching.

Hit-or-miss SCH phasing may have been tolerated in the past—but now it's costing you time and money every day.

The Tektronix 1750 can help you regain control. By maintaining consistent SCH phase ...or by seeing potential problems *before* a glitch occurs, you'll avoid the frustration of multiple passes and enjoy getting it right the first time. Saving time saves you money and makes the best use of your valuable resources.

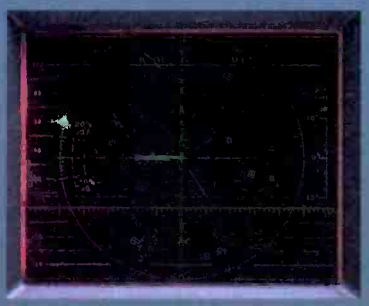
SCH phase, of course, isn't the only parameter you need to keep on track, and SCH display is only part of the 1750's comprehensive signal monitoring capabilities. At the push of a button it also displays vector mode...or waveform mode, enhanced by digital line selection through the vertical interval ...or R-Y/sweep mode for easy interpretation of differential phase distortions.

Whether used for monitoring video in production and editing environments, or for making fast and accurate measurements during equipment maintenance, the 1750 Series is a new benchmark for comprehensive performance in both NTSC (1750) and PAL (1751) standards.



Correct SCH phase relationship is clearly displayed on the 1750 when dot on the calibration circle is aligned with the vector on the −x axis.

Dot placement on the +x axis indicates an error in the color frame matching of two signals.



This 17-degree offset, indicating a 17-degree SCH timing error, would be impossible to perceive on an ordinary waveform monitor display.

A compact 5.25 inch package, mechanically interchangeable with many other "half-rack" packages, allows easy installation in new or existing facilities.

If you see the advantages of comprehensive signal monitoring, you'll like what you see in the 1750.

For more information on this or other Tek television products, or for the number of your nearest Tek sales office, call our toll-free information service today: (800) 547-1512. In Oregon, (800) 452-1877.

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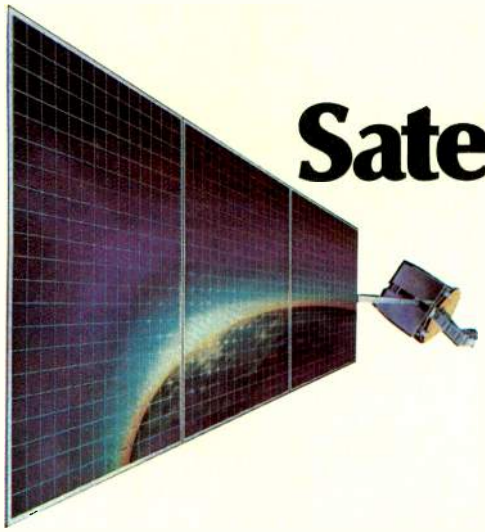

Satellite update

By the **BE** staff

Dawn of DBS dims

The concept of DBS is inviting. Homeowners may use a small (approximately 2-foot diameter) roof-mounted dish antenna to receive various satellite-relayed programs. An improvement of picture quality over that provided by CATV companies may be expected. Power-related outages, which sometimes plague CATV, are avoided. The homeowners associations will not find the smaller antennas as objectionable to the beauty of the residential area as they do some of the 9- to 12-foot antenna systems currently in use. Other advantages of DBS include multiple-channel sound, high-definition pictures, a variety of screen/text services and individually addressable receiving systems for pay programming.

Although DBS is an interesting idea, the cost of providing the service has caused several potential participants to withdraw until later, perhaps indefinitely. When the first tier of applicants was granted construction permits, a year was given before a due-diligence filing had to be made. That filing was to show that firm commitments had been made toward providing satellite system facilities and that financing for the project was available. In the weeks before the July 17, 1984, due-diligence deadline, Western Union pulled out of the competition. RCA Americom changed its plans to include fewer lower-powered satellites. CBS ceased discussions with COMSAT's Satellite Television Corporation division. The result left an air of uncertainty about the TV medium of the future.

Explanations

To date, only one DBS attempt is operating in the United States. United Satellite Communications, Inc. (USCI) has been working with funds from Prudential Insurance, General Instruments and other private investors. Prudential has indicated that it will offer no further funds. In a bid to locate additional money, USCI met with defeat on Wall Street. It now looks askance at its future.

Western Union says that it is a supplier of end-to-end communications services. WU's decision to pull out of the arena at this time was made because of a lack of program material. The void of software seemed to reduce the chances of enticing subscribers to make a paying service from the DBS endeavor.

CBS, a programmer, was exploring the formation of a venture with the COMSAT division. COMSAT's STC, in a position similar to WU, said it had hoped that CBS and other programming entities would join in the venture. USCI's problems in finding the $40 million of funding it sought seems to have signaled the CBS withdrawal, along with the fact that no other programmers had come upon the scene to join that venture.

RCA's move, lowering transponder power from 230W to 100W on fewer transponders, was engineered to reduce the RCA investment by nearly half. As a result, it could offer channel facilities to prospective program sources at a more attractive, lower cost. RCA's application modification, filed with the FCC, also requested a delay in launching the first of the satellites from 1988 until late 1989. The effect that RCA's modified game plan will have on its entry into the FCC's overall plan is unknown at this time.

The Player Roster

Of the original eight players, five remained to file due-diligence. STC has qualified by initiating construction of an uplink facility in the Las Vegas area. STC has requested a modification of their permit, however. The original license granted permission for four satellites. If the modification is allowed, six channels to cover the entire contiguous United States will emanate from one orbital location. The move would allow STC to trim about $500 million from its costs and would ease the need of obtaining additional funding for the project.

Hubbard Broadcasting, owner of United States Satellite Broadcasting, has signed an agreement with RCA Astro-Electronics for two high-power satellites, at a price tag of $160 million. No payment to fix the agreement was made at the June 25 signing, however. Dominion Video and Direct Broadcast Satellite Corporation have submitted due-diligence filings with the commission, while Graphic Scanning scrambled to make some final arrangements before the deadline date.

Meanwhile, seven second-tier applicants have filed for FCC consideration. If construction permits are granted, the seven will be given a construction permit with a 1-year limit, at which time they, too, will have to file the appropriate statements of intent.

A favorite DBS-related project of CBS, i.e., HDTV, has not been forgotten. The proposed 2-channel method of HDTV transmission by DBS carriers is temporarily off the launch pad. CBS plans to put its energy into developing a world standard for production of higher-definition imaging. If, and when, such a standard is a reality, CBS may reconsider the DBS transmission plan.

Direct-to-home transmissions have met with limited success in other parts of the world as well. Certainly cost is one aspect, but the European theater is also plagued with political ideological thorns, because the footprint of satellite signals is guaranteed to spill over the political boundaries of many smaller European countries. The result is that the medium of the future remains just that, and for many, perhaps even further into the future than was expected. |:-)))|

HOUR$ AWAY,

GET TOUGH . . .

MRC-1600

Remote control is sometimes more remote than control. Not so with the MRC-1600 Microprocessor Remote Control. It's Moseley tough, Moseley reliable, and Moseley designed to give broadcasters flexibility at a not-so-tough price. Sixteen raise/sixteen lower command channels, coupled with sixteen status and sixteen telemetry channels, assure control and feedback of critical operation parameters to the station. Power-down problems? All setup data is stored in Moseley Memory. Plug-in modules adapt the MRC-1600 to two or four wire telco lines, subaudible, FM subcarrier or any combination thereof.

MRC-1600 operation is tailored to individual station requirements during setup. Status inputs may be set to alarm on rising, falling, rising and falling waveforms, or they may be muted completely. Upper and lower telemetry limits can be set or disabled independently. Each telemetry channel may be calibrated in one of four modes: power, indirect power, linear or millivolt. Should there be a disallowed change in status, or telemetry data exceed preset limits, visible and audible alarms are activated. When the operator acknowledges the alarm, the MRC-1600 automatically displays the data needed to correct the situation. The optional CRT gives the operator keyboard control of the transmitter and provides a clear-English display of all status and telemetry data, which is printed on the optional Logger. Tough remote site? Get Moseley tough.

- 16 RAISE/16 LOWER COMMANDS
- 16 CHANNELS, STATUS AND TELEMETRY
- NON-VOLATILE MEMORY STANDARD
- USER-DEFINABLE ALARMS
- CRT AND LOGGER AVAILABLE

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Planning for survival

The need for planning by the broadcast industry cannot be emphasized too strongly. We have called in this column many times for attention to the technical quality of present-day facilities and planning for the broadcast facilities of tomorrow. This issue of **Broadcast Engineering** includes the second part of our **BE** Proof program for FM radio stations. (See page 22.) We want this program to be a starting point for future consideration of technical performance objectives for radio *and* TV stations. Broadcasters who let their technical plants slip behind the state-of-the-art run the risk of losing their audiences to other, more aggressive, stations and services that provide higher-quality performance. We have heard many times from broadcasters that they cannot afford to keep pace with the state-of-the-art. We fear, in reality, that stations cannot afford not to.

Survival in today's highly competitive marketplace requires excellence in technical performance and programming. Survival in the marketplace of the future, however, places even greater demands on the broadcast industry. This point was addressed eloquently by Joseph Flaherty, vice president for engineering and development of the CBS Broadcast Group, in a speech at the recent WOSU Broadcast Engineering Conference. (See "WOSU Conference replay," page 230.) He warned his audience that over-the-air broadcasting was poised for a technical explosion, and that the radio and TV industry must start planning for the future now, or suffer the consequences. Reprinted here are some excerpts from Flaherty's address:

"I submit to you that terrestrial broadcasting need not become a secondary service, inferior to its 21st century competition. But at the same time, I caution you that it surely will, if broadcasting surrenders its creative and technical leadership to the new and hungry competition.

"Over the years, 'broadcast quality' has come to mean 'the ultimate'—that to which all else is compared, and that from which all else is scaled. Our programs are the best, our news is the best and our technical quality is unsurpassed.

"Our programming colleagues nationwide are bringing, and will continue to bring, the best creative talent to broadcasting. This, of course, is fundamental, because people watch programs and not technology. Nevertheless, all of our programs—our total creative effort—are delivered solely through this vast and complex technical network, extending from the lens in the studio to the screen in the home.

"Heretofore, broadcasting set the technological pace. Technical quality and broadcasting were synonomous. Cable systems and VCRs were designed to match broadcast quality and to be as good as the home receiver. Pay cable programmers use broadcast equipment to originate their programs—to 'measure up' as it were. In short, we and our competitors use the same technology to deliver similar quality.

"But all this is changing! New and better technology is becoming available, and the technical quality of services delivered to the home will become an ever-increasing factor in audience appeal, and thus in audience size.

"As we evaluate the on-rush of new technologies, we must bear in mind that the standard of service enjoyed by the viewer today will not be his level of expectation tomorrow.

"I think that most of us here would agree that our intuitive measure of picture quality is the cinema—not television. What will our audience do when they can have wide screen, stereophonic cinema quality at home?

"The viewer's *expectation level*, not the present standard of service, will drive our future market.

"If we are to compete 15 years hence, we must undertake the enormous task of directing our television technology during these explosive few years. Many of the future directions are already clear.

" 'Good enough' is no longer 'perfect' and may, in fact, become wholly unsatisfactory. Quality is a moving target, and our future judgments must not be based on today's performance.

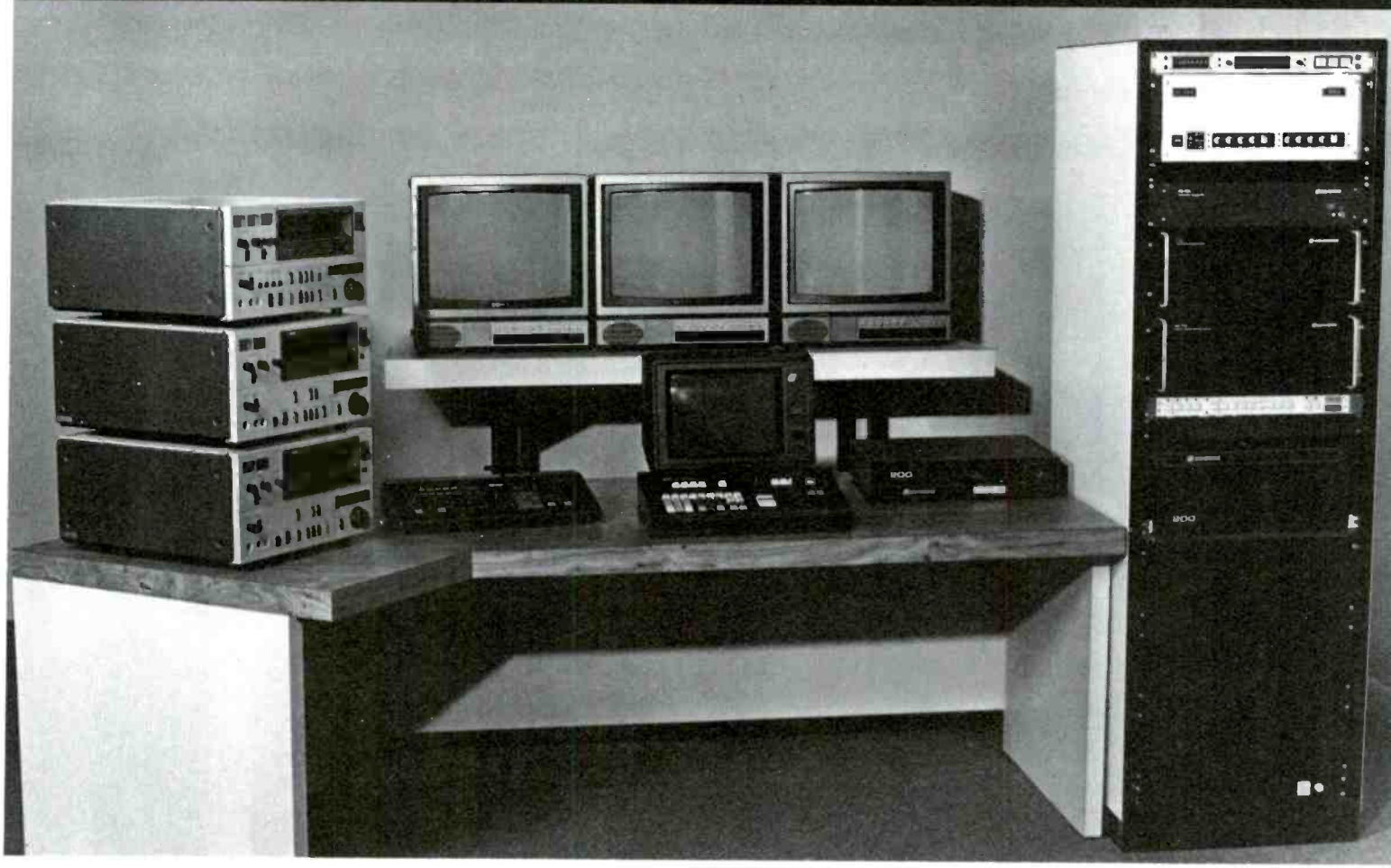
"What, then, must terrestrial broadcasters do in these countdown years to maintain their pre-eminent position?

"First, broadcasters must realize that they are in an era of rapidly expanding technology, technology that may favor new and competing systems. Thus, they must explore all the new technologies and adopt those that improve the quality, efficiency and audience appeal of broadcasting.

"Second, broadcasters must understand that the viewing public is becoming more technically sophisticated and has an increasing level of expectation.

Continued on page 247

CONVERGENCE VIDEO EDITING SYSTEM



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Includes delivery and instructions

ECS204S Convergence Editor. 800 event memory, "409" list cleaning program, block moves, and comments including,

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- Status display video terminal, amber phosphor CRT
- Rack mountable electronic control frame
- VTR Interface boards with 12' interconnecting cable

TCR100 SMPTE time code reader, 3 reader cards, power supply, rack frame

DD200 Dual floppy disk drive, 5.25"

CG100 Command generator, 10 contact closure plus TTL out

ME110/CP Switcher/special effects generator. 5 input, audio follow video, 23 effect patterns with hard/soft and normal/reverse transitions, both manual control and full computer editor list control, remote manual keyboard included.

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1—VO-5850 Sony 3/4" VTR
2—VO-5800 Sony 3/4" VTR
1—DT-113 Gray time Code Recorder
1—AC-20A Adda Dual Channel TBC
1—Monitor stand, edit desk and rack

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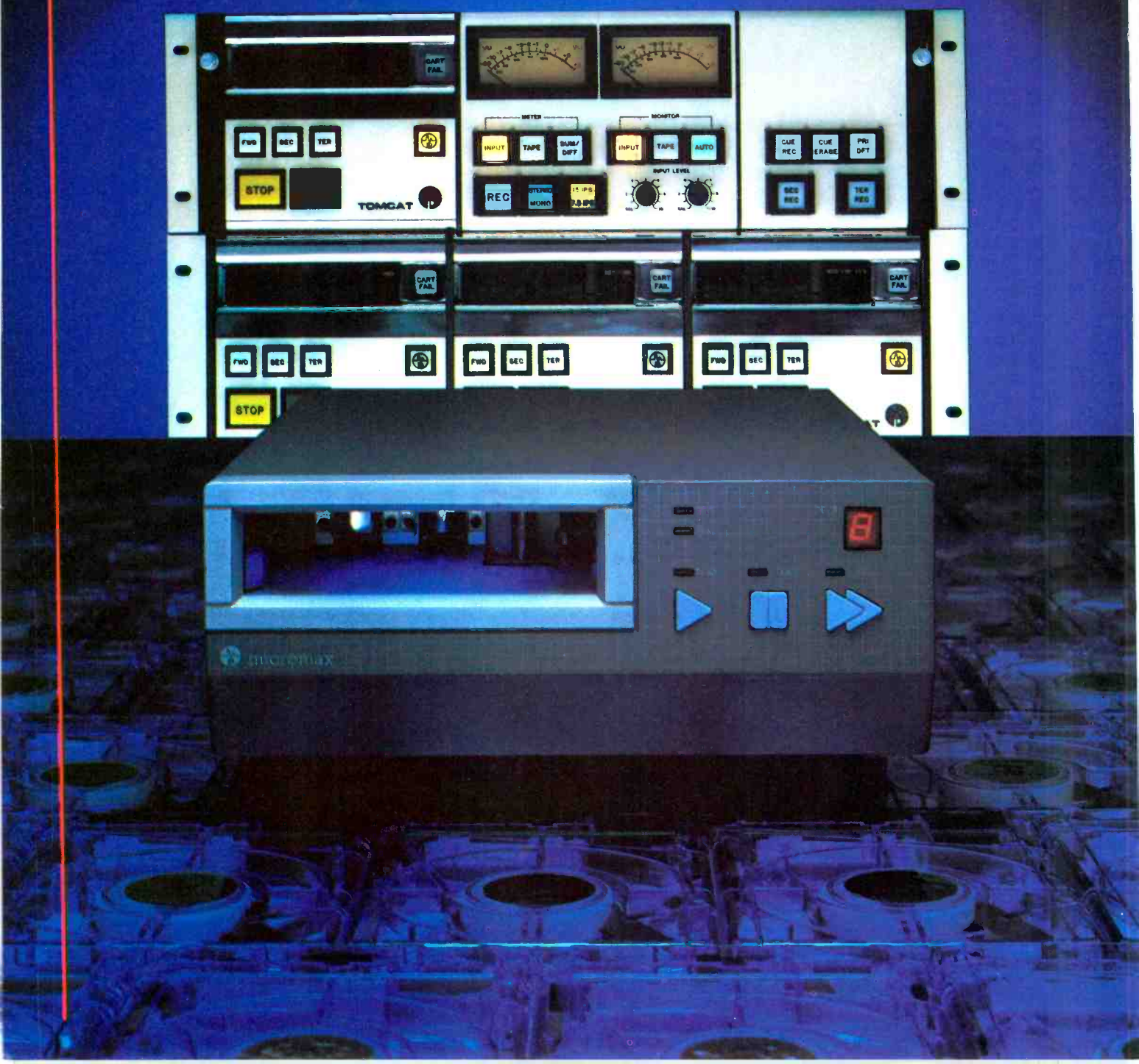
The New Micromax

How to get the best of a TOMCAT™. . . without upsetting the kitty.



When performance comes first, the TOMCAT has become the paws-down, #1 choice for more #1 stations. Over 2,000 TOMCATS in those stations are proof that radio broadcasters are willing to invest their money where it can return the most on their sound.

Because TOMCAT isn't cheap (excellence never is), a lot of broadcasters who have wanted to upgrade their station's sound have been stuck: they've either had to get by with their existing tired, clunky and funky-sounding machines or compromise and settle for buying someone else's.

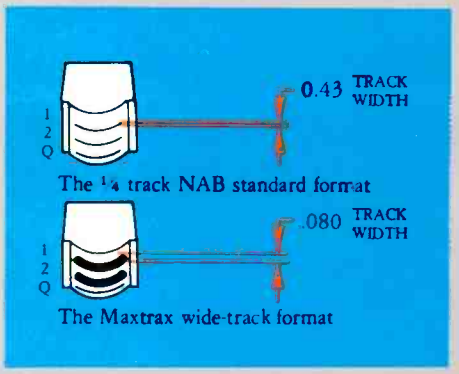
Now that's really bothered us TOMCAT-makers.

So, we've come up with a solution: the new Micromax: the best of a TOMCAT, without the pain of it's price.

MICROMAX IS MORE THAN THE HIGH-TECH LOOK

Micromax's sleek, high-tech front panel only hints at the technology behind it. Our exclusive wide-track Maxtrax® stereo heads come standard because they give you more tape signal and less tape noise. If your tape library is ¼ track (NAB standard), no problem — we've got an optional set of playback heads to get you over the hump until you can take advantage of our better-sounding MAXTRAX format. Naturally, the heads are fully adjustable and mounted in beefy, precision cast assemblies. The cartridge guides guarantee accurate, repeatable positioning. The deckplate is thick aluminum alloy, precision milled and surfaced.

The D.C. controlled capstan runs in sealed microfine bearings, and is driven by a servo/belt system developed from computer disk drives. The result is superb wow & flutter specs. The conventional pinchroller solenoid was eliminated (and thus the damaging heat) and replaced with a simple D.C. servo/motor that assures optimum, adjustable capstan-to-tape pressure and remarkably rapid starts and stops. Center-supported by a floating ball bearing race, the pinchroller self-aligns to prevent tape skew.



Nearly twice as much track width with Maxtrax. The bottom line is better sound.

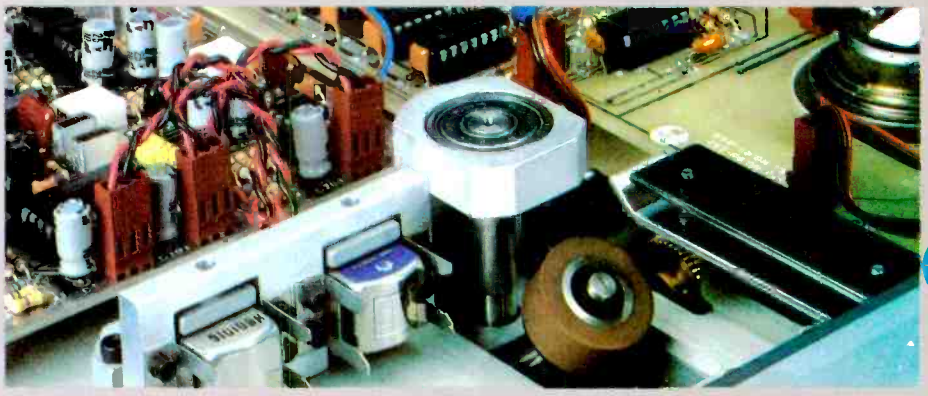
THE ELECTRONICS ARE JUST AS IMPRESSIVE.

With Micromax you've got lots of headroom, better transient response, a wide frequency response, and +24 dBm active, balanced program outputs. We've even designed in super-fast, low-noise CMOS control logic.

Micromax has the standard three auxiliary cue tones and a high-speed recue (22.5 ips!). You can set a replay lockout, and assign a machine number to the front panel LED display (which also doubles as the power indicator).

IT SOUNDS AS GOOD AS IT LOOKS

The sound of Micromax isn't something that can be described with specs though: you have to hear it to appreciate it — a red-hot, crystal clear top-end, a fat, punchy low-end. Micromax can instantly put much better sound on-air for you. Now! Regardless of your station's choice of carts.



Lots of technology and performance secured to a rugged, compact chassis-built to take abuse.

BUILT FOR THE REAL RADIO WORLD

If the above isn't enough, then maybe you should know that there isn't a machine around that's easier to keep running (even our own TOMCAT). All of the electronics are on three accessible boards and the elegantly simple mechanics couldn't be easier to get to for routine inspection and maintenance. Micromax is totally RFI-immune, and consumes only 7 watts, running! Because the attractive case doesn't require any ventilation slots and screens, there's less dust to worry about. The compact design lets you have two across in only 3½" of rack space (playback version, the Recorder is coming soon). Of course, Micromax is pin-for-pin compatible with our TOMCAT.

The Cartcue splice finder/eraser. The fast 30 ips speed and better depth of erasure gives new life to old carts.

FOR THOSE WHO CAN'T WAIT.

If you've skipped ahead to find out the price — fine: $1,445.00. FOB Carlsbad, California where it's entirely manufactured. Now go back and read about everything that you get — that is, if you're not too busy fixing a broken cart machine.

Give us a call now at 800-874-2172. In California, call 619-438-3911.

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The *Choice* for More #1 Stations.

Strictly TV

By Carl Bentz, television editor

ICPM—More than a buzzword

Stereo aural television will give viewers enhanced sound with their pictures. When all works well, viewers should experience at least a pseudo-improved fidelity from the new aural imaging. Separation should approach, if not equal, that of FM broadcast. With the good, however, comes the bad, ever-present buzz, which will require greater attention than with monaural transmissions.

Murphy's law of broadcasting states that *No matter how close the station operates to the FCC rules, it's wrong!* The corollary for the law adds *Every viewer's television is perfect!* Oddly enough, the same applies to CATV. Loss or variation of color, picture or sound is always blamed on the transmission source. So, too, are problems such as buzz, when saturated colors, titling and rapid luminance transitions occur in the picture.

Complaints of TV sound buzz may, however, result from both station and receiver faults. Any stage within the transmission/reception chain that exhibits a degree of commonality between video and audio is suspect. For example, from a common amplifier stage, as in multiplexed TV transmitters, LPTV systems, microwave repeaters and CATV systems, sync and video may cause a 60Hz buzz in the audio of the viewer's set. Separate audio and video amplifiers that are powered by the same dc source may cause a crossover of sync/video information to the audio, if the drive to the video amplifier is too great. Obviously, the two situations may occur in the home television as well.

The TV transmitter system is not without fault. Inadequate filtering of the visual sidebands near the aural carrier may result in buzz on the home receiver. Incidental carrier phase modulation (ICPM) within the transmitter may also cause the problem, even when separate aural and visual amplifiers are used with separate power supplies.

When phase-modulated components within the video signal are transferred to the aural signal, the result is a low-frequency (ca. 60Hz) sound. Sync and vertical blanking components are prime causes. In normal monaural transmissions with typical mono receivers, narrow audio bandwidth circuits help to make the buzz component barely noticeable. The added subcarriers of multichannel TV sound add a complication, however. The higher the frequency of the subcarrier, the greater will be the vulnerability to sync/video-related noise components, or buzz.

FM is inherently less sensitive to amplitude changes, because of limiting stages and the type of detection that is used. In TV sound, just as in FM broadcast, equalizing or pre-/de-emphasis is used to reduce the high-frequency noise that would result from various sources, including thermal ones. In fact, thermal noise in the signal will increase by 6dB (doubled voltage) for an octave frequency increase (doubled). Thus, the stereo subcarrier for MTS will be more likely to experience problems than the regular (sum) aural; the separate audio program (SAP) channel will be worse than the stereo (difference) subcarrier; and the professional or engineering channel will be affected the most.

In the receiver

Most TV receivers in use today are designed after the *intercarrier* concept. In a single tuner (UHF and VHF count as one), a local oscillator signal beats with the received TV signal. Sum and difference signals result. As the set is tuned, the local oscillator frequency is changed, such that the resulting difference between the oscillator and received signals is better centered within the intermediate frequency (IF) response of the television. The sum signal is far enough away in frequency to be filtered out and may be ignored.

From the tuner, a single IF signal includes both visual and aural information. In the IF strip or amplifier section, the information is amplified and filtered with envelope-shaping to develop the best picture and color response. At the output of the IF strip, the visual IF carrier becomes a second local oscillator to recover the audio in an envelope detector. The 46.25MHz visual carrier, beating against a 41.75 aural carrier, results in a 4.5MHz or intercarrier sound signal. Any amplitude variation of the visual is removed by limiting stages of the FM system. Any phase variation, however, is transferred directly to the aural carrier.

The intercarrier design concept came early in TV history. Originally, a *split-sound* system of reception used two separate processing paths for audio and video information. Two factors, however, prompted a different solution. Tube technology, and its associated heat, made it difficult to design sufficiently stable circuitry for use in the 40MHz region. The additional components needed for the dual paths added expense to the receiver. Intercarrier operation allowed a single collection of components to be used. The lower component count cost allowed increased component quality for stability.

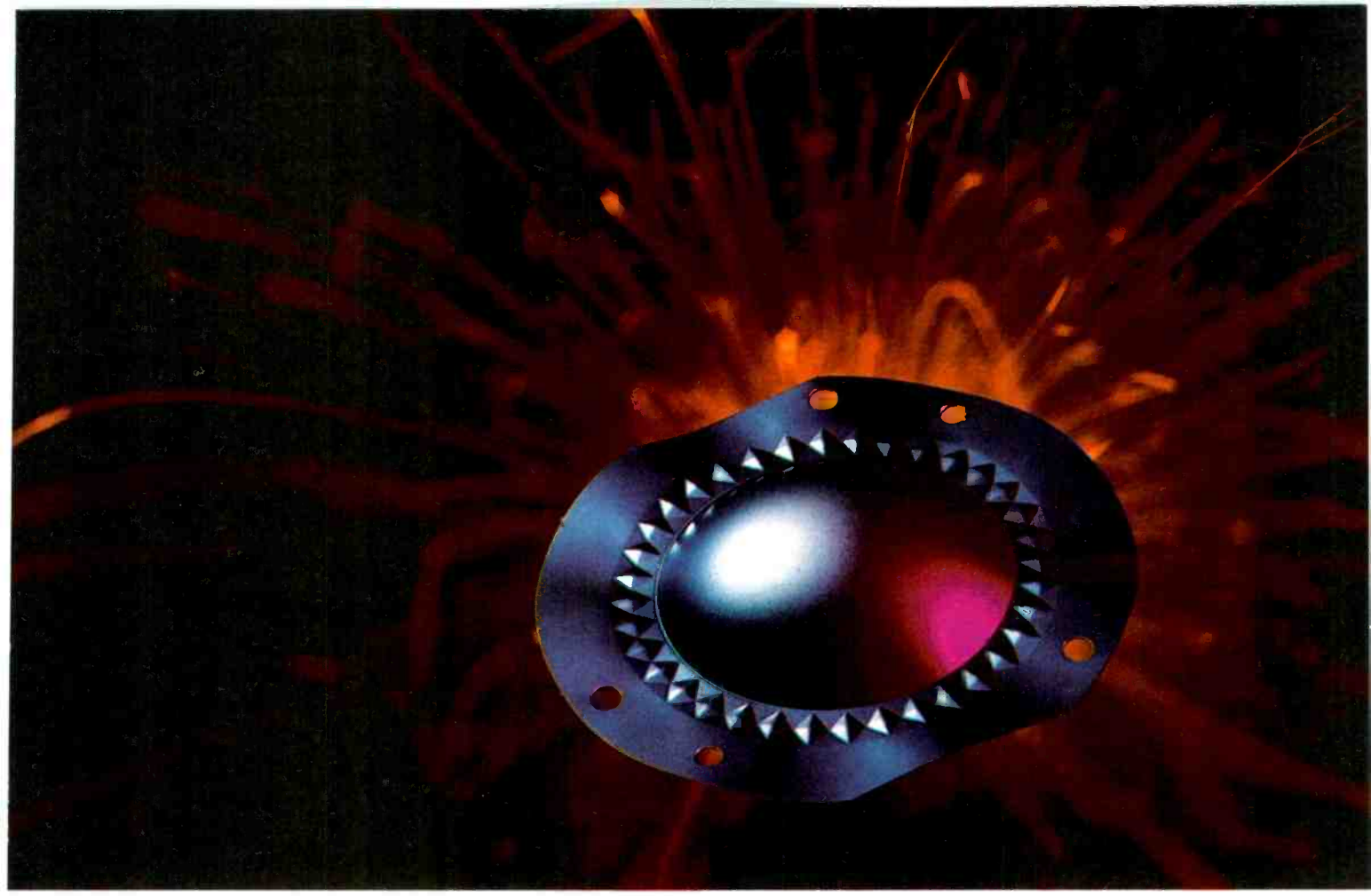
The inevitable result of intercarrier receivers is that the viewer's perfect TV set is flawed from the start, as far as buzz is concerned. Convincing several thousand viewers, however, could be difficult. Therefore, it is wise to correct as many problems at the transmission end as possible to reduce the receiver portion of the buzz.

At the transmitter

Within the plumbing between the transmitter final amplifiers and the antenna, several types of filtering are often used. Of these, the diplexer is a major source of filtering action to remove visual energy from the aural carrier location. Other filtering devices may also be used, as well as pre-correction networks.

Unfortunately, the visual amplifier is prone to introducing distortion. If the transfer curve for the amplifier were strictly linear, then nearly all problems would eliminated. (See

Continued on page 257

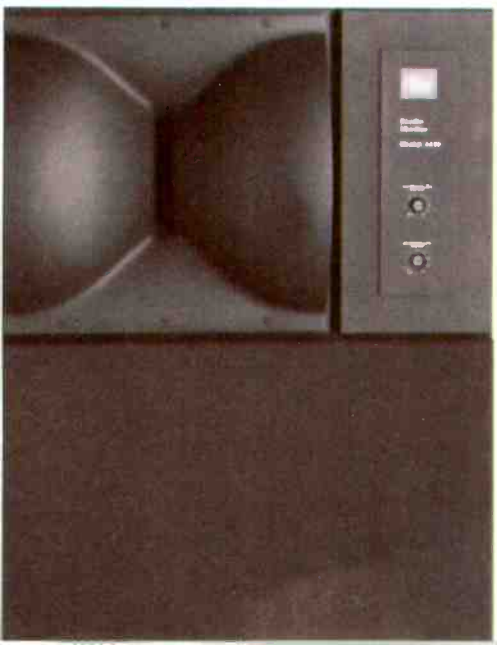


JBL's unique titanium diaphragm and "Diamond Surround" bring new purity and consistency to high frequency response.

IT TOOK JBL SCIENCE, A NITROGEN EXPLOSION, AND PURE TITANIUM TO GIVE YOU PERFECTED HIGH FREQUENCY SOUND.

High frequency sound has always fought with the technology that brings it to the ear. The driver diaphragm has been most vulnerable, pushed to the breaking point, unable to hold uniform frequency response.

JBL scientists decided to fight back. They exploded nitrogen into a remarkable metal, pure titanium, encircling their unique diaphragm with a vibration-absorbing "Diamond Surround," so revolutionary it warranted its own patent.



The result? A diaphragm that delivers and sustains a power and purity to high frequency response never before approached in the industry.

Perfecting titanium technology is just one of innumerable ways in which JBL science is re-shaping the quality of sound. From driving your studio monitors in a demanding final production mix, to critically evaluating in detail actual on-air signal quality, JBL audio systems are focused on the most exacting demands of the broadcast professional. To find out which system is designed to meet your specific requirements, contact your authorized JBL professional products dealer today.

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Part 2

Broadcast Engineering's Audio Proof Program

FM fidelity: Is the promise lost?

This article examines in detail the technical reasoning behind the **BE** audio proof of performance objectives outlined last month. The **BE** proof effort begins with FM radio and will be expanded to other services in the coming months. We welcome comments from readers on the concept of the program, which may include certification of outstanding technical facilities.

By Dennis Ciapura, **BE** consultant on technology

In the first part of this series, we traced the history of FM audio performance and proposed some tighter performance objectives for quality-conscious stations. In Part II, we will explain how the performance parameters were derived and suggest some measurement techniques.

In general, our specifications were based upon a balance between inherent FM performance limitations and a pragmatic approach to audio fidelity requirements for system transparency. A pragmatic approach is necessary because no transmission medium is likely to serve the needs of the super-purist who interconnects his audio components with 3-inch Heliax and runs ½-inch copper tubing to his speakers. Likewise, it would be futile to suggest performance objectives that defy the laws of physics relative to maximum expected system performance. To be realistic from a business standpoint, we also must consider the real-world requirement for effective average levels.

These factors form the triad of objectivity that drives FM broadcast system design:

- Practical fidelity requirements,
- Inherent system limitations, and
- The need for effective average levels.

The practical fidelity requirements were based upon actual experimental results reported by audio industry experts. Detailed references are provided in the bibliography so that you may review the background data and arrive at your own conclusions as to the validity of the assumptions behind the numbers. Like everything else on earth, audio fidelity does reach a point of diminishing returns. Improvement beyond a certain point will be noticed by too few listeners to be of any practical consequence.

General test conditions

The objective here is to simulate as closely as possible the normal operating conditions of the station. Although we suggest sampling the system at the transmitter output, a high-quality off-air demodulator would be ideal, if available. An off-air demodulator has the advantage of taking transmitter and antenna bandpass irregularities into account. The demod must, however, be very flat to avoid invalid results. For stations with a modern wideband antenna and near-zero VSWR indications under static and modulations conditions, an output line tap makes the most sense.

Frequency response

Absolute frequency response accuracy over the audible bandpass *does* make an audible difference. Researchers exploring subtle differences in audio amplifier designs have found that errors as small as 0.2dB can be heard.[1,2] As a matter of fact, if the levels and frequency responses of good-quality amplifiers are made equal, virtually no one can tell them apart in double blind testing. Therefore, very flat frequency response (strict adherence to the 75μsec non-Dolby or 25μsec Dolby pre-emphasis) is reflected in our performance objectives.

Because most musical content is in the 100Hz-10,000Hz range, we call for ± 0.2dB in the *superior* category and ± 0.5dB in the *excellent* classification. There is no reason that an FM broadcast system can't be absolutely flat

Technical excellence in broadcasting is a full-time effort that demands careful attention to all links in the broadcast chain. The **BE** proof program provides guidelines to help engineers measure their systems against the capabilities of current equipment. Shown in the photographs are (1) announcer Terri Moore in the control room of KLSI, Kansas City; (2) the 445-foot transmitting tower of KUDL, Kansas City; and (3) the program automation equipment room at KUGN, Eugene, Oregon.

over this range, and in view of how critical flat response is to overall fidelity, it pays to optimize.

Somewhat looser tolerances are specified at the frequency extremes in recognition of practical highpass and lowpass filter considerations relative to sub-sonic warp components and 19kHz pilot filtering requirements. Fortunately, relatively little program material reaches the extremes of the band, so small response variations have less audible impact. As long as excessive frequency-dependent limiting is not employed, a station meeting the superior objectives would do extremely well against program input in a double-blind test comparing subjective frequency response. Most listeners would also have a tough time hearing any difference with the *excellent* parameters.

Although there has been much controversy over whether or not more than 15kHz response is required for perfect fidelity, many researchers have found little, if any, advantage to extension beyond 15kHz or 16kHz, even when the signal source is available for comparison.[3,4] Snow's research results of 50 years ago are still valid today.[5] As a matter of fact, I have conducted experiments wherein program material was passed through *two* cascaded 15kHz toroidal lowpass filters and no audible change could be detected even with direct-to-disk sources and electrostatic headphones. A strong case, based on objective research, can be made for FM broadcast frequency response not being an audible limitation, if the response *within* the passband is optimally flat.

This is especially true of stations equipped with late-generation audio

Midwest puts on a great show because it uses the best components

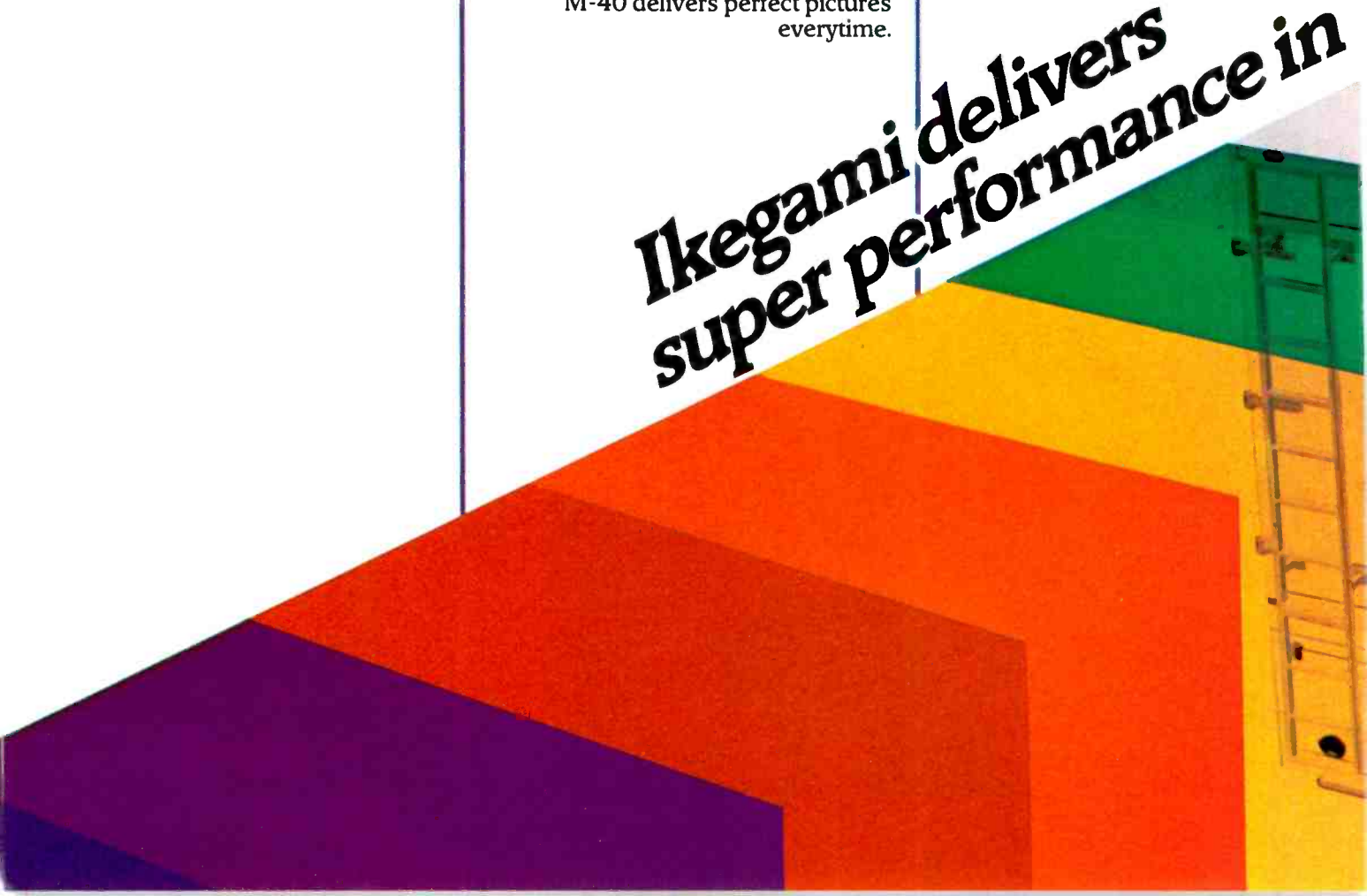
One of the reasons that the Midwest M-40 Series is the most advanced class of large mobile teleproduction units available today is our policy of only using the finest components. This "no compromise" design philosophy ensures a system of superior quality and reliability. Our M-40 units give you up to 47 feet of unparalleled technical and creative capacity. Because we only use the best components . . . from companies like Ikegami.

Ikegami HK-322 automatic color cameras make Midwest picture perfect

In the M-40, we wanted the ability to produce the best possible pictures. So we selected the HK-322 as a basic building block of the system. When the position as the world's most popular field camera passes from the Ikegami HK-357A, it will be to the HK-322. This fully automatic color camera sets the new standard for picture resolution, signal-to-noise ratio and registration accuracy. Standard computer set-up takes much of the hassle out of preparing for remote telecasts. With the Ikegami HK-322, the Midwest M-40 delivers perfect pictures everytime.

Ikegami HL-79E Series plays dual role for Midwest units

The Ikegami HL-79E Series camera was selected for use aboard the Midwest M-40 because it can handle two separate functions with superlative results. Although it's renowned as the perfect hand-held camera, the HL-79E Series can easily be converted into a field camera that produces higher quality images than many other manufacturers' top-of-the-line studio models.



This exceptionally fine performance is due to Ikegami's painstaking attention to detail. Designed to meet the most rigorous performance standards, the HL-79E Series also offers optional automatic set-up, either via its own set-up computer or by interface into the HK-322 set-up computer for total system integration. With the HL-79E Series, Midwest's M-40 offers you the versatility required to produce network quality productions in any circumstances.

Ikegami 9-Series color monitors give Midwest "true to life" pictures

Ikegami 9-Series Color Monitors are standard in the Midwest M-40 mobile unit because of their superb resolution and ability to reproduce colors that are amazingly life-like. This performance is unmatched by any other monitor in the world. Since the 9-Series monitors use In-Line Gun CRTs, they provide more than excellent colorimetry and

fantastic resolution. They also offer high stability, unit interchangeability, low power consumption, and convenient pull-out circuit panels. By using the Ikegami 9-Series, the Midwest M-40 can reproduce colors that are true to life.

Midwest road shows

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processors, which do a superb job of preserving the high end while protecting against overmodulation. Because the super processors have most frequently been used as heavy artillery in the loudness wars, many users are not aware of how beautiful a psychoacoustic picture these units can paint when used with lower input levels, and a little audio artistry.

The recommended method for measuring response is as follows:

- Feed test tones into the line inputs used for music sources.
- With AGC voltages switched off, select a console level near 0VU that produces a convenient modulation level (50%, for example, at 300Hz).
- Vary the input frequency and record the difference in signal

Performance objectives

- System in stereo mode.
- Input signals applied to console line input(s) used for most program sources.
- System output sampled and demodulated at transmitter antenna output.
- All processing and EQ left in line and adjusted as usual.
- Operating level defined as 0VU or equivalent at console.

Frequency response
Conditions

- AGC voltages switched off, not simply bypassed. Unfortunately, not all processors provide this feature. In such cases, use the *bypass* mode.
- Any convenient modulation level between 50% and 100%.
- Input level as required to maintain reference modulation level.
- Response error expressed as input level deviation required to maintain reference modulation level, compared to the 75μs characteristic for non-Dolby stations or 25μs characteristic with Dolby encoding.

*Superior performance**

- ± 1dB 30-15,000Hz
- ± 0.5dB 50-15,000Hz
- ± 0.2dB 100-10,000Hz

*Excellent performance***

- ± 2dB 30-15,000Hz
- ± 1dB 50-15,000Hz
- ± 0.5dB 100-10,000Hz

*Superior performance is the first proposed **BE** spec representing the maximum performance capability of a state-of-the-art FM stereo facility.
Excellent performance is the second proposed **BE spec. Although it is tighter than the FCC numbers, it is attainable by almost any properly engineered station with typical equipment.

Distortion
Conditions

- AGC switched on, input levels as required to produce specified console levels. De-emphasis in.

Superior performance
at standard operating level

- THD = 0.3%, 30-7500Hz
- IMD = 0.3%, 60Hz & 7kHz, 4:1
  at operating level + 10dB
- THD = 0.5%, 30-7500Hz
- IMD = 0.5%, 60Hz & 7kHz 4:1

Excellent performance
at standard operating level

- THD = 1% 50-7500Hz
- IMD = 1% 60Hz & 7kHz, 4:1
  at operating level + 10dB
- THD = 1.5% 50-7500Hz
- IMD = 2% 60Hz & 7kHz, 4:1

Audio clipping
Conditions

- Same as for distortion tests except that the input level is increased until left/right channel clipping is observed on an oscilloscope at the indicated test frequencies.
- Clipping level is defined as that level above operating level (0VU) required to produce visible clipping as the input level is increased.

Superior performance

- 30-5000Hz + 15dB

Excellent performance

- 50-5000Hz + 10dB

Composite clipping
"A" conditions

- Composite output of the monitor demodulator viewed on an oscilloscope with the transmission system in the stereo mode (and 19kHz pilot on).
- Clipping level is defined as that level above operating level required to produce visible clipping of the *total* waveform.

Superior performance

- 15dB at 1kHz

Excellent performance

- 10dB at 1kHz

"B" conditions

- Switch pilot off, view waveform clipping as defined above.

Superior performance

- 10dB at 7.5kHz
- 5dB at 15kHz

Excellent performance

- 10dB at 7.5kHz

Noise
Conditions

- Measured at each stereo audio channel output with all processing equipment in the line and adjusted for normal operation.
- Noise level is referred to the output level produced by an input signal at 0VU at the console.

Superior performance

- – 60dB, 30-15,000Hz unweighted, de-emphasis in.

Excellent performance

- – 56dB, 30-15,000Hz unweighted, de-emphasis in.

Separation
Conditions

- Measured at each stereo audio channel output with all processing equipment in the line and adjusted for normal operation.

Superior performance

- 40dB, 400-15,000Hz
- 30dB, 30-400Hz

Excellent performance

- 36dB 400-15,000Hz
- 30dB 50-400Hz

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generator output required to maintain the exact same modulation level.

- Compare the recorded results to the standard pre-emphasis curve in use (25μsec or 75μsec) to calculate the frequency response error.

An alternate method would be to feed the test signals at a low enough input level to keep the total modulation down around –20dB (excluding pilot) and measure the response at the de-emphasized audio outputs. This produces quicker results because response is read directly and no calculations are required. Obviously, this is not quite as accurate as the traditional method described above, because the monitor's de-emphasis networks will have some small error. If exact testing shows that the system is a little off and corrective EQ is required, the de-emphasized output route is a convenient adjustment tool. When everything looks flat, the final check can then be made by the traditional modulation sensitivity-vs-frequency method.

Distortion

Our distortion tests are based upon twin objectives:

1. Keeping the test tone frequencies low enough so that at least the second harmonic of the highest audio frequency input will fall within the system's 15kHz passband. Therefore, no test time will be spent making harmonic distortion measurements at frequencies where the harmonics have been filtered out in the stereo generator, and possibly the test demodulator. Virtually everyone who has done an FM stereo proof is familiar with the phenomenon in which the distortion at 10kHz and 15kHz is the same whether the test tone is on or off. The test instruments are reading noise.
2. System performance is probed at two important levels:

- At operating level, because that is where most of the program energy is most of the time.
- At 10dB above operating level to be sure that most program peaks are cleanly reproduced.

When distortion measurements are being made, we have specified that the AGC voltages be switched back on. After all, that's the way stations broadcast, and that's what the listener hears. Excessively fast attack-time constants will produce low-frequency and IM distortion (in older limiter designs) and excessive high-frequency clipping will obviously increase high-frequency distortion. The newer limiters with adjustable limit/clip ratios and low-frequency distortion protection are an audio engineer's dream.

Although every chief engineer will have his own opinion as to what the optimum processor input level should be, high compression figures will make it more difficult to pass the +10dB distortion tests. Consider the fact that if 0VU on the console is right at the threshold of limiting (under these conditions 6dB-10dB of compression will be indicated with program material) a 7.5kHz input will be compressed by early 12dB due to pre-emphasis. If the level is increased to 10dB above operating level, 22dB of compression will result. Most systems should still provide fairly low distortion at 22dB of compression, although the 0.5% superior objective might be illusive. If 0VU at the console is 10dB above the threshold of limiting, the resulting total of 32dB of compression at 7.5kHz might let the signal get into the safety clippers.

There is definitely a point of diminishing returns relative to compression vs. loudness until the generation of distortion components pro-

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vides loudness with a *second breath*. We assume here that the folks who subscribe to that school of thought abandoned us after Part I, paragraph one, and we make no apologies for suggesting that clipping should not be a routine event.

Although the IM tests are relatively impervious to system noise, the THD tests are limited by the noise floor. If the noise is 60dB below 100% modulation (mono noise measurement), the S/N ratio of either stereo audio channel is about 54dB (10% pilot + 45% for one channel leaves 45% remaining for the second audio channel). When most modern mod monitors make the FM *Left* or *Right* noise test, 6dB is added to the actual audio S/N ratio to refer the noise level to 100% modulation, as specified by the FCC rules. Distortion test readings are, however, susceptible to the noise floor below the recovered left or right channel audio voltage, thus a 6dB impairment. Actually, the lower figure measured at the de-emphasized audio output terminals is what the listener hears.

If a station is just making present FCC specs, a 54dB S/N ratio at the audio outputs would amount to a 0.2% residual reading when making the distortion tests. Our 0.3% *superior* and 1% *excellent* performance objetives recognize this fact. If a low-frequency spectrum analyzer is available, the distortion components can be picked out of the noise, and readings down to 0.1% are possible.

It is a worthwhile goal to try and get the distortion products down to the noise level, and the noise level down to −56dB to −60dB at the audio outputs. Although THD and IM tests alone do not check dynamic instability problems like TIM, careful selection of high slew rate components in the audio chain and THD/IM figures down in the noise floor will leave an audiophile audience impressed.

Clipping

The clipping objectives target audio clipping at the audio output, and pilot clipping at the composite output. Either will obviously cause distortion on peaks. The audible consequences of such clipping range from harshness to gross peak distortion. Because peak energy in music falls off rapidly above 5kHz, and the most irritating distortion components of higher frequencies will fall out of the audible passband, the audio clipping tests stop there. At 15dB above operating level and 8dB of pre-emphasis at 5kHz, this is a fairly severe test. The 2-tone composite clipping tests are also demanding, but important. Pilot clipping is difficult to detect visually (on an oscilloscope). It looks like slightly less peak-to-peak amplitude of the pilot waveform as it rides on the composite audio wave peaks. The best way to ensure freedom from clipping is to vary the input to the clipper while watching the pilot on the main wave peaks to determine the clipper threshold. The threshold of clipping can then be noted and avoided.

The combination of very low distortion at operating levels and freedom from clipping at high peak levels under actual operating conditions results in audio transmission that is clean and open, with never a trace of harshness. It is the stuff that long listening spans are made of.

Noise

In many cases, system noise is the most frustrating parameter to bring under control. The opportunities for poor results are legion and the Telco/STL stories legend. Fortunately, many noise problems are in the STL and not the transmission system. Over the years, I have experienced more trouble with RFI in STL receivers and Telco closets than noise in transmitters.

Many engineers disconnect the Telco lines or microwave receiver and, upon finding that the noise goes away, conclude that the line or link is bad. A cavity filter on the microwave receiver antenna input or careful shielding of Telco loops can make a world of difference. If modulation monitor RFI infiltration is suspected, a quick test with a remote receiver will isolate the problem.

For many years, program source noise has been so much more audible than even a marginal FM station S/N that many engineers have become complacent about this area of performance. With CD digital source material proliferating, it's a whole new ball game. To make matters worse, popular home audio systems with sizzling highs accentuate any hiss.

Our *superior* objective reflects state-of-the-art transmitter performance (about −66dB) and assumes that the noise contribution from the audio chain and STL is minimal. Referenced to 100% modulation, −66dB noise at the transmitter means −60dB out of each audio channel. If the audio chain noise is kept down to −70dB or less, the overall S/N for the system will be close to 60dB. The *excellent* objective of 56dB is just 2dB better than that needed to make the FCC requirement. But every decibel of noise improvement is tough to come by.

Although 56dB-60dB of dynamic range doesn't look very impressive in this digital age, it's important to bear two facts in mind. First of all, limited

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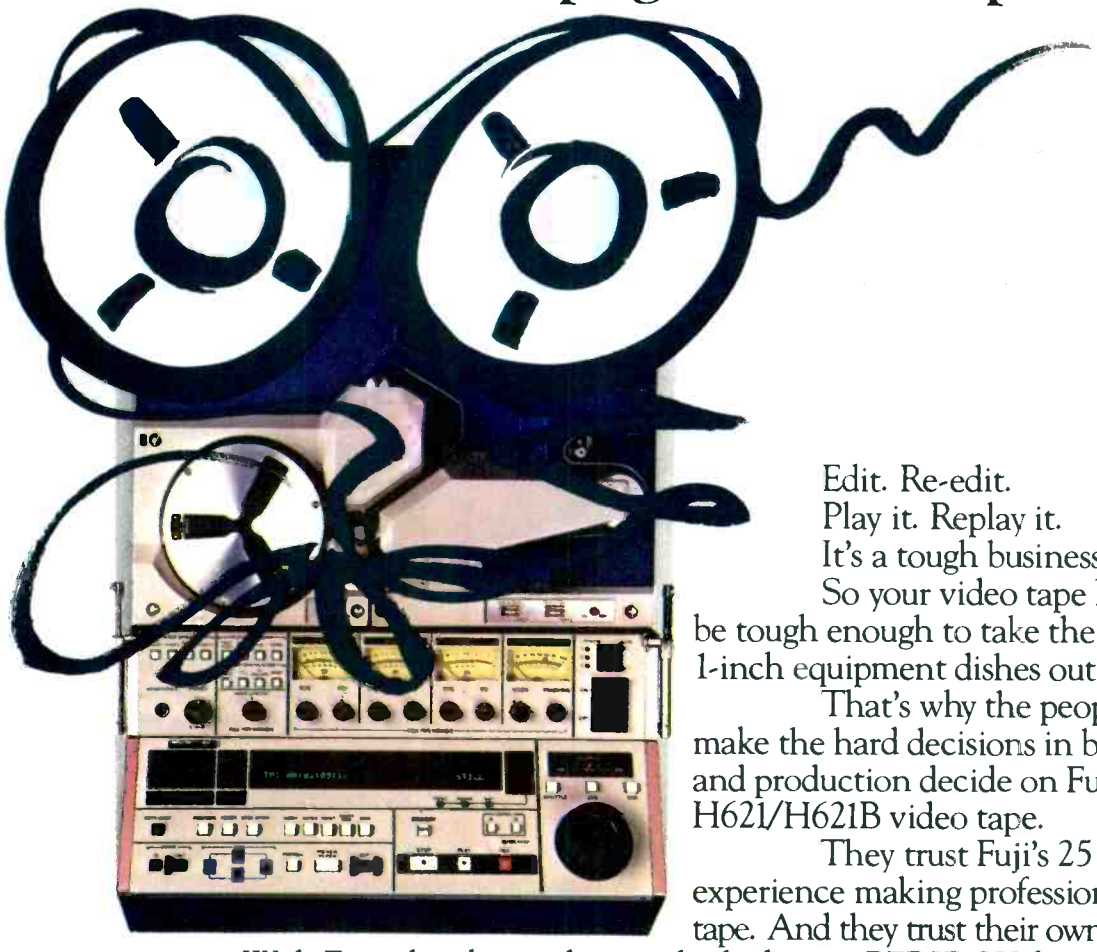

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dynamic range isn't a limit at all unless the program input exhibits greater dynamic range.[6] Most program material in most formats stays within a 20dB range most of the time. Another key factor is that the apparent loudness continues to increase as the threshold of limiting is exceeded and compression begins. The limiter may present a peak modulation barrier, but loudness forges ahead as density increases. Therefore, a station operating program levels a few dB under the threshold of limiting can present a somewhat greater *apparent* dynamic range than is electrically possible.

A more important question is whether a 60dB S/N ratio provides a low enough noise floor at a receiver playing at high levels in the home. This leads to the subjective determination of how high is high. However, millions of audiophiles have found similar S/N ratios quite acceptable in Dolby-equipped tape decks. In practice, if one monitors a well-engineered FM station during a quiet period between program segments and adjusts receiver volume so that the residual noise is just perceptible at the listening position (assuming full receiver quieting), a considerable din will be generated when the next segment reaches full volume. The hardest part of arranging this demonstration is finding a period of true silence, devoid of higher noise floors from various sources, especially if the console operator tends to leave pots open.

Stereo separation

The **BE** proof separation tests are made in the traditional manner by feeding tones into one channel while measuring the leakage into the other. Our low-end separation objectives are looser than for mid- and high-frequencies in recognition of the non-directional acoustic properties of long audio wavelengths, and the fact that the bass is usually mixed to center for disk production. In large orchestral recordings employing 2-microphone techniques, lower frequencies end up in both mics, even when not intentionally mixed to mono, because of the long wavelengths involved. In view of this, it seems silly to strive for more low-frequency separation than we have recommended.

In the mid- and high ranges, we look for more separation than the FCC specifies to preserve stereo imaging. Program sources rarely provide greater than 30dB of separation, so we suggest 6dB to 10dB more than that to ensure that the transmission system is not a limiting factor.

Recommended processing levels

Obviously, a station can test quite well under static conditions and sound mediocre because of excessive processing. Because it is the intent of the **BE** proof series to propose performance objectives that describe performance in the excellent to superior strata, completeness requires recommending processing targets. To that end, we suggest the following operating levels below the threshold of limiting (400Hz tone input to one channel):

- Classical/Fine Arts – 6 to – 10dB
- Beautiful Music/ Jazz – 3 to – 5dB
- AOR/Adult Contemporary – 2 to – 4dB
- Rock 0 to – 2dB

The fastest way to adjust for a given operating level-vs.-limiting threshold is to feed a test tone down one channel at a time, at a console level above 0VU equal to how far below the limiting threshold the operating level is to be. The processor input level for the active channel is then adjusted for the first sign of gain reduction. Normal console program levels will then cor-

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respond to the targeted processing levels.

Optimum release times (and other user-adjustable operating parameters) vary widely from model to model and often affect distortion characteristics. Therefore, these parameters should not be altered after data is measured unless the system is retested afterward. Tweeking time-constants and optimizing the performance of the audio chain is the area of individual prerogative that can give a system that extra measure of crispness and openness. One huge benefit of the conservative processing levels and fidelity objectives recommended in the **BE** proof is that the transmission system becomes transparent enough to make source and console improvements audible.

Final thoughts

Achieving the fidelity objectives suggested in the **BE** proof program means more than simply providing outstanding FM audio. It means that participating stations are back in the high-fidelity business and ready to meet the challenges of the digital audio world creeping up on us. FM broadcasters will find improved source signals widening the gap between FM quality and home system quality, unless FM can once again establish itself as a high-fidelity medium.

It may well be that a whole generation of broadcast engineers who were reluctant soldiers in the loudness wars will respond to the call to serve under a new and more rewarding banner. For listeners fortunate enough to have these stations in their area, perhaps Dr. Armstrong's promise of FM fidelity will not be a promise lost after all.

Editor's note:
We welcome feedback from station engineers and managers on the **BE** audio proof program. Please take some time now to fill out the post card questionnaire located at the back of this issue.

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Broadcast product manufacturers' addresses are featured beginning on page 104. In this section, you will find a complete, alphabetized index of mailing addresses for all of the companies listed in the *Product Directory*. Additional information appears in the index listing for the 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 company.

Broadcast product dealers/distributors are listed separately in the section beginning on page 144, followed by the states they serve and the products/services they provide. Ads for dealers/distributors in this issue appear either on the page of the company's listing or on the facing page. A complete explanation of this section appears on page 142.

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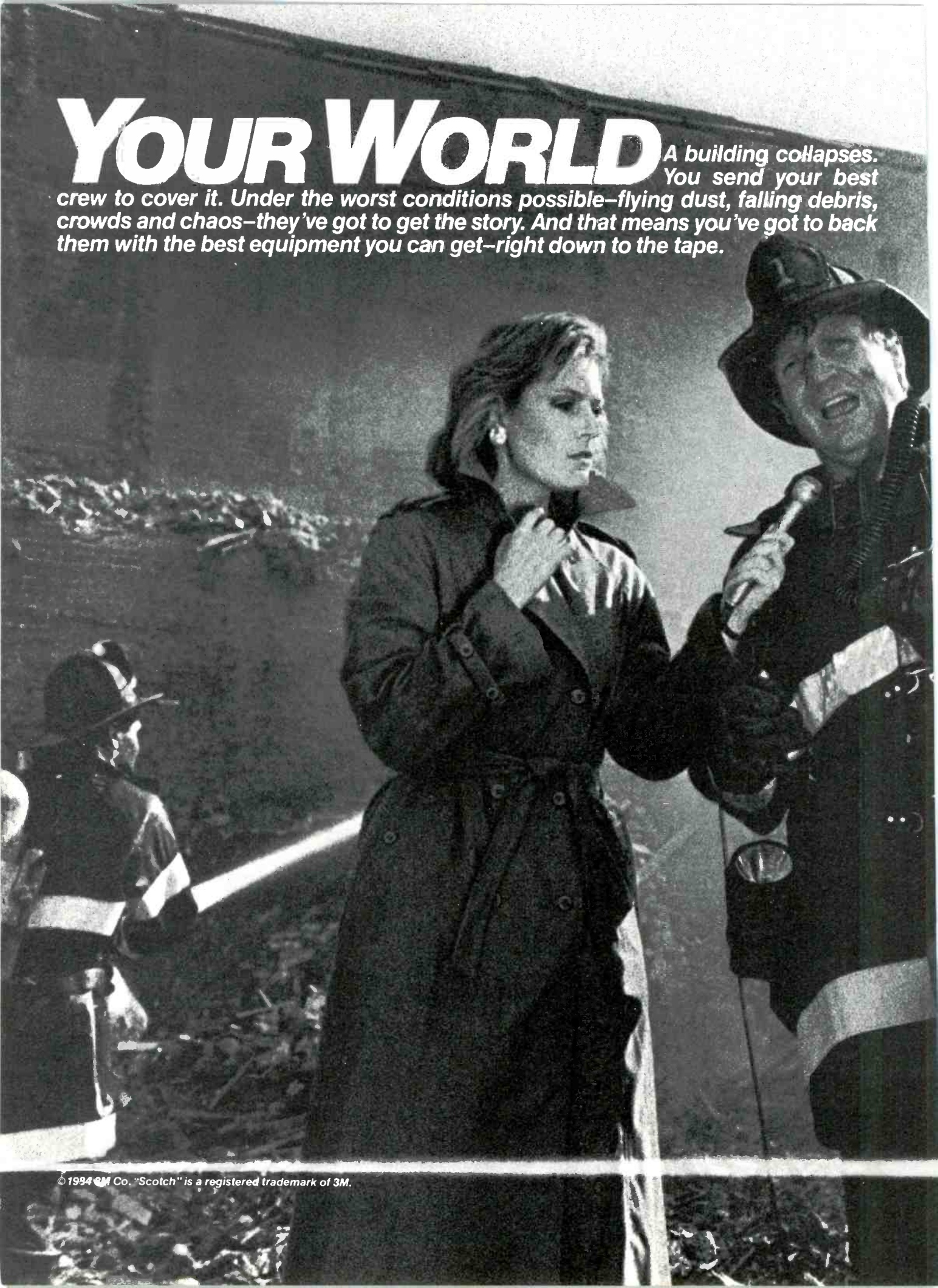
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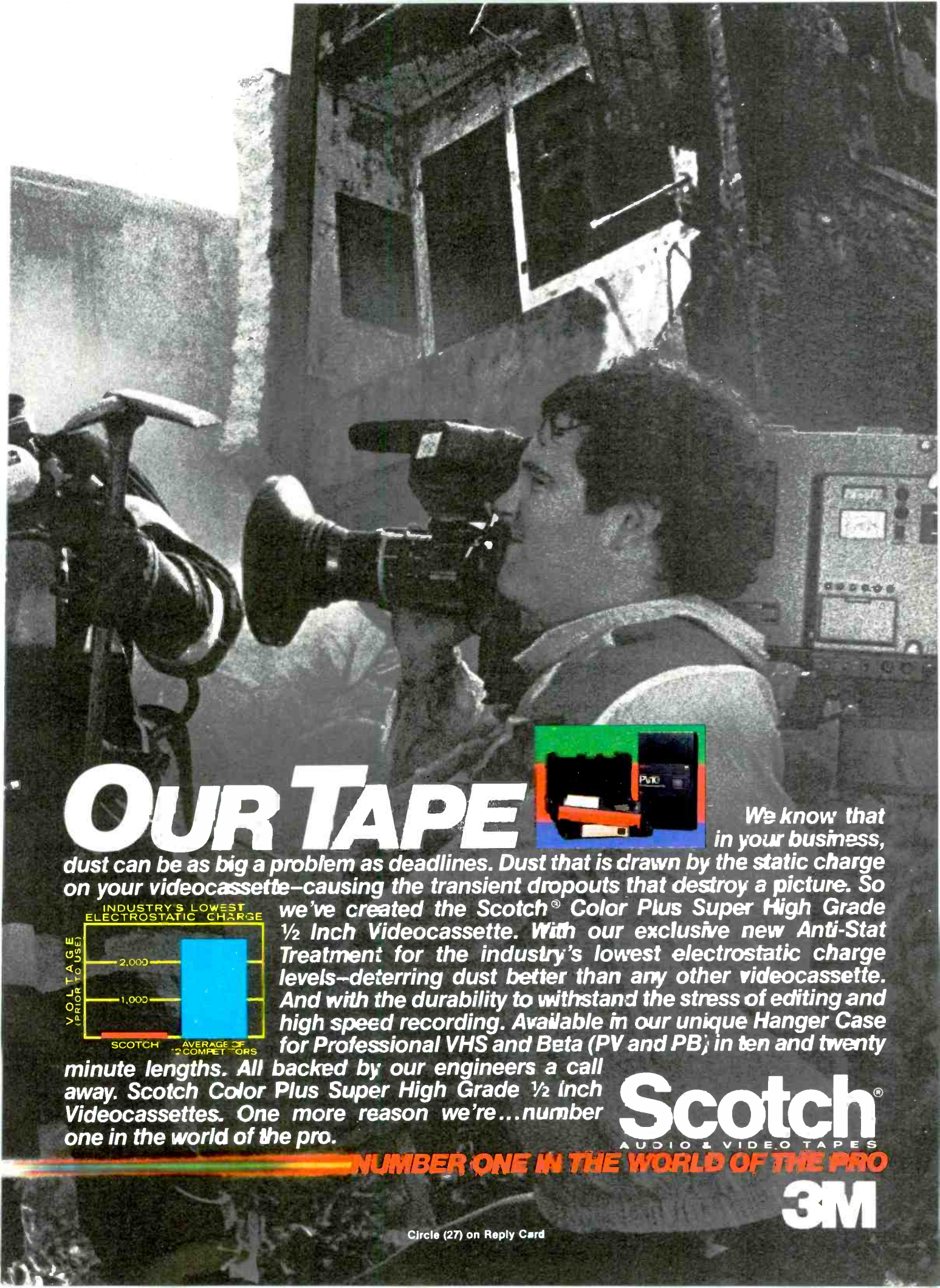

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Harris All-Solid-State SX Transmitters

Bring Back Your AM Listeners!

Contrary to what you may have heard, your "average" listener has a better-than-average knack for finding stations with a quality, transparent sound—even on a crowded dial. The lower your sound quality, the higher your audience tune-out.

Bring back those listeners with a Harris SX Series all-solid-state AM transmitter. Harris' exclusive Polyphase PDM modulation system provides a ***discernible difference in sound***... a crisp transparency that virtually eliminates listener fatigue and compares with the best FM has to offer. The specs will show you why. On the SX-5, for example, Intermodulation Distortion (IMD) is less than 1%!

SX Series transmitters (available in 1, 2.5 and 5 kW) also offer diagnostic capability through a microprocessor-based, pushbutton information center. You get instant readings on vital parameters.

Solid-state design means you'll save up to 46% more power than with other transmitters currently in use. That's a plus you'll see immediately in lower power bills.

And Harris has designed the SX Series transmitters for optimum AM Stereo performance. Strict AM Stereo compatibility was a major design goal right from the start—not an add-on or an after-thought.

Make the investment in quality sound that can build and hold your listening audience. For more information on Harris SX Series AM transmitters, contact Harris Corporation, Broadcast Group, P.O. Box 4290, Quincy, Illinois 62305-4290. 217-222-8200.

HARRIS

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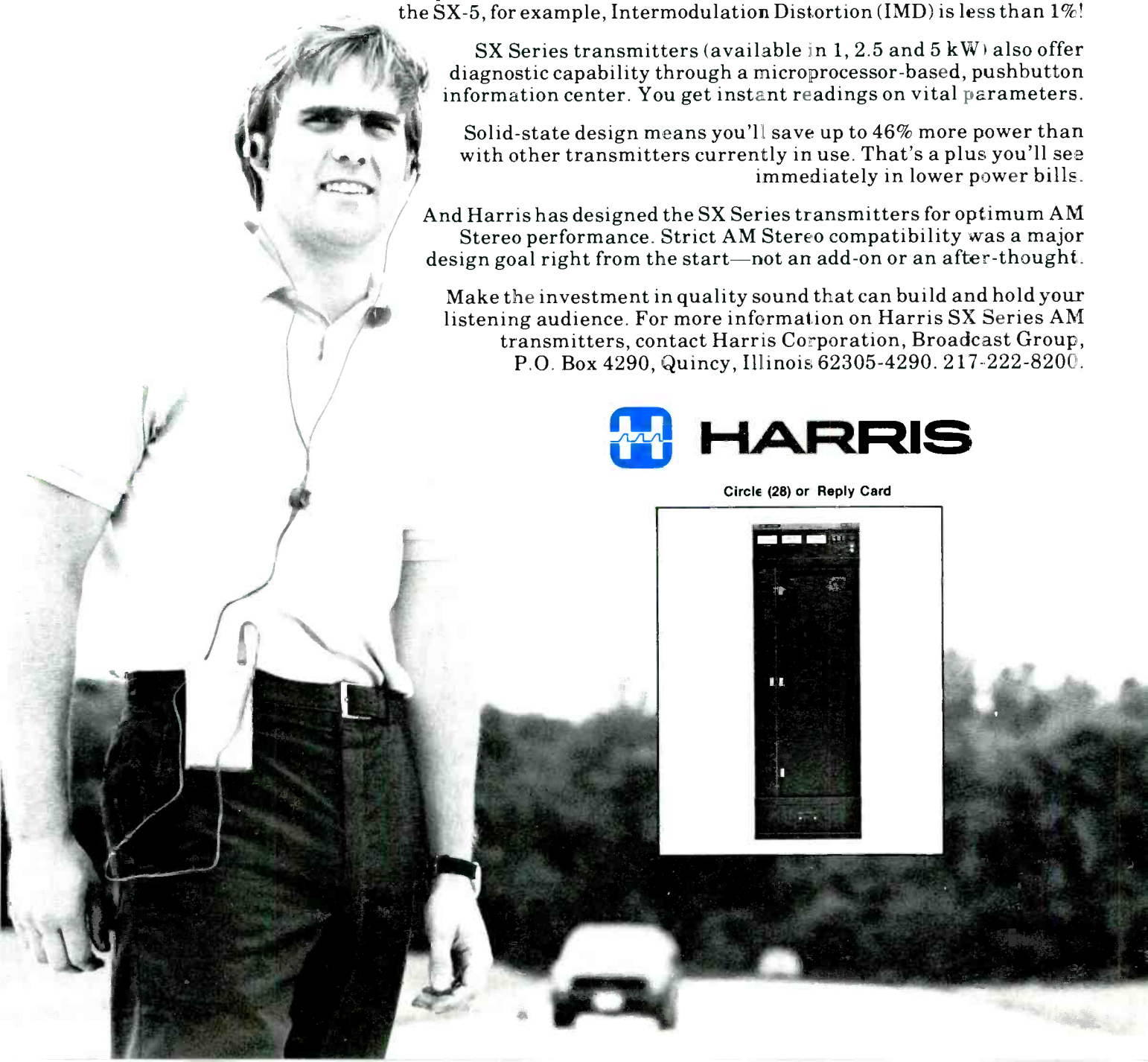

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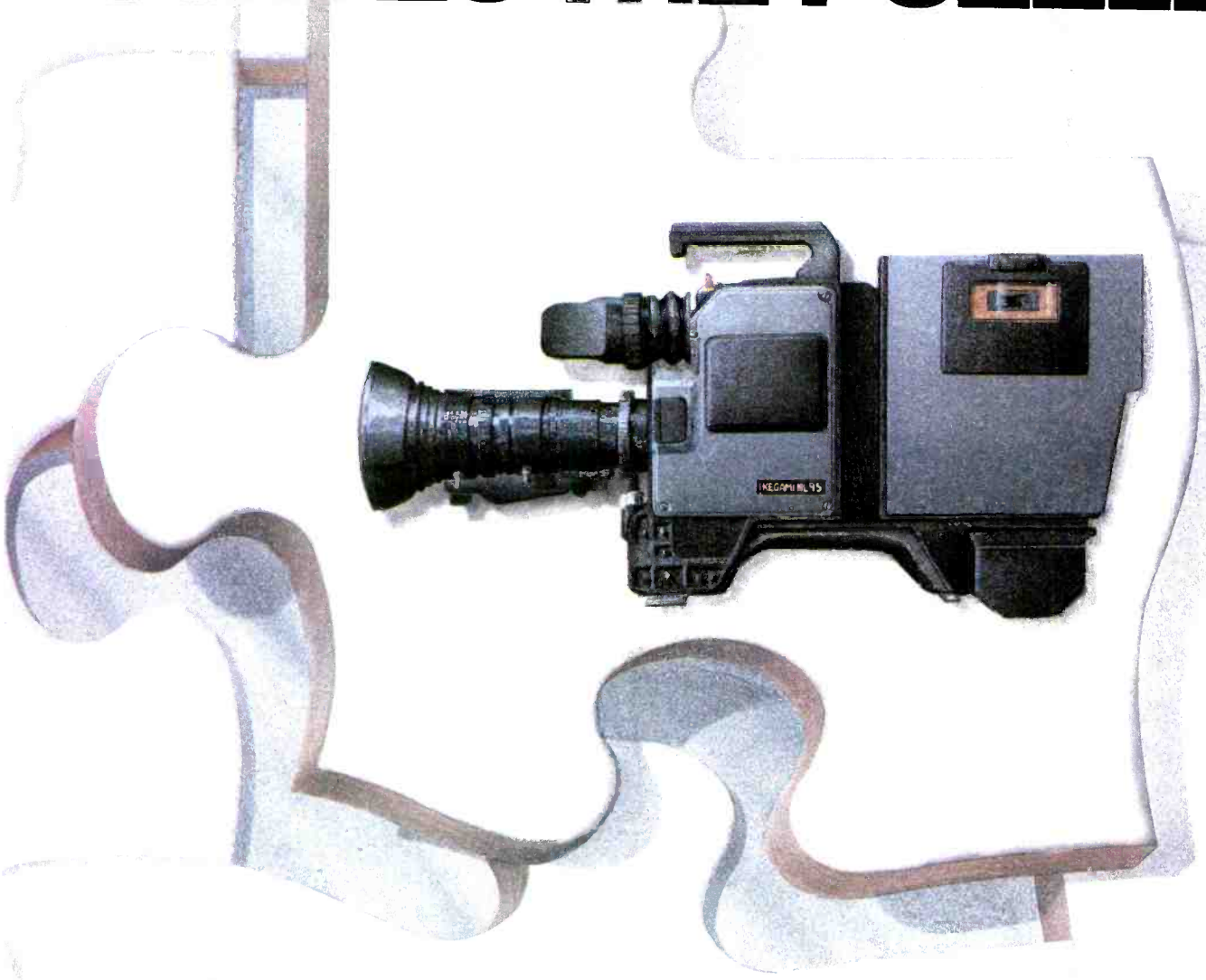

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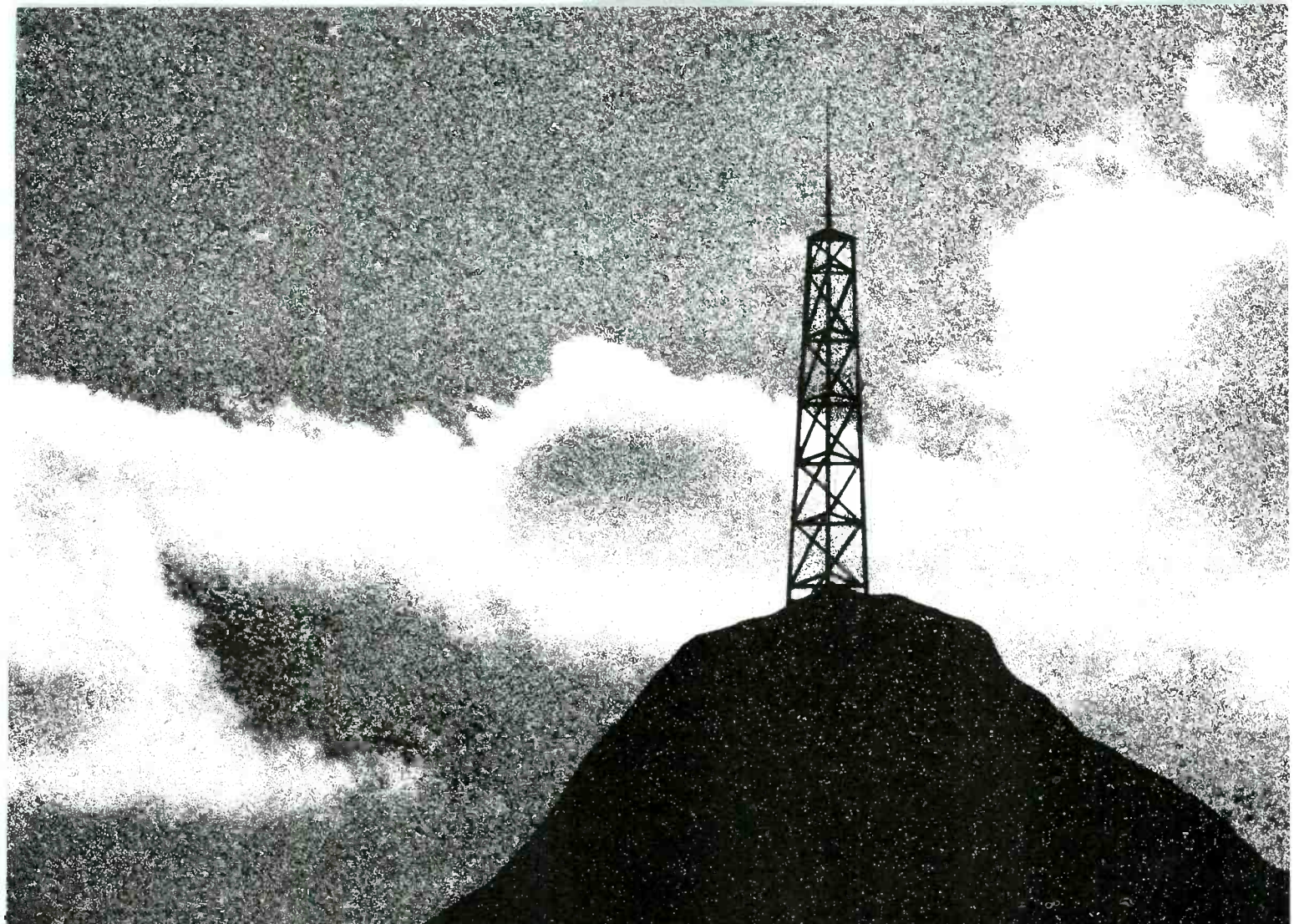

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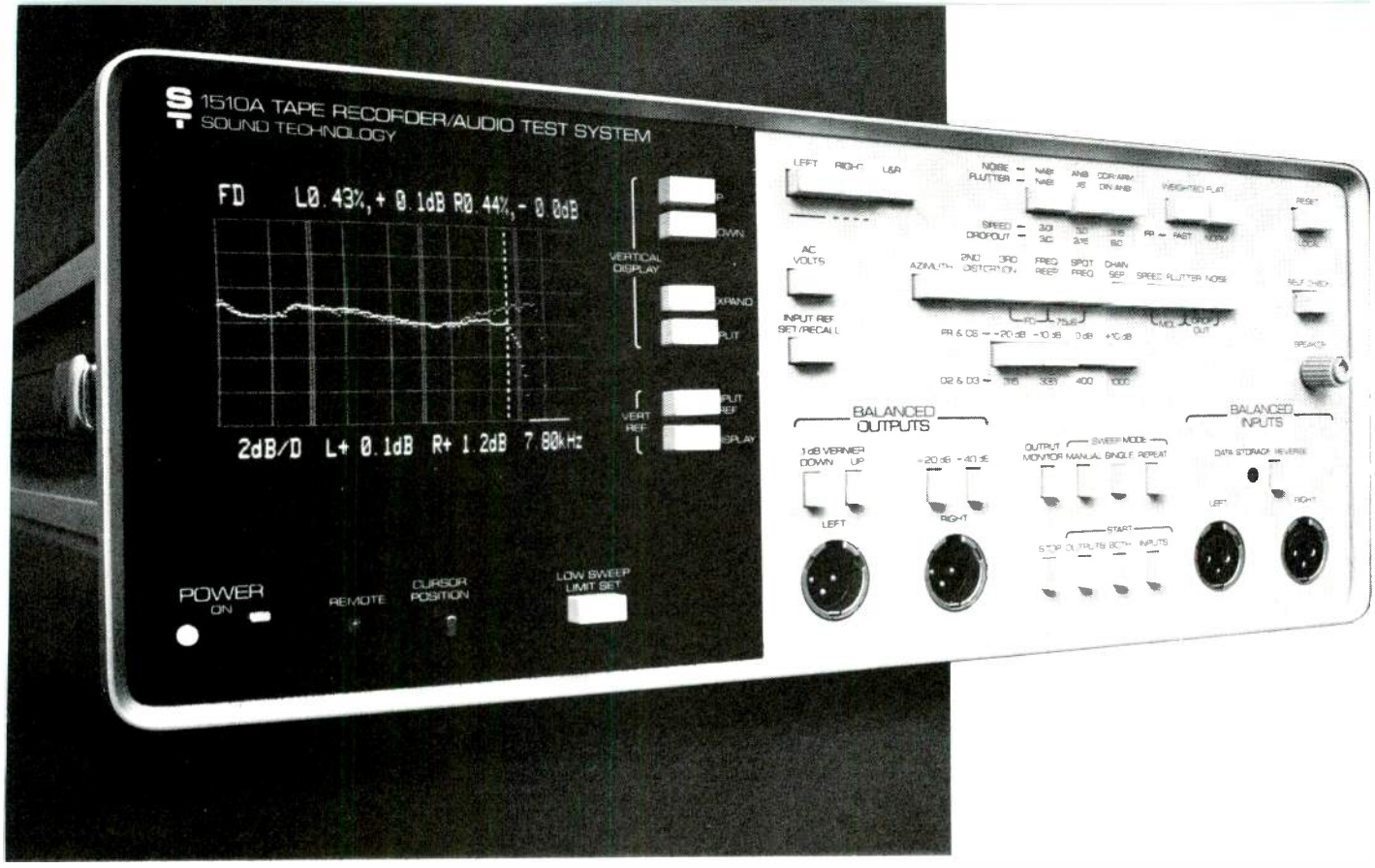

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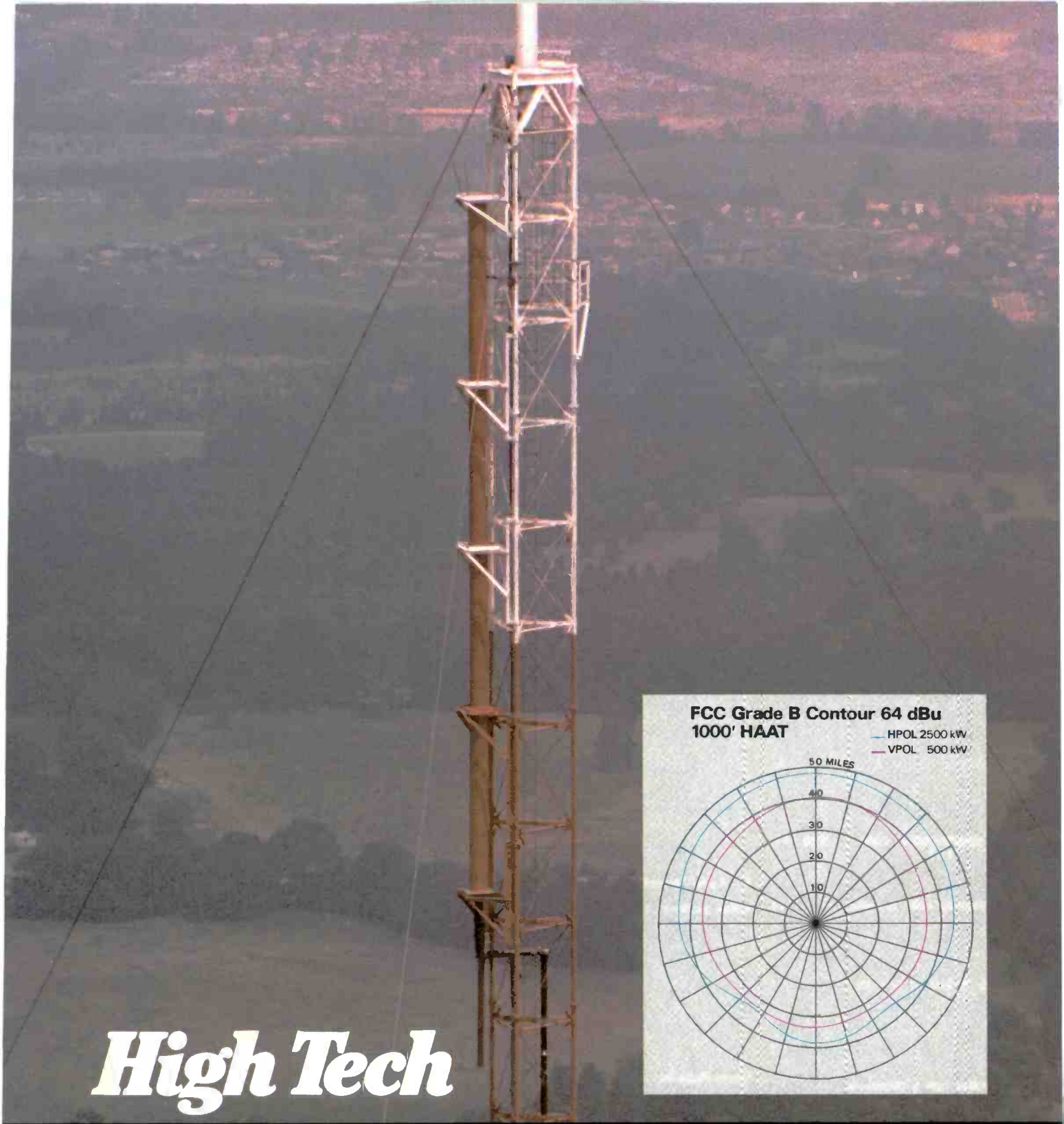

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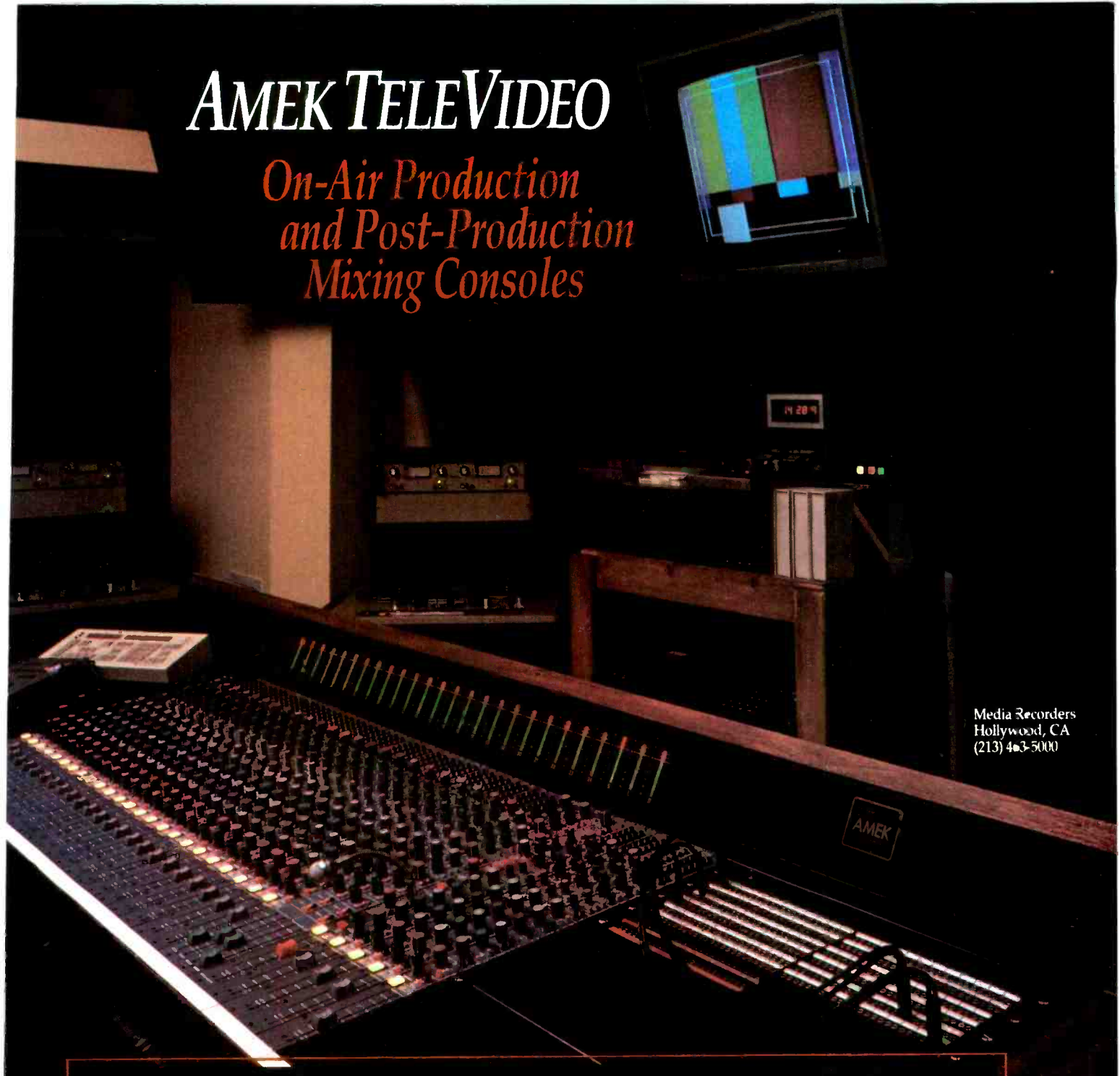

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- **M-1000** 8 Buss, 8, 16, or 24 Monitor
  8 to 32 Inputs
- **M-1000A** 24 Buss, 24 or 48 Monitor
  16 to 56 Inputs, opt. VCA Automation
- **M-2500TV** 24 Buss, 24 or 48 Monitor
  24 to 56 Inputs, VCA Automation
- **M-3500TV** 24 or 48 Buss, 24 or 48 Monitor
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- **M-5000AIR** 24 or 48 Buss, 24 or 48 Monitor
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  Motorized Fader Automation

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REGIS
The Zei-Mark Corp.

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The Durafilm Co.
Lipsner-Smith Co.
Neumade Industries, Inc.
Pioneer Technology Corp.
RTI-Research Tech. Int'l.
RTI Video Products Co.

Film Photographic and Processing Equipment

Neilson-Hordell Ltd.
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Audisar
Comprehensive Video Supply Corp.
dbx, Inc.
Global Specialties
Klark-Teknik Electronics
The Ken Schaffer Group, Inc.
Soundolier
Studio Technologies, Inc.

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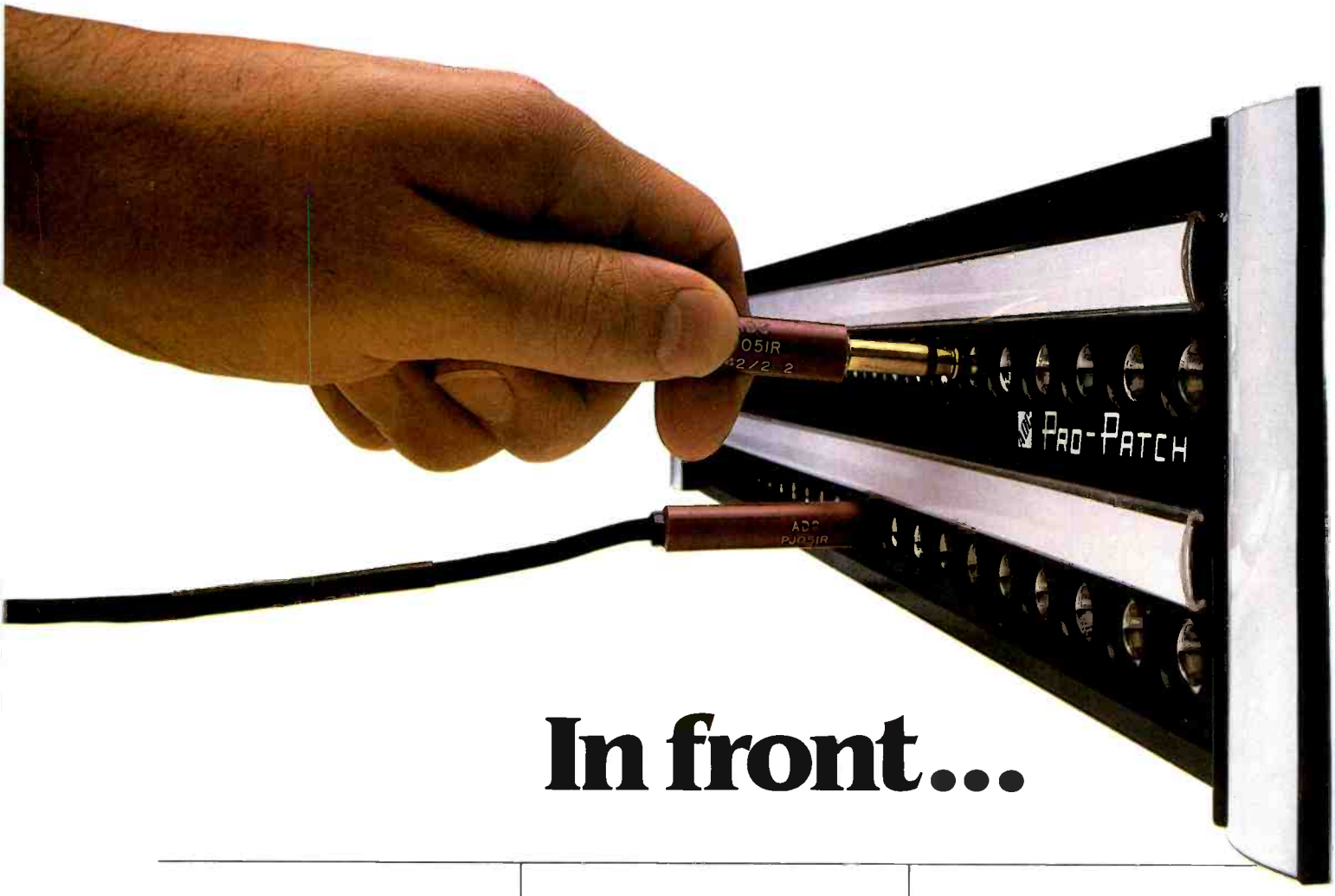

In front...

Your engineering staff has more important things to do than soldering patch panels. That's why you'll find a big advantage in ADC's 100% pre-wired Pro-Patch™ jackfields and Ultra-Patch™ panels. Featuring ADC's new split cylinder contacts, these units allow for fast, reliable, hassle-free installation.

Fully assembled, computer tested and ready to hook up, Pro-Patch and Ultra-Patch completely eliminate labor intensive soldering or crimping operations.

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Pro-Patch jackfields and Ultra-Patch panels cut installation time from hours to minutes and allow circuit or normalling configuration changes in seconds.

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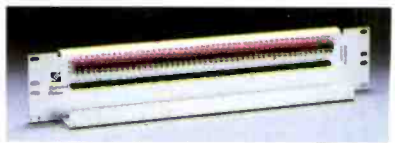
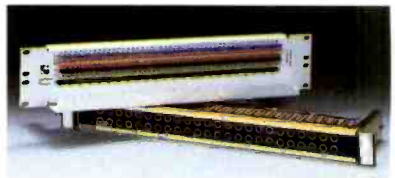
Since their introduction last April at NAB, Pro-Patch jackfields and Ultra-Patch panels have appeared in virtually every segment of the Broadcast industry.





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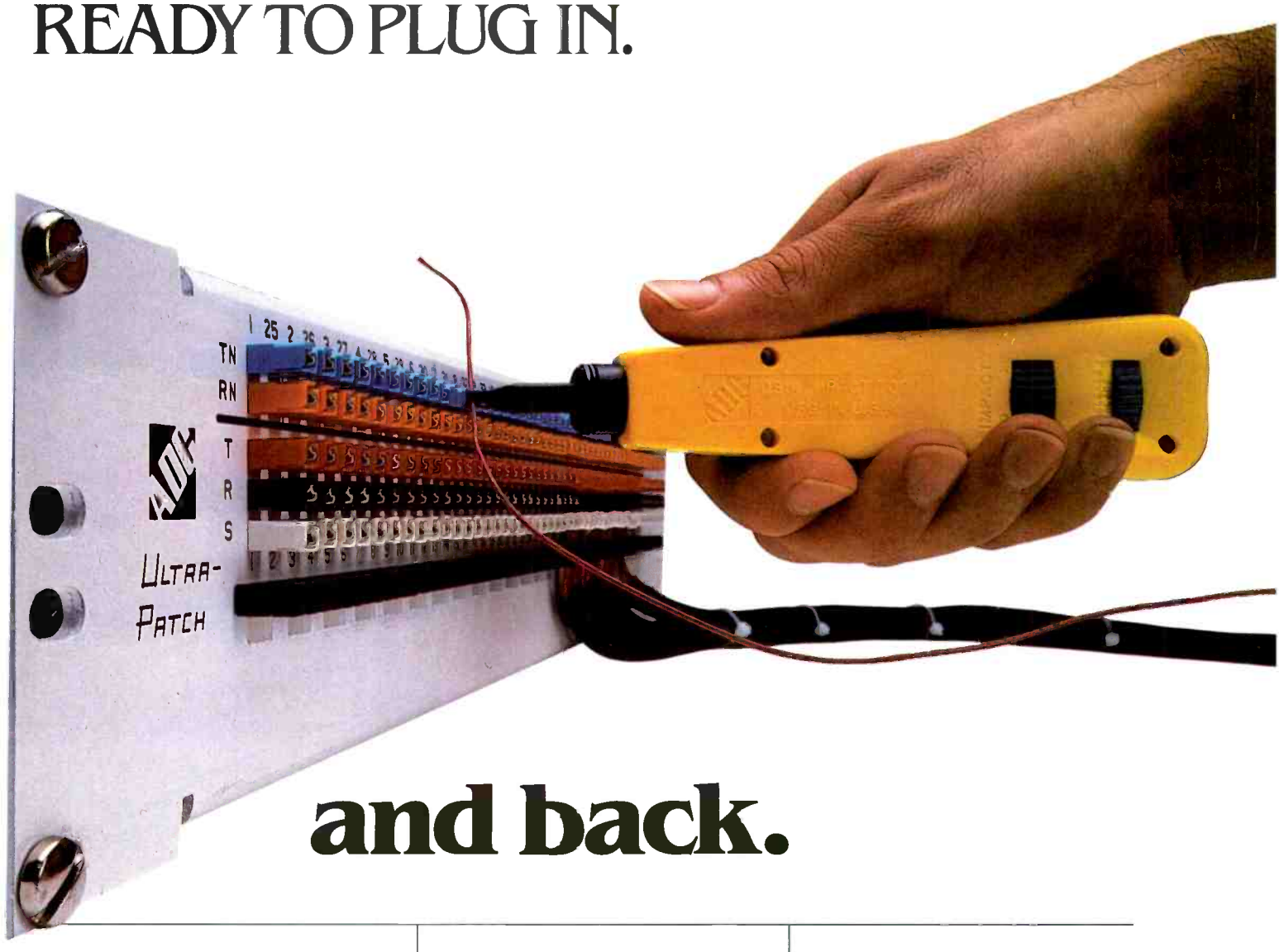
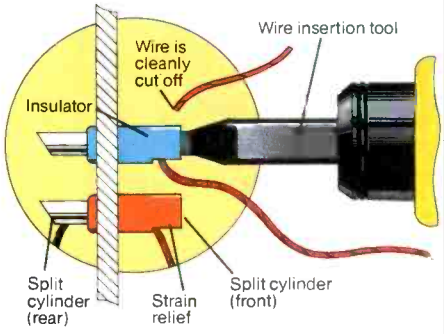


and back.



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Brush Industries, Inc.
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Re: DB Co. A Div. of Pierce Industries Inc.
Saki Magnetics, Inc.
Taber Mfg. & Eng. Co.

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Utility Tower Co.
World Tower Co. Inc.

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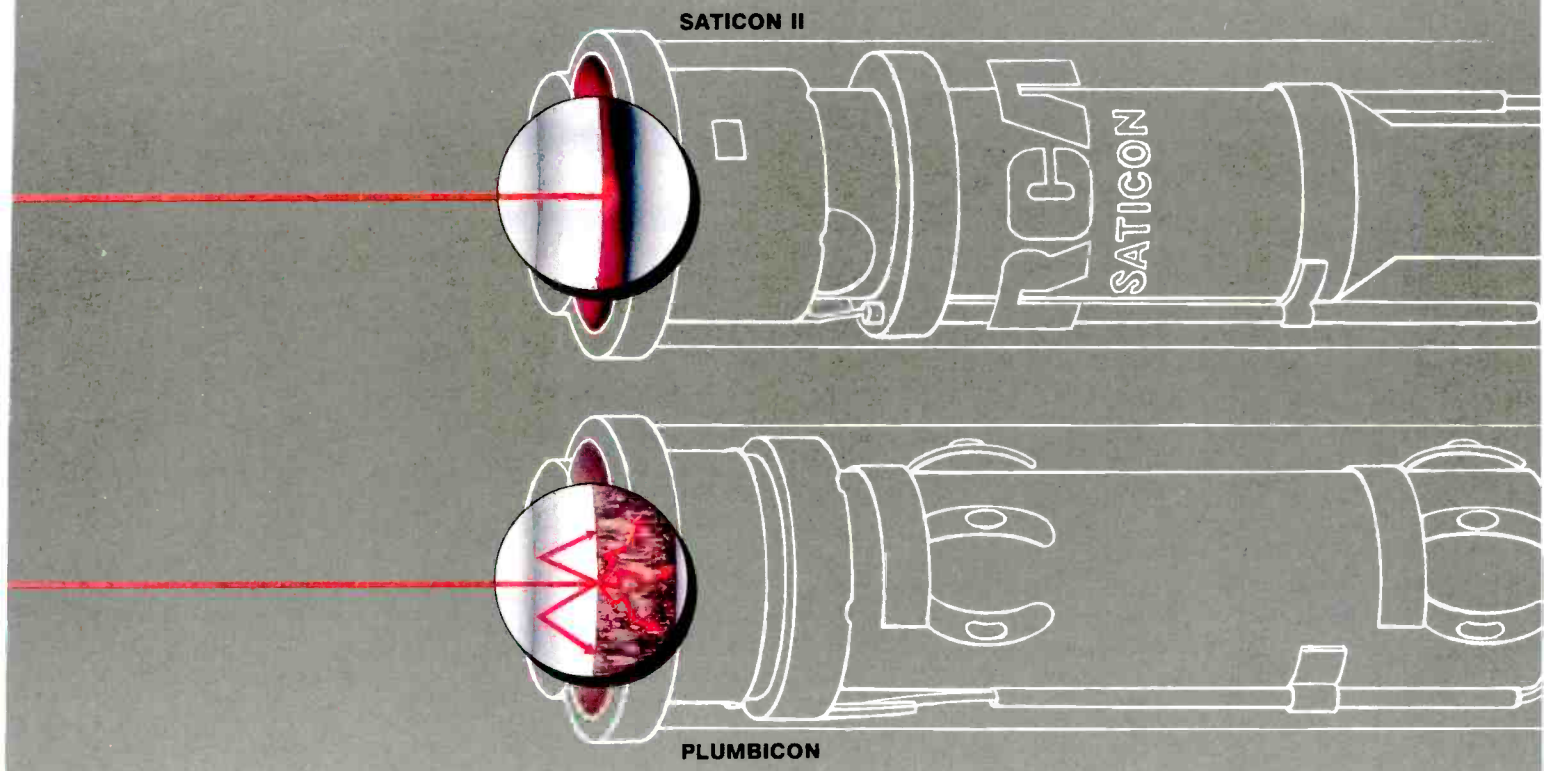
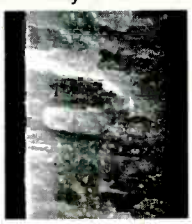
Part of your best work may never get past your camera tube.



What you see is not always what you get. The character and quality of your pictures are dependent to a significant degree on the camera tubes you use.

With high performance Saticon* II tubes, you can expect distinctively cleaner, clearer and sharper pictures. The reason lies in Saticon II's newly improved photoconductor. Developed through computer-aided processes, this thin glassy film allows the light to pass through without color diffusion or distortion. The end result is high resolution, distortion-free color, very low lag, high sensitivity and depth of modulation. Highlight memory (without red trail) is also significantly reduced with Saticon II.



With Plumbicon™ tubes, the polycrystalline structure of the photoconductor causes diffusion of incident light. The Plumbicon photoconductor is three times thicker than Saticon II's, which limits its resolution.

*Used by permission of trademark owner.

Make sure your best work gets past your camera and on the air by specifying high performance Saticon II camera tubes in your original equipment and for tube replacements.

For our guide to camera tube selection, contact your RCA distributor or write to RCA Camera Tube Marketing, New Holland Avenue, Lancaster, PA 17603. Or call (800) 233-0155. In Penna., phone (717) 397-7661. Overseas, contact RCA Brussels, Belgium. Sao Paulo, Brazil. Sunbury-on-Thames, Middlesex, England. Paris, France. Munich, W. Germany. Hong Kong. Mexico 16 DF, Mexico.

RCA

Take out the doubt.

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The Narda Microwave Corp.

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Information Transmission Systems, Corp.
Micro Communications, Inc.
Townsend Associates, Inc.

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Selco Products Co.
Soundolier

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Patch Bay Designation

Lamps, Stage/Studio Lighting

Bardwell & McAlister. Inc.
Colortran, Inc.
Desisti Lighting Desmar Corp.
Electro Controls
GTE Sylvania Lighting Products U.S. Lighting Div.
Kliegl Bros. Lighting
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Ercona Corp.
Film/Video Equip. Service Co.
Fujinon Inc.
GBC Closed Circuit TV Corp.
Alan Gordon Enterprises Inc.
JVC Co. of America
Schneider Corp. of America
Jos. Schneider Optische Werke Kreuznach GmbH & Co. KG
Warren R. Smith Co.
VMI-Visual Methods Inc.
The Zei-Mark Corp.

Lens Systems, TV Camera

Advanced Technology Div. Of Symbolized Systems, Inc.
Angenieux Corp. of America
Canon USA, Inc. Optics Div. 241
Century Precision Optics
Crow of Reading Ltd.
D.O. Industries, Inc.
Ercona Corp.
Evershed Power Optics
Frezzolini Electronics, Inc.
Fujinon Inc.
GBC Closed Circuit TV Corp.
Alan Gordon Enterprises Inc.
JVC Co. of America
Javelin Electronics, Inc.
Lenzar Optics Corp.
Schneider Corp. of America
Jos. Schneider Optische Werke Kreuznach GmbH & Co. KG
Warren R. Smith Co.
VMI-Visual Methods Inc.
Vicon Industries Inc
Western Group Mini-TP/Nova II
The Zei-Mark Corp.
Zellan Enterprises, Ltd.

Light Masking

Bardwell & McAlister, Inc.
The Great American Market

Lighting Dimmer Controls

AVAB America Inc.
B-W Lighting Systems (formerly Panoak Lighting)
CAE Inc.
Colortran, Inc.
Design Line Inc.
Desisti Lighting Desmar Corp.
Dilor Industries Ltd.
Electro Controls
Electronics Diversified, Inc.
The Great American Market
Kliegl Bros. Lighting
Lighting Methods Inc.
Lumitrol, Ltd.
Mole-Richardson Co.
L. E. Nelson Corp.
Omni Q Inc.
Packaged Lighting Systems
Ross-American Logic Systems Inc.
The Superior Electric Co.
Teatronics Inc.
Theatre Techniques Inc.
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B-W Lighting Systems (formerly Panoak Lighting)
Bardwell & McAlister, Inc.
Walter S. Brewer Co., Inc.
Cinema Products Corp.
Colortran, Inc.
Desisti Lighting Desmar Corp.
Electro Controls
Alan Gordon Enterprises Inc.
The Great American Market
Kliegl Bros. Lighting
LTM Corp. of America
Lowel-Light Mfg., Inc.
Manfrotto Lino & Co., spa
Matthews Studio Equipment, Inc.
Modulight Systems Inc.
Mole-Richardson Co.
L. E. Nelson Corp.
Osram Sales Corp.
Packaged Lighting Systems
Perrott Eng. Labs, Inc.
Phoebus Mfg.
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Teatronics Inc.
Ultimate Support Systems
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Comprehensive Video Supply Corp.
Cool Light Co., Inc.
Desisti Lighting Desmar Corp.
Dilor Industries Ltd.
Electro Controls
Frezzolini Electronics, Inc.
Alan Gordon Enterprises Inc.
Kliegl Bros. Lighting
LTM Corp. of America
Lighting Methods Inc.
Lowel-Light Mfg., Inc.
Matthews Studio Equipment, Inc.
Modulight Systems Inc.
Mole-Richardson Co.
L. E. Nelson Corp.
Osram Sales Corp.
Packaged Lighting Systems
PAG Power A Div. of PAG Ltd.
Perrott Eng. Labs, Inc.
Strand Century, Inc.
Teatronics Inc.
Theatre Techniques Inc.
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VDO-PAK Products

Lighting, TV Studio System

Peter Albrecht Corp.
Arriflex Corp.
Automatic Devices Co.
B-W Lighting Systems (formerly Panoak Lighting)
Bardwell & McAlister, Inc.
Bogen Photo Corp.
Walter S. Brewer Co., Inc.
Colortran, Inc.
Comprehensive Video Supply Corp.
Cool Light Co., Inc.
Design Line Inc.
Desisti Lighting Desmar Corp.
Dilor Industries Ltd.
DYMA Engineering, Inc.
Electro Controls
Alan Gordon Enterprises Inc.
Kliegl Bros. Lighting
LTM Corp. of America
Lighting Methods Inc.
Matthews Studio Equipment, Inc.
Modulight Systems Inc.
Mole-Richardson Co.
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Crouse-Hinds Co. Aviation Lighting
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Utility Tower Co.
World Tower Co. Inc.

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NOT ALL ROUTING SWITCHES ARE CREATED EQUAL...

DATATEK MAKES THE DIFFERENCE IN QUALITY–RELIABILITY–PERFORMANCE!

Industry-leading technical performance.
For example, maximum audio output is +30dBm without requiring transformers and noise is over 105dB below maximum output.

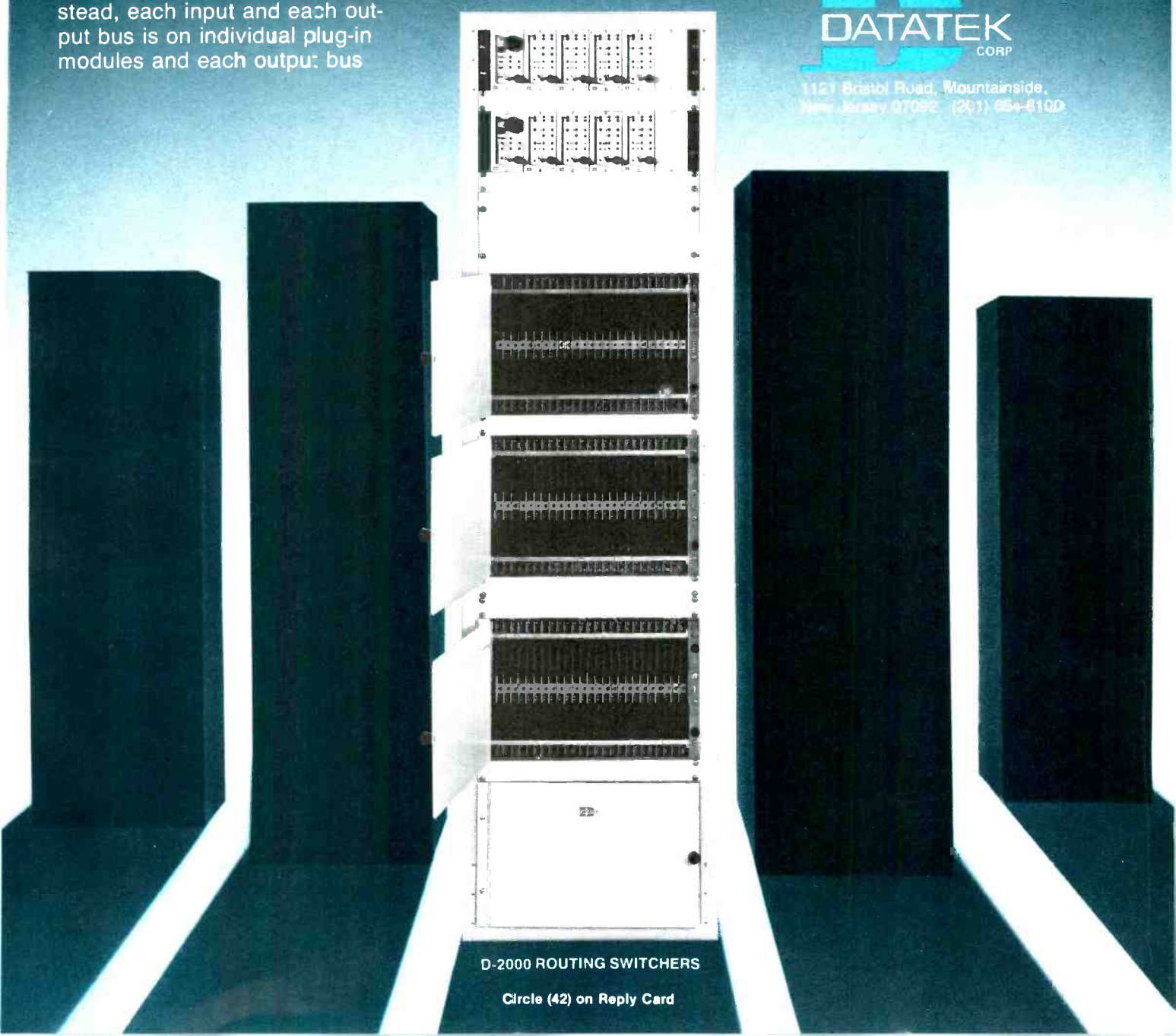
Inherent reliability.
For example, the D-2000 avoids putting multiple inputs and outputs on a common PC board, and avoids reliance on a central microprocessor system. Instead, each input and each output bus is on individual plug-in modules and each output bus has its own independent microprocessor control system. A fault therefore can only affect one input or one output and not the entire system.

Expansion Capacity to 500x500 Systems, with up to 8 control levels. There is no need to specify initially the ultimate matrix size.

Large Selection of Control Panels.
For example, there are over 30 different standard control panels, including individual pushbutton, keypad, alpha numeric and CRT matrix status display. Datatek can also design control panels for special requirements. Control is over a single coax line.

For More Information, Write or Call:

DATATEK CORP
1121 Bristol Road, Mountainside,
New Jersey 07092 (201) 654-6100



D-2000 ROUTING SWITCHERS

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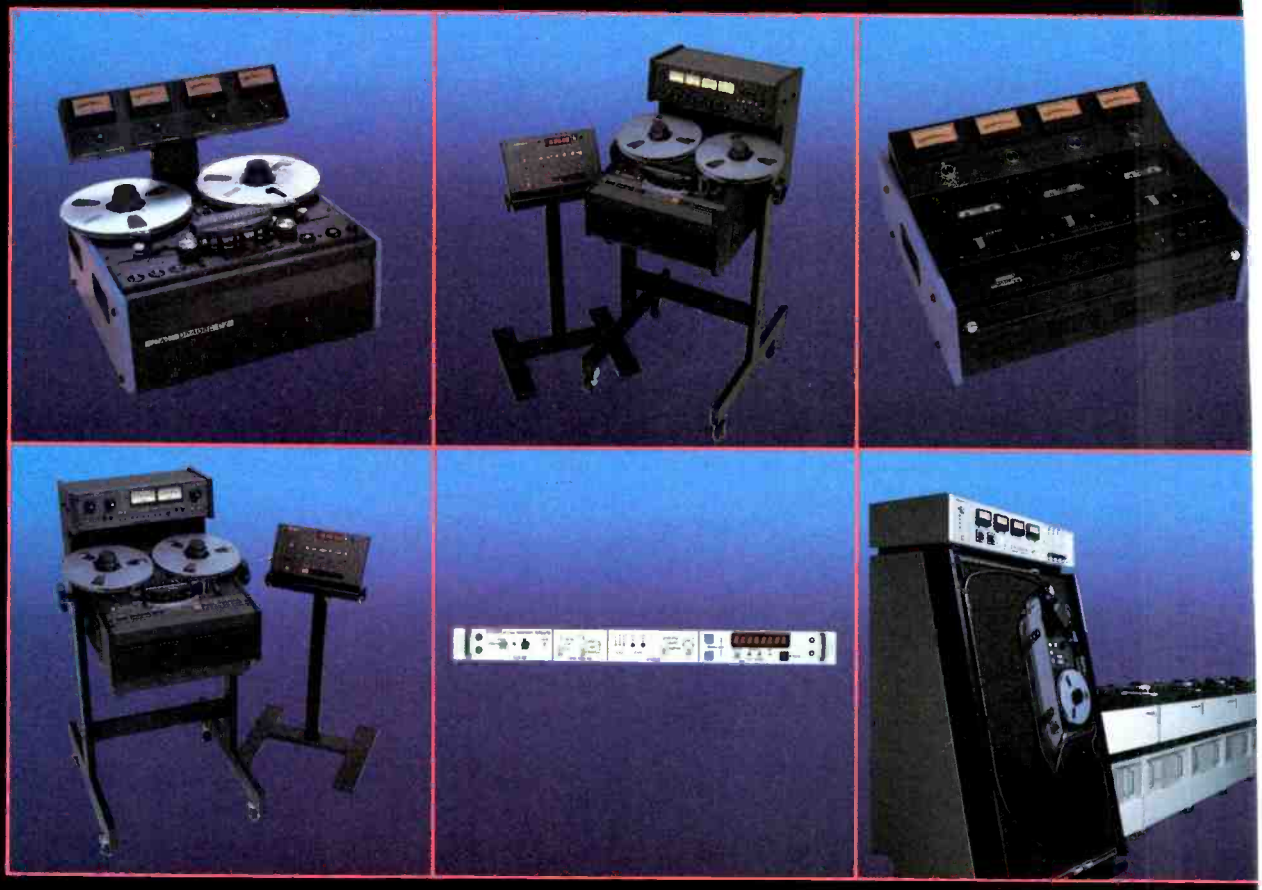
The DP-4050-OM *is an open reel master reproducer, capable of driving up to 28 cassette slave units at 8:1 speed. The OM is fully automatic, with rewind-to-cue and repeat functions, and is available in versions providing 3.75 and 7.5 ips, or 7.5 and 15 ips.*

The MARK III/4*, an affordable ½" 4-channel recorder for professional broadcast and audio post-production. It compares, feature-for-feature and spec-for-spec, with many more expensive ½" 4-channel recorders. And for top quality audio-visual programs, the BQII (a ¼" version of the MARK III/4) is the world's best ¼" 4-channel recorder.*

The DP-4050-C2 *cassette-to-cassette duplicator with two slave units, copies cassettes at 8:1 speed, duplicating both sides simultaneously in one pass, providing full stereo duplication. The C2 can be combined with additional slave units to reproduce up to 11 copies per pass, and will process a C-60 in under 4 minutes.*



The MARK III/2 *tape recorder delivers high performance at a price that will surprise you. It excels as a broadcast editing machine, or in studio mix-down and copy applications. The MARK III/2 features a single interface connector to SMPTE time-code-based editors, machine controllers or synchronizers.*

The EC-400 Series *options for pilot tone resolve applications, and the EC-100 Series "in-machine" chase synchronizer modules, are designed to optimize the unique high performance capabilities of Otari tape transports. These options are another example of Otari's on-going product development program designed to keep your audio systems ready for the future.*

The Otari DP-80 *is the only 64:1 audio tape duplication system that is capable of running a 7.5 ips master tape. The system can be configured with from 1 to 20 slave units, producing up to 2880 C-45 cassettes per hour.*

The "Super Analog" MTR-12. *The MTR-12 combines the advanced features of the MTR-10, with expanded reel capacity to 12.5 inches, important for recording studio and post-production applications. It is available in several formats, including the state-of-the-art ½" 2-channel for record mastering.*

The MARK III/8. *The most widely accepted ½" multi-track recorder for broadcast production, recording studio, and audio post-production applications. The MARK III/8 is available with a remote controller and an auto-locator for quick cueing and punch-ins.*

The MTR-20. *Otari's new "Super-Analog" with computer-controlled Record self-alignment. The MTR-20 features 4 speeds and 14-inch reels, with a transport specifically engineered for audio post-production; an application where precise machine control is a must.*

The MTR-90 *Master Tape Recorder, with its flawless multi-track transport is available for multi-channel music recording and audio post-production. Its pinchrollerless servo-controlled transport sets it apart from all other 8-, 16-, or 24-channel recorders.*

The ARS-1000 *and* ***BGM-1000*** *series reproducers are the most widely accepted reproduce-only tape machines. They offer long-term reliability and simple operation under the toughest conditions.*

The 5050 BII. *The industry standard audio machine for ¼" 2-channel or mono recording. The BII is unmatched for its sonic performance and its durability under demanding broadcast use.*

The MTR-10 *is the most advanced broadcast production recorder available from Otari. It gives you features and performance for tomorrow's audio, and is available in half- and quarter-inch formats; mono, 2-channel, or 4-channel.*

The new ***Otari MX-70,*** *the MTR-90's little brother. Fast, accurate and affordable for recording studio and audio post-production. The 70 sets the trend for the future: High performance, high quality, and low cost.*

"SOLUTIONS, SOLUTIONS, SOLUTIONS. . ."

We realize that your job can often be summed up by the phrase: "problems, problems, problems". For 20 years our job has been to provide solutions. Our unique size and structure allows us to do that better than anyone else in the business.

We're large enough to support a leading-edge research and development facility to keep our customers at the forefront of technology. At the same time, we're small enough to provide concentrated product support and individual service.

We're also small enough to be close to you and your job, so it's no accident our products reflect your needs. In fact, your ideas often end up in our new products. You could say our customers are our best designers. We're pleased to say they're also our best sales people.

Otari: The Technology You Can Trust. Otari Corporation, 2 Davis Drive, Belmont, CA 94002. (415) 592-8311.

Technology you can Trust. OTARI

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Micron Audio Products Ltd.
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Atlas Sound
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Audiotechniques Inc.
Beyer Dynamic, Inc. 98-99
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Cinema Products Corp.
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Alan Gordon Enterprises Inc.
Gotham Audio Corp.
Karl Heitz, Inc.
LTM Corp. of America
Matthews Studio Equipment, Inc.
Micron Audio Products Ltd.
Mole-Richardson Co.
Sennheiser Electronic Corp. 224
Shure Brothers Inc. 109
Sony Professional Audio
Telex Communications, Inc.
Ultimate Support Systems

Microphones, Hand Held/Mounted

AKG Acoustics, Inc. 188
Accusonic Systems Corp.
Audio Engineering Associates
Audio-Technica U.S., Inc.
Audiotechniques Inc.
Beyer Dynamic, Inc. 98-99
Bogen Div. Lear Siegler, Inc.
Bruel & Kjaer Instruments, Inc.
Calrec Audio, (Audio + Design/ Calrec, Inc.)
Comprehensive Video Supply Corp.
Countryman Associates Inc.
Crown International, Inc.
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Ercona Corp.
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Alan Gordon Enterprises Inc.
Gotham Audio Corp.
HM Electronics, Inc. 223
Marti Electronics
Panasonic Industrial Co. Audio Video Systems Div.
Schoeps/Posthorn Recordings
Sennheiser Electronic Corp. 224
Shure Brothers Inc. 109
Sony Broadcast Products Co.
Sony Professional Audio
TEAC Corp. of America 27
Telex Communications, Inc.
Vidaire Electronics Mfg. Corp.
West Coast Audio, Inc.

Microphones, Lavalier

AKG Acoustics, Inc. 188
alphaton Elektroakustik
Audio-Technica U.S., Inc.
Audiotechniques Inc.
Beyer Dynamic, Inc. 98-99
Bogen Div. Lear Siegler, Inc.
Coherent Communications
Comprehensive Video Supply Corp.
Countryman Associates Inc.
Crown International, Inc.
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Alan Gordon Enterprises Inc.
Micron Audio Products Ltd.
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Schoeps/Posthorn Recordings
Sennheiser Electronic Corp. 224
Shure Brothers Inc. 109
Sony Professional Audio
Telex Communications, Inc.

Microphones, Special Purpose

AKG Acoustics, Inc. 188
Accusonic Systems Corp.
alphaton Elektroakustik
Audio Engineering Associates
Audio-Technica U.S., Inc.
Beyer Dynamic, Inc. 98-99
Calrec Audio, (Audio + Design/ Calrec, Inc.)
Coherent Communications
Countryman Associates Inc.
Crown International, Inc.
Dukane Corp.
Electro-Voice Inc. 87
Ercona Corp.
Fostex Corp. of America 190
Alan Gordon Enterprises Inc.
Gotham Audio Corp.
Micron Audio Products Ltd.
Sennheiser Electronic Corp. 224
Shure Brothers Inc. 109
Sony Professional Audio
Telex Communications, Inc.

Microphones, Wireless

Audiotechniques Inc.
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Com-Tek Communication Tech.
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Nady Systems Inc.
Panasonic Co. Technics
Panasonic Industrial Co. Audio Video Systems Div.
The Ken Schaffer Group, Inc.
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Sony Professional Audio
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System Wireless Ltd.
Telex Communications, Inc.

Microwave Components

Amplica, Inc.
Andrew Corp. 61
Avantek Inc.
Broadcast Microwave Services, Inc.
Channel Master Satellite Systems
GEC McMichael Ltd.
International Microwave Corp.
M/A-Com MVS, Inc.
M/A-Com Microwave Power Devices
MCL Inc. 200
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Moseley Associates, Inc. 15
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North Hills Electronics, Inc.
Radio-Research Instrument Co., Inc.
Rockwell Int'l. Collins Transmission Sys. Div.
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Crow of Reading Ltd.
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Crow of Reading Ltd.
Magnatech-The DSD Co.
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The ingredients of Varian's new S-Tube bring super-high efficiency.

Varian's new "S-Tube" klystron operates at super-high efficiency—translating to significant savings in electric utility costs for UHF-TV broadcasters. The new S-Series, 5-cavity klystron provides significant improvement in operating efficiency through a unique configuration of tuning and cavity loading.

Efficiency-tuned for 10% improvement.

The new S-Series klystrons are tuned to maximize efficiency while maintaining useful gain. The Q of the second cavity is reduced by external loading and the output cavity is optimized by use of a variable visual coupler. These tubes will provide efficiency improvement of up to 10 percentage points over current high efficiency types when used under equivalent conditions.

Interchangeable with Varian H-tubes.

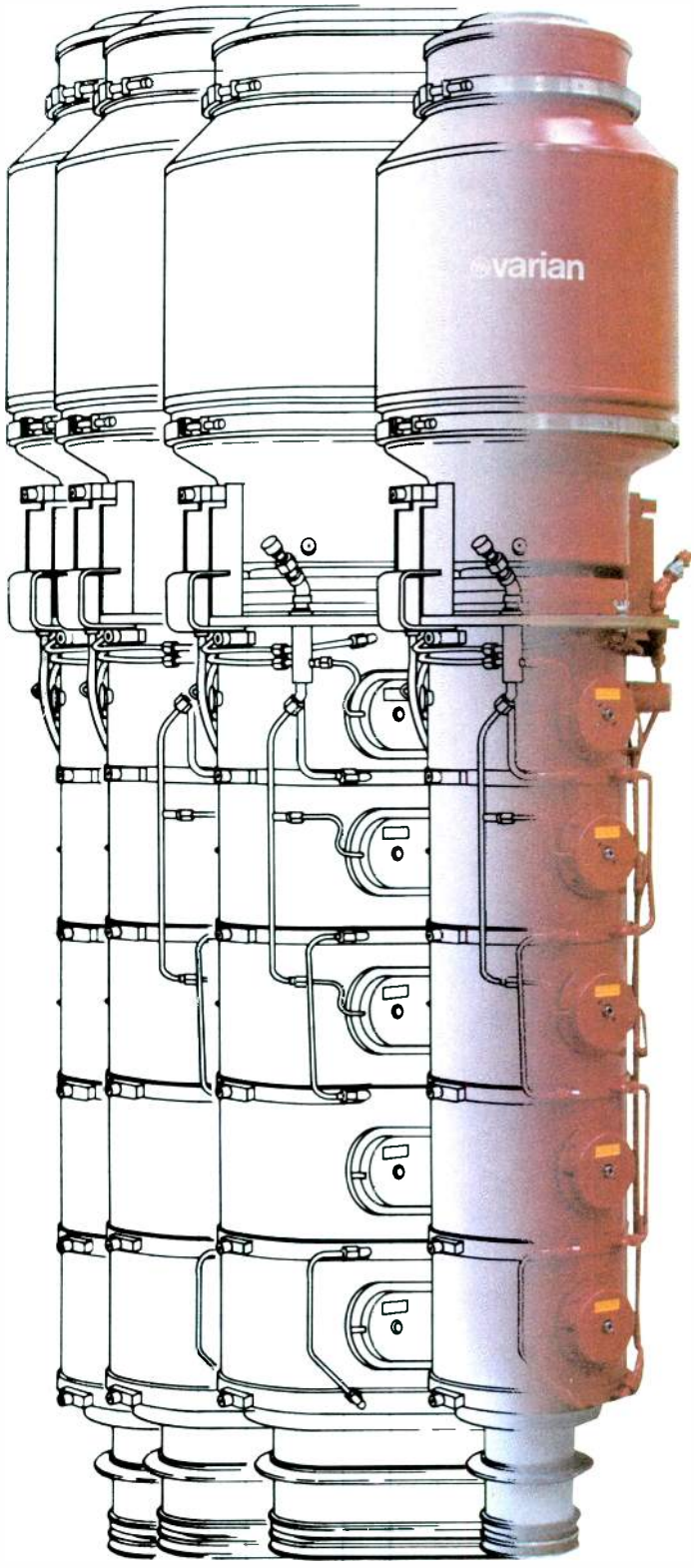
The most practical aspect of the new S-Series tubes is the complete interchangeability with the Varian VA-953H-Series tubes, providing broadcasters maximum flexibility in planning new equipment acquisitions.

More information on Varian's new S-Tube is available from Varian Microwave Tube Division, or any Electron Device Group worldwide sales organization.

Varian Microwave Tube Division
611 Hansen Way
Palo Alto, California 94303
Telephone: 415•424-5675

Varian AG
Steinhauserstrasse
CH-6300 Zug, Switzerland
Telephone: 042•23 25 75

varian



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G E Datel
Hipotronics Inc.

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Dollar for dollar, our graphics stack up better.

3M offers character generators priced from $4,195 to $10,995. And our BFA Paint System, priced at $31,995. In each case you can pay thousands more for comparable equipment without seeing any noticeable difference in quality.

Our D-1000 Character Generator is a self-contained, two-channel, full-featured generator with 70 nanosecond resolution.

Our D-1512 Character Generator is self-contained with two fonts, a genlock keyer and 512 color possibilities.

Our D-5000 Character Generator offers 35 nanosecond resolution for broadcast and production applications, over 150 fonts and 512 colors. It's expandable to multiple keyboards and channels.

And our BFA Paint System is a stylus-operated, menu-driven art station for broadcast news, weather and sports graphics, with 16 million color possibilities.

Comparable paint systems sell for three times the cost of our BFA Paint System. And the savings are similar with our three character generators.

So whether you're a small production studio or a flagship TV station, don't make a decision without looking into 3M graphics. Because the object is to look like a million, not to spend a million.

3M Broadcast and
Related Products Division.

3M hears you...

3M

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Raven Screen Corp.
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Projector Lamps/Accessories

Bardwell & McAlister, Inc.
Bell & Howell Audio Visual Div.
Kinotone Inc.
Plastic Reel Corp. of America
RTI Video Products Co.

Projectors, Film

Bell & Howell Audio Visual Div.
Buhl Optical Co.
Kalart Victor Corp.
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L-W International 235
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Magna-Tech Electronic Co., Inc.
Multi-Track Magnetics, Inc.
Pioneer Technology Corp.
RTI Video Products Co.
Redlake Corp.
West Coast Audio, Inc.
The Zei-Mark Corp.

Projectors, Slide

Buhl Optical Co.
Crow of Reading Ltd.
D.O. Industries, Inc.
Dukane Corp.
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RTI Video Products Co.
Sauppe Media, Inc.
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Telex Communications, Inc.
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Foundation Instruments Inc.
GEC McMichael Ltc.
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Coastcom
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Bogen Div. Lear Siegler, Inc.
CATEL Telecommunications
Communitronics Ltd.
Crown International, Inc.
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Record Care Products

Audio-Technica U.S., Inc.

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The best equalizer is no equalizer.

It's Belden fiber optic cable.

Now a video signal can go two miles on a Belden optical cable with 60dB SNR and no hint of high frequency roll-off. That means a cleaner picture without equalizers, and less maintenance than alternative transmission systems—coax or microwave.

For tower installations, Belden's high-strength, all-dielectric optical cable design doesn't have the problems generally associated with coax, such as ground loops, lightning and other E.M.I. problems. Plus, it's rated for full performance from −40°C to +60°C.

Belden optical fiber cable is also thinner and up to 30% lighter than conventional cable. That makes it easier to install on transmission towers, or through underground ducts. A recent installation of Belden cable on a 1500 ft. vertical tower was accomplished in less than one day.

For remote applications, Belden optical cable is much easier to carry around the golf course, or the metropolitan sports arena. Its toughness has been proven in rapid deployment cables designed by Belden for military applications in desert terrain.

Put Belden optical fiber cables and experience to work for you. They'll put you ahead with cleaner signals, better reliability and total system economy. For information on our fiber optic line and application reports or system design guide, contact your local Belden distributor or write: Belden, Fiber Optics, 2000 S. Batavia Ave., Geneva, IL 60134. Phone: 312-232-8900.

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BELDEN

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To create the finest television audio mixing console, you have to do a lot of listening.

Neve's 51-series for television production.

To create great audio it's important to listen to and satisfy the needs of your marketplace. We know all about great audio. Neve has pioneered almost every major innovation in audio mixing from computer-assisted Necam systems to Digital (DSP) Systems. And we're very proud of that distinction.

That's why when we created a system designed to meet the growing needs of video post-production, we listened very carefully.

The result is that now video production facilities can enjoy the same superior audio quality that recording and film studios throughout the world have enjoyed, plus special features designed just for television production.

Human Engineered: First and foremost, from the size of the knobs and layout, to the straight-forward signal flow and powerful sub-grouping, the Neve 51-series is always easy to use, yet gives you all the features you want and need.

Four Band Equalizer and Filters: Our formant spectrum equalizer is renowned as the most musical sounding in the industry. No one else has the "Neve sound." Plus effective, high pass and low pass filters remove noises often encountered in live television production.

Dynamics Unit: Each input module contains a highly-regarded limiter/compressor and noise gate, perfect for processing those difficult tracks in post production or for use in live recording, from dramatic shows to musicals and sports.

Multitrack Capability: The 51-series separately controlled direct outputs, pre- or post-EQ, make simultaneous multitrack and live recording a snap.

Because Neve listened, the 51-series is what the television industry wants to hear.

For further information, call Neve's Television Production Sales Department at (203) 744-6230 or write:

51 SERIES

Demand Neve

RUPERT NEVE INCORPORATED: Berkshire Industrial Park, Bethel, CT 06801 (203) 744-6230 Telex 969638 • 7533 Sunset Blvd., Hollywood, CA 90046 (213) 874-8124 • RUPERT NEVE OF CANADA, LTD. represented by: Sonotechnique, 2585 Bates, Suite 304, Montreal, P.Q. H3S 1A9 Canada (514) 739-3368 Telex 055-62171 • NEVE ELECTRONICS INTERNATIONAL, LTD. Cambridge House, Melbourn, Royston, Hertfordshire, SG86AU England Phone (0763) 60776 • RUPERT NEVE GmbH: 6100 Darmstadt Bismarckstrasse 114, West Germany Phone (06151) 81764.

Circle (47) on Reply Card

Our consoles have always been quiet. Have we been too quiet about our consoles?

Perhaps we have.

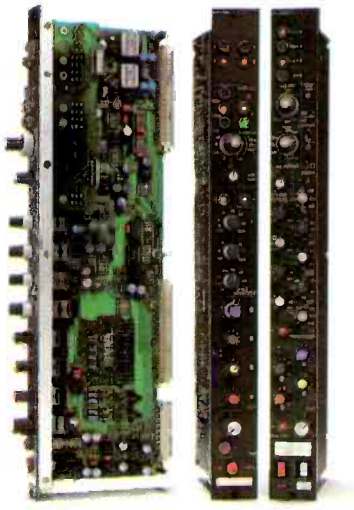
Thanks to the success of Studer recorders, we're often thought of as strictly a tape recorder company. But, Studer has also been making audio consoles for over 16 years, and dozens of our 169/269 compact mixers are now at work in broadcast and video production facilities all across America. Recently, with the introduction of the Series 900, Studer has become a major supplier of studio production consoles.

So we're not keeping quiet about this any longer.

Name your frame. Series 900 frame sizes from 12 to 50-plus inputs are available for any application, from remote recording and OB vans to sophisticated broadcast production and multi-track recording. Within these frame sizes, we configure the console to fit your requirements. The secret is our wide array of module options.

Mix and Match Your Modules. The 900 is a true system console offering custom configurability at standard

prices. Choose from 10 different metering modules, 3 multi-track monitor options (including separate monitor EQ), mono or stereo faders, audio subgroups, automation compatible VCA groups, video switcher interfaces, subgroup reassignment modules, up to 3 solo systems, multi-function test generator, input selectors, limiters, compressors, patchbays with bantam or ¼" systems, and up to 10 auxiliary busses.



Basic input modules feature 3 or 4 band EQ, microphone/line inputs, 5 pre/post-fade auxiliary sends, and channel overload indicators. Options include transformerless mic preamps on a subcard, separate transformerless TAPE input for remix, stereo input modules, stereo EQ, internal stereo X-Y/MS active matrix, stereo blend control, dual line inputs, variable HP and LP filters, user defined panel switches, and the list goes on.

Listen to the quiet. The entire 900 console frame design is consistent with the advanced module design. A completely independent signal reference ground system assures preservation of individual circuit CMRR figures. The result is overall noise performance compatible with digital recording.

As time goes by. All 900 consoles adhere to strict Studer standards for precision and reliability. The frame is built on a rigid channel and brace structure, and each module uses pin-and-socket Eurocard connectors. Frame connectors are mounted on longitudinal master boards with solid support from horizontal and vertical frame members. All components, switches and pots are commercial/industrial grade from the best U.S. and European manufacturers. In sum, a 900 is built to last as long as a Studer recorder.

The Swiss alternative. If you have been considering a high quality mixing console from any American or English manufacturer, you should also look closely at the Swiss-made Studer 900. For quality, flexibility, and reliability, it ranks among the world's finest. Also, you may find the pricing surprisingly competitive.

For more information on Studer consoles, call or write: Studer Revox America, Inc., 1425 Elm Hill Pike, Nashville, TN 37210; (615) 254-5651.

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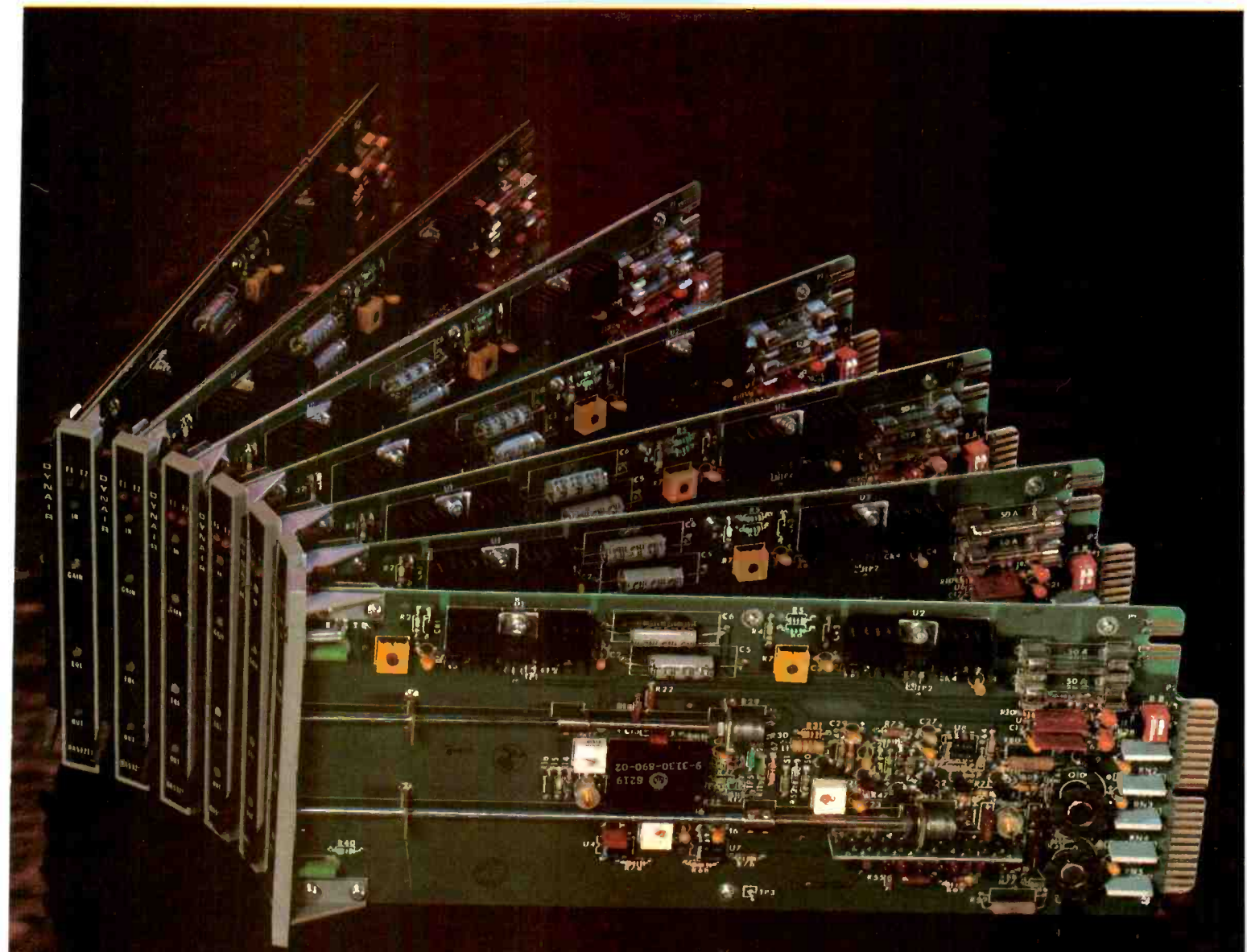

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But it's the 0.05% we want to talk about . . . because that is what is important to you.

Less than 0.05% differential gain and 0.05° differential phase (both at 5 MHz) are the most you'll get through these DAs. And they're all alike . . . no twiddling . . . no tweaking.

You'll be hard pressed to see this distortion even when you run through 5 to 7 DAs as many do in large plants.

Select the Dynair DA-5320B distribution amplifier for this high performance and a bandwidth of 30 MHz.

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Your studio is unique. That's why there's a family of Electro-Voice® Sentry® Studio Monitors.

Meet the new addition!

Electro-Voice is proud to announce the addition of a fourth member to the SENTRY family of studio monitors. The new MODEL 100EL combines the superb audio reproduction of the SENTRY 100A with an integral 50 watt power amplifier. The SENTRY family now includes a model to meet the requirements of every professional studio.

SENTRY 100EL–with an integral power amplifier

The SENTRY 100EL adds a 50 watt power amplifier to the SENTRY 100A. The internal amplifier has both balanced and unbalanced line-level inputs, an infrasonic filter to reduce distortion and a torroidal transformer—but nothing to get in the way of the trusted SENTRY performance. The SENTRY 100EL is a solution to problems like limited rack space, equipment transport on remotes, or cramped spaces in video editing booths.

SENTRY 100A–for tight spaces

The compact 8-inch, two-way SENTRY 100A is the ideal choice where space is limited but sonic accuracy cannot be compromised. Flat 45-18kHz frequency response, excellent imaging, true rack-mountability, high efficiency and incredible power handling are some of the features that have made the SENTRY 100A the standard of respected studios everywhere.

SENTRY 500–for wider coverage

The Constant Directivity SENTRY 500 broadens the "sweet spot," allowing more than one person to hear the same accurate sound without "beamy" high frequency problems. The 12-inch, two-way SENTRY 500 will produce 96dB at one meter with only a one

watt signal, yet can handle 100 watts of continuous power with 6dB of headroom—400 watts on peaks.

SENTRY 505–for "quarter-space" environments

The SENTRY 505 is the accoustical equivalent of the SENTRY 500 when mounted in a "quarter-space" environment such as the intersection of a wall and ceiling. The front baffle angles downward at either a 30° or 60° angle making this a large monitor that can be easily used in some of the tightest control room and production environments.

"Test equipment philosophy" of design.

Each of the four SENTRY monitors is a consistent, dependable audio reference combining high efficiency, high power handling and low distortion. All deliver the linear response and uniform polar patterns that are mandatory for stringent quality control.

Greg Silsby talks about the SENTRY monitor family:

"Consistent quality audio requires the test equipment accuracy we've built in to every SENTRY Studio Monitor. If you need quality you need SENTRY."

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Greg Silsby

Market Development Manager, Professional Markets

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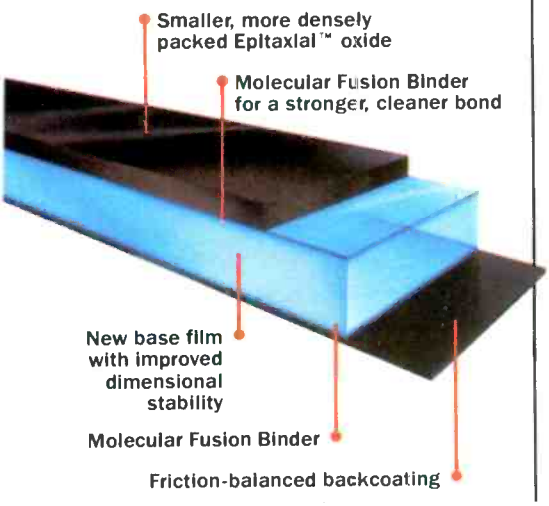

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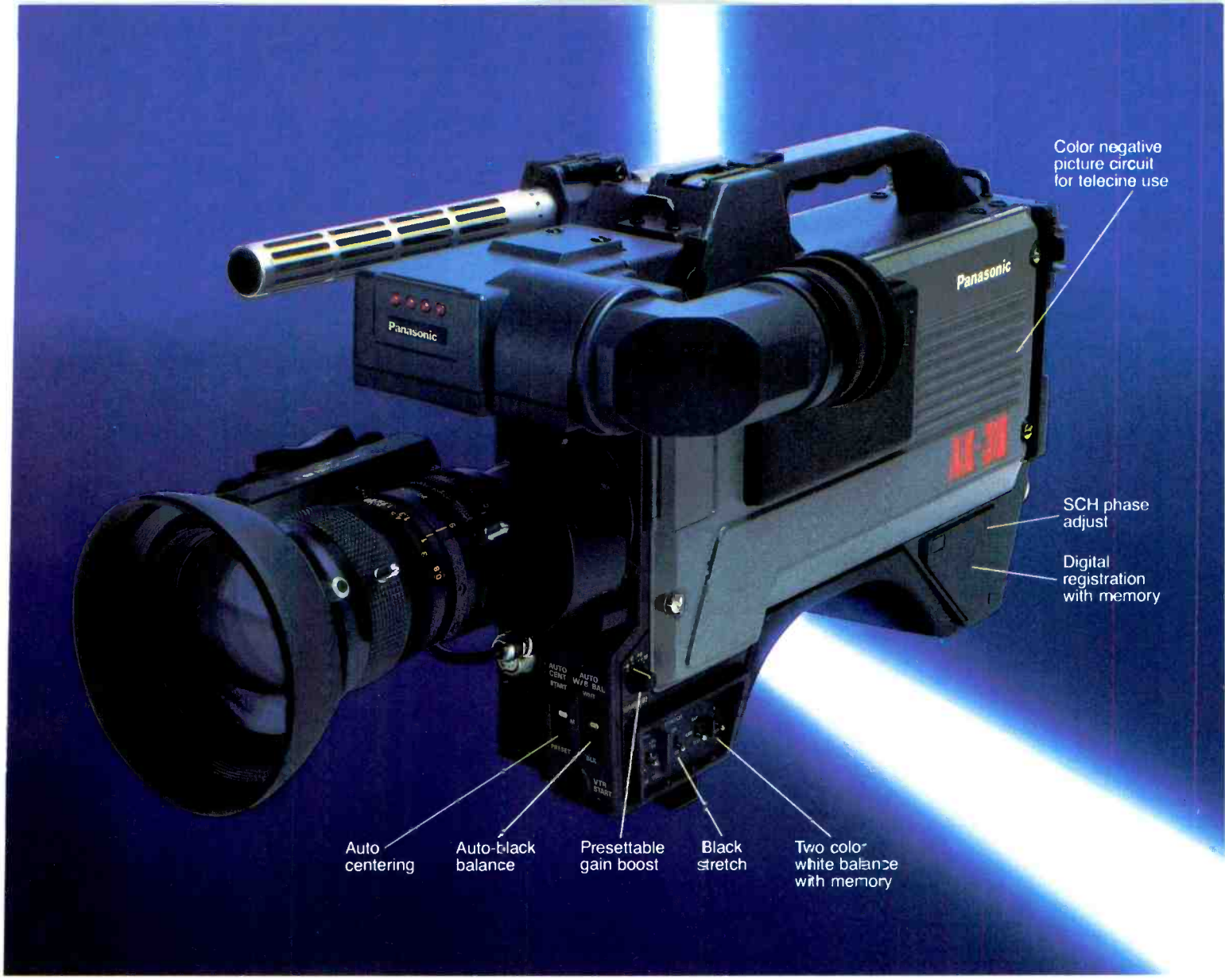

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Panasonic
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Harris Corp. Broadcast Group 43,107, 168-169,191,197
High Country Engineering
R. L. Hoover Consulting Telecommunications Eng.
IGM Communications
International Microwave Corp.
JRF Magnetic Sciences Inc.
Jamieson & Associates, Inc.
Jenel Consultants Corp.
KalaMusic
KAVCO Div. of Daycom Corp.
George Kleinknecht Inc.
LTM Corp. of America
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MBI Broadcast Systems
Magnetic Media
D. L. Markley & Associates, Inc. Consulting Engineers
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STUDIO 1

STUDIO 2

VTR

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Beyer provides typical condenser accuracy

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The ongoing technical evolution of Beyer condensers has produced several newly designed mics offering matchless performance and long-term reliability. The new MC 737 long shotgun (lobe pattern) and MC 736 short shotgun (cardioid/lobe) utilize a built-in switchable bass rolloff to effectively suppress low end noise and rumble below 200 Hz and provide increased intelligibility for optimum speech and music recording. A 12 dB attenuator prevents high sound pressure levels from overloading the mic's internal electronics without coloration. These mics also feature an extended frequency

without typical condenser sound.

response of 40 Hz to 20 kHz (± 2.5 dB) and an excellent signal-to-noise ratio of 74 dB.

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Visit one of our select professional dealers for a complete demonstration. To obtain a Beyer Condenser Dealer List, please write to: Beyer Dynamic, Inc., 5-05 Burns Avenue, Hicksville, New York 11801 or call us at (516) 935-8000.

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Allied Film & Video Services
Allied + WBS Film & Video Services
Devlin Productions, Inc.
Diner + Allied Film & Video Services
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Film Processing Corp.
Image Transform, Inc.
Tape-Film Industries/TFI

Film-to-Tape Transfer

ABP Systems Inc.
All Mobile Video
Allied Film & Video Services
Allied + WBS Film & Video Services
Robert Bosch Corp. Video Equipment Div.
Center Video Center
Devlin Productions, Inc.
Diner + Allied Film & Video Services
Image Transform, Inc.
KAVCO Div. of Daycom Corp.
Magnasync/Moviola Corp.
Media Concepts, Inc.
NEP Supershooter's Inc.
One Pass Film & Video
Radmar, Inc.
Roscor Corp.
See Hear Industries
Sonar Radio Corp.
T & G Optics
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Bald Mountain Lab
Broadcasting Frequency Monitor Service
Commercial Radio Monitoring Co.
Frequency Measurement Services of AZ
Frequency Measuring Service Inc.
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Caig Labs, Inc.
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Spectrum Planning Inc.
Steiger, Hurray & Associates Inc. Broadcast Tech. Consultants
Utility Tower Co.
World Tower Co. Inc.

Maintenance, TV

ABP Systems Inc.
Alpha Video & Electronics Co.
Audio-Video Consultants
Robert Bosch GmbH
Bowen Broadcast Service Co., Inc.
Broadcast Aids, Inc.
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World Tower Co. Inc.

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Rebuilding/Reconditioning Equipment

ABP Systems Inc.
A. F. Associates, Inc.
Audi-Cord Corp.
Audio Service Corp.
Barrett Associates, Inc.
Robert Bosch Corp. Video Equipment Div.
Brush Industries, Inc.
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United Research Lab Corp.
Videomagnetics, Inc.

Recording, Audiotape

BPI (Broadcast Programming Int'l.)
Century 21 Programming Inc.
JBL Inc./UREI 21
KalaMusic
Mineroff Electronics, Inc. Uher Products
NEP Supershooter's Inc.
Network Production Music, Inc.
Omnimusic
Radio Programming/Management
Radmar, Inc.
Schoeps/Posthorn Recordings
Tape-Film Industries/TFI
United Research Lab Corp.
Thomas Valentino Inc.

Recording, Cartridge

Century 21 Programming Inc.
JBL Inc./UREI 21
NEP Supershooter's Inc.
United Research Lab Corp.

Recording, Tape-to-Film

Allied Film & Video Services
Associated Production Music
Devlin Productions, Inc.
Image Transform, Inc.
NEP Supershooter's Inc.
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Adams-Russell Co., Inc. Video Info. Systems Div.
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Coastcom
Image Transform, Inc.
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NEP Supershooter's Inc.
NETCOM
Oak Communications Inc.
Quickscan Systems Ltd.
RCA American Communications
Satellite Transmission Systems, Inc. A CA Microwave, Inc. Subsidiary
Western Union Video Services
Wold Communications

Slide Services

Allied Film & Video Services
Allied + WBS Film & Video Services
Devlin Productions, Inc.
The Graphic Express Corp.
NEP Supershooter's Inc.
One Pass Film & Video
R/SCAN Corp.
Radmar, Inc.
Sonar Radio Corp.

Standards Conversion

Devlin Productions, Inc.
GEC McMichael Ltd.
Image Transform, Inc.
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Tape-Film Industries/TFI

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Lakeside Associates Inc.
Lerro Electrical Corp. Communications Systems Div.
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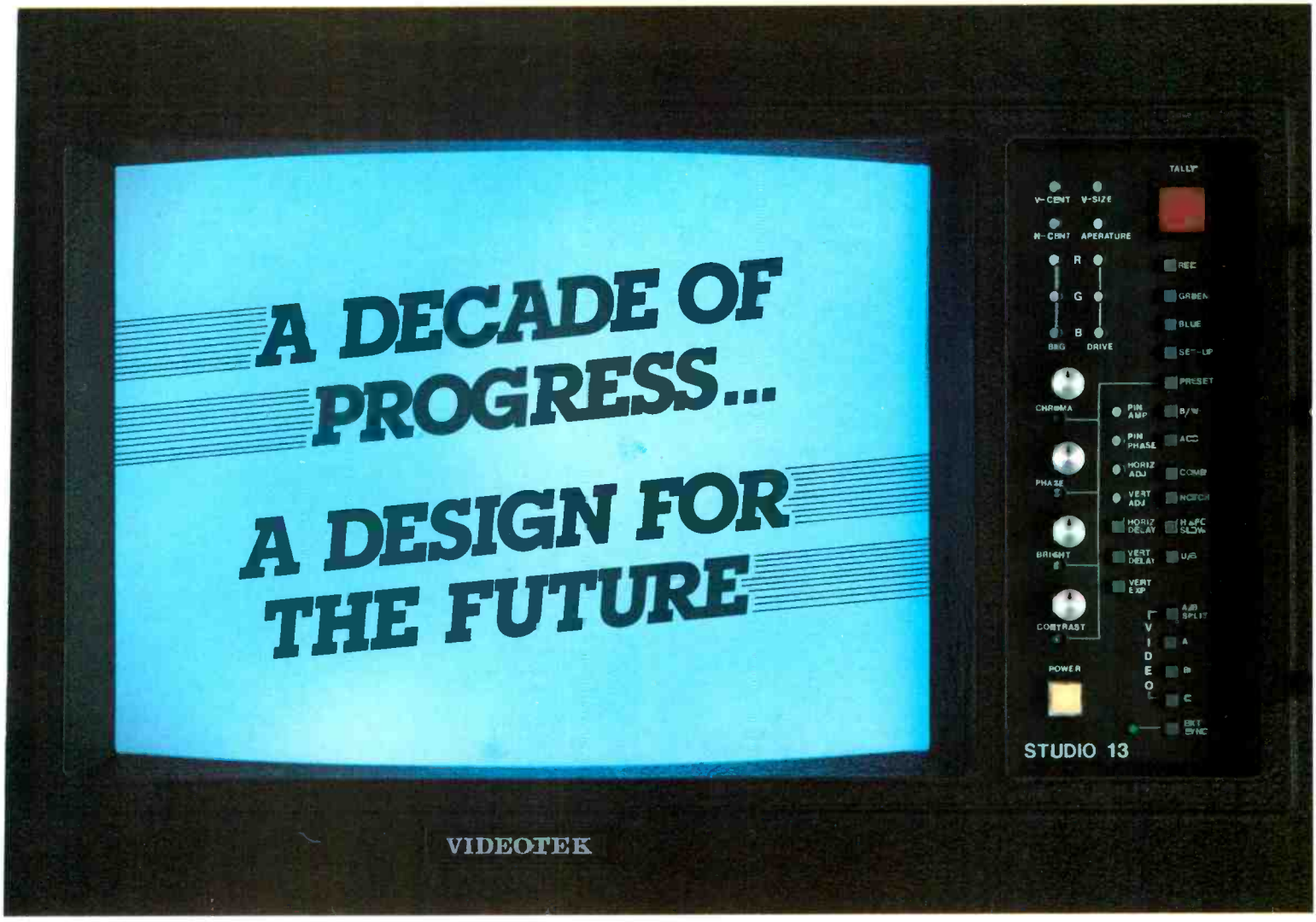

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A

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VA: ADC Magnetic Controls Co., 1225 Jefferson Davis Hwy., Suite 412, Arlington, VA 22202 (703) 486-5300 Chris Clewes
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AEG-Telefunken, Transmitter Div., Sickingenstrasse 20-28, D-1000 Berlin, West Germany

A. F. Associates, Inc., 100 Stonehurst Court, Northvale, NJ 07647

AKG Acoustics, Inc., 77 Selleck St., Stamford, CT 06902

AMP Special Industries, Box 1776, Southeastern, PA 19399

ANT Nachrichtentechnik, Box 1680, D-334 Wolfenbuettel, West Germany

ANT Telecommunications, (Formerly AEG-Telefunken), Box 7647, Hollywood, FL 33081

ATI-Audio Technologies Inc., 328 W. Maple Ave., Horsham, PA 19044

Ed Mullin (215) 443-0330

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Accu-Weather, Inc., 619 W. College Ave., State College, PA 16801

Accurate Sound Corp., 3515 Edison Way, Menlo Park, CA 94025

Accusonic Systems Corp., 12 Kulick Rd., Fairfield, NJ 07006

Acoustilog Inc., 19 Mercer St., New York, NY 10013

Acquis Ltd., 18952 MacArthur Blvd., Irvine, CA 92715

Acrodyne Industries Inc., 516 Township Line Rd., Blue Bell, PA 19422

Adams-Russell Co., Inc., Video Info. Systems Div., 1370 Main St., Waltham, MA 02154

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WI: Flanners Pro Audio, Inc., 2323C Bluemound Rd., Waukesha, WI 53186 (414) 785-9166 John Loeper

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Advance Industries, Inc., 2301 Bridgeport Dr., Sioux City, IA 51102

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Advanced Designs Corp., Box 1907, Bloomington, IN 47402

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Advanced Imaging Devices, Inc., 875 Maude Ave., Mountain View, CA 94043

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Advanced Technology Div., Of Symbolized Systems, Inc., 23950 Craftsman Rd., Calabassas, CA 91302

Advancing Technology Corp., 27106 South 46th Ave., Kent, WA 98032

Agfa-Gevaert Inc., Magnetic Tape Div., 275 N. Street, Teterboro, NJ 07608

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AirTeck, 5113 W. Chester Pike, Edgemont, PA 19028

Alamar Electronics, 478 W. Hamilton Ave., Suite 207, Campbell, CA 95008

Peter Albrecht Corp., 325 E. Chicago St., Milwaukee, WI 53202

P. Albrecht Elektronik, Alte Rother Strasse 16, D-8540 Schwabach, West Germany

Alco Electronic Products, Inc., 1551 Osgood St., No. Andover, MA 01845

Alden Electronics, Inc., 40 Washington St., Westborough, MA 01581

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Allsop, Inc., Box 23, Bellingham, WA 98227

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Alpha Automation, 2049 W. Broad St., Richmond, VA 23220

Alpha Video & Electronics Co., 28 E. Mall Plaza, Carnegie, PA 15106

alphaton Elektroakustik, 506 Indian Creek Dr., Roanoke, TX 76262

Altec Lansing, Div. of Altec Corp., 10500 W. Reno Ave., Oklahoma City, OK 73126

Amber Electro Design Inc., 4810 Jean Talon West, Montreal, Que., Canada H4P 2N5

Amco Engineering Co., 3801 N. Rose St., Schiller Park, IL 60176

Amek Consoles Inc., 10815 Burbank Blvd., No. Hollywood, CA 91603

Bob Owsinski (818) 508-9788

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MA: LaSalle Pro Audio, 75 N. Beacon St., Watertown, MA 02172 (617) 923-4420 Les Arnold
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American Laser Systems, Inc., 106 James Fowler Rd., Goleta, CA 93117

American Photonics Inc., Box 289, Brookfield Center, CT 06805

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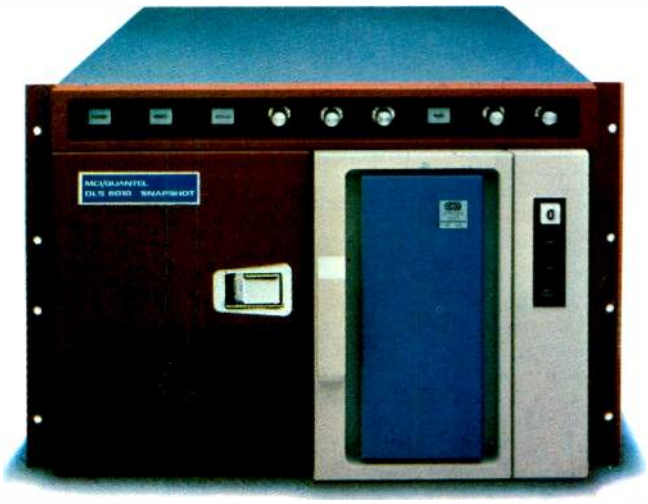

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TX: Ampex Corp., 3353 Earhart Dr., Carrollton, TX 75006 (214) 960-1162 Frank Nault, Reg. Sales Mgr.

Amplica, Inc., 950 Lawrence Dr., Newbury Park, CA 91320

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Amtel Systems Inc., 400 W. Cummings Park, Suite 4750, Woburn, MA 01801

Amtron Corp., Box 1150, Aptos, CA 95003

Anchor Systems, 913 West 223rd St., Torrance, CA 90502

Andersen Labs, Inc., 1280 Blue Hills Ave., Bloomfield, CT 06002

Anderson Radio Eng. Co., 202 Dayton School Rd., Easley, SC 29640

Andrew Corp., 10500 West 153rd St., Orland Park, IL 60462

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Antek, Analysis Technologies, Inc., Box 821603, Dallas, TX 75382

Antenna Development & Mfg., Inc., Box 1178, Hwy. 67 S., Poplar Bluff, MO 63901

Antenna Products Inc., Box 520, Mineral Wells, TX 76067

Antenna Technology Corp., 8711 E. Pinnacle Peak Rd., Suite C-103, Scottsdale, AZ 85225

Antennas For Communications, Inc., 334 Cypress Rd., Ocala, FL 32672-3198

Anton/Bauer, Inc., 1 Controls Dr., Shelton, CT 06484

John O'Keefe (203) 929-1100

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Apis Corp., 2960 S. West Temple, Salt Lake City, UT 84115

Apple Frequency Measuring Service, Box 997, Burlington, NC 27216

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Aqua-Tronics, Inc., 3021 Industrial Way N.E., Salem, OR 97303

Arben Design, 9870 Derby Lane, Westchester, IL 60153

Aries Antennas, Inc., 3857 Birch St., Suite 417, Newport Beach, CA 92660

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IN: Allied Broadcast Equipment, 635 South E St., Richmond, IN 47374 (317) 962-8596
NC: Southern Coastal Marketing Services, 6300 Carmel Rd., Charlotte, NC 28211 (704) 542-6543
WA: Broadcast Supply West, 7012 27th St. West, Tacoma, WA 98466 (206) 565-2301 Irv Law
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Arunta Satellite Telecommunications, Box 15082, Phoenix, AZ 85060

Arvin/Diamond, Box 200, Lancaster, OH 43130

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IL: Video Images, 890 Cambridge Dr., Elk Grove Village, IL 60007 (312) 640-7111
IL: Roscor Corp., 6160 W. Oakton St., Morton Grove, IL 60053 (312) 539-7700 Paul Roston
IA: Video Images, 2219 Ingersoll, Des Moines, IA 50312 (515) 243-4740
MD: Professional Products, Inc., 4964 Fairmont Ave., Bethesda, MD 20014 (301) 657-2141 Carter Kaufmann
MA: Lake Systems Corp., 55 Chapel St., Newton, MA 02160 (617) 244-6881 Frank DeMayo
MN: Video Images, 9916 West 74th St., Eden Prairie, MN 55344 (612) 941-9267
NJ: Broadcast Video Marketing Corp., 275 Route 18, East Brunswick, NJ 08816 (201) 390-0770 Paul Backer
PA: John Bell Associates, 3331 Street Rd., Mechanicsville, PA 18934 (215) 794-7075 John Bell
TX: G.P. Enterprises, Inc., Box 912, Arlington, TX 76010 (817) 467-0051 Gordon Peters
TX: Advanced Research Technology, 11408 Audelia, #4780, Dallas, TX 75243 (214) 644-1331 Roy Edenson
UT: RIA, Inc., 50 E. Malvern Ave., Salt Lake City, UT 84115 (801) 484-1701 Robert Bacon
WI: Video Images, 811 Mayfair Ave., Madison, WI 53714 (606) 241-5281
WI: Video Images, 12200 W. Adler Lane, Milwaukee, WI 53214 (414) 475-0111 John Fuchs
WI: Video Images, Route 2, Brookside Dr., Pulaski, WI, 54162 (414) 822-5975

Ashly Audio Inc., 100 Fernwood Ave., Rochester, NY 14621

Associated Production Music, 6255 Sunset Blvd., Hollywood, CA 90028

Associated Production Music, 888 Seventh Ave., New York, NY 10106

Atlantic Research Corp., 5390 Cherokee Ave., Alexandria, VA 22312

Atlas Sound, 10 Pomeroy Rd., Parsippany, NJ 07054

Atlas Tower Corp., Box 972, Vinita, OK 74301

Auburn Instruments, 107 Church St., Watertown, MA 02172

Audi-Cord Corp., 1845 W. Hovey Ave., Normal, IL 61761

Audico, Inc., 219 Crossen Ave., Elk Grove Village, IL 60007

Audio Accessories, Inc., Mill St., Marlow, NH 03456

Audio + Design (Audio + Design/Calrec, Inc.), Box 786, Bremerton, WA 98310

Audio Developments, Inc., 414 N. Sparks, Burbank, CA 91506

Ronald Fuller (818) 842-6260

Audio Engineering Associates, 1029 N. Allen Ave., Pasadena, CA 91104

Audio Kinetics, Inc., 4721 Laurel Canyon Blvd., Suite 209, No. Hollywood, CA 91607

Rodney Pearson (818) 980-5717

Audio Kinetics (UK) Ltd., Kinetic Centre, Theobald St., Borehamwood, Herts, England WD6 4PJ

Audio-Metrics, 5113 W. Chester Pike, Edgemont, PA 19028

Audio Service Corp., 4210 Landershim Blvd., No. Hollywood, CA 91602

Audio-Technica U.S., Inc., 1221 Commerce Dr., Stow, OH 44224

Audio-Video Consultants, 11538 Prager Ave., Lake View Terrace, CA 91342

Audio-Video Engineering Co., 65 Nancy Blvd., Merrick, NY 11566

Olga Drucker (516) 546-4239

Audiocom Electronics Inc., E. 12503 26th, Spokane, WA 99216

Audiolab Electronics, Inc., 3725 Esperanza Dr., Sacramento, CA 95825

Audiotechniques Inc., 652 Glenbrook Rd., Stamford, CT 06906

Audisar, Box 1561, Bellevue, WA 98009

Auditronics, Inc., 3750 Old Getwell Rd., Memphis, TN 38118

Michael Uhl (901) 362-1350

REGIONAL SALES CONTACTS:

CA: Sound Genesis, 2001 Bryant St., San Francisco, CA 94110 (415) 285-8900 Dave Van Hoy
FL: Control Technology, Inc., 2322 Davie Blvd., Ft. Lauderdale, FL 33312 (305) 587-2716 Jim Woodworth
GA: Allied Broadcast Equipment, Shannon Towers, Suite 314, 4405 Mall Blvd., Union City, GA 30291 (404) 964-1464 Mark Drummond
IL: Allied Broadcast Equipment, 5097 N. Elston Ave., Suite 303, Chicago, IL 60630 (312) 794-0224 Tom Harle
IN: Allied Broadcast Equipment, 635 South 'E' St., Richmond, IN 47374 (317) 962-8596 Dave Burns
MI: Audio Broadcast Group, Inc., 2342 S. Division Ave., Grand Rapids, MI 49507 (616) 452-1596 Dave Howland
NC: Broadcast Services Co., Rt. 3, Box 45-E, Four Oaks, NC 27524 (919) 934-6869 Neal Davis
TX: Allied Broadcast Equipment, Chaddick Center, Suite 309, 1201 East 15th, Plano, TX 75074 (214) 423-8667 Pat Hurley
WA: Allied Broadcast Equipment, 1112 So. 344th St., Suite 312, Federal Way, WA 98003 (206) 941-5453 Fred Harkness
CANADA: J-Mar Electronics, Ltd., 6 Banigan Dr., Toronto, Ont. Canada M4H 1E9 (416) 421-9080 Chris Brooks
CANADA: Nortec West Ltd., 7056 B Farrell Rd., S.E., Calgary, Alta., Canada T2H 0T2 (403) 252-8141 Ron Hill
CANADA: Nortec West Ltd., 325 West 5th Ave., Vancouver, BC, Canada V5Y 1J6 (604) 872-8525 Bob Whitehouse

Auernheimer Laboratories & Co., 4561 E. Florence Ave., Fresno, CA 93725

Auratone Corp., Box 698, Coronado, CA 92118

Aurora Systems, 185 Berry St., Suite 143, San Francisco, CA 94107

Autocue, 33 West 60th St., New York, NY 10023

Autogram Corp., Box 456, Plano, TX 75074

Automatic Devices Co., 2121 South 12th St., Allentown, PA 18103

Automation Techniques, Inc., 1550 N. 105th E. Ave., Tulsa, OK 74116

AVA Electronics, 4000 Bridge St., Drexel Hill, PA 19026

AVAB America Inc., 967 Howard St., San Francisco, CA 94103

Avantek Inc., 481 Cottonwood Dr., Milpitas, CA 95035

Avitel Electronics Ltd., Unit 6, Croydon Rd. Industrial Estate, Tannery Close Beckenham Kent, England BR3 4BY

Avtec Industries, Inc., 5 Audrey Place, Fairfield, NJ 07006

Donald Jaquin (201) 882-9460

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FL: Avtec Industries, 10013 Garrison Lane, Orlando, FL 32821 (305) 351-6408 Herb Nettleton

Avtek Inc., Box 188, Aurora, NE 68818

Product Directory begins on page 38

Which company provided FM transmitters to over 1,000 broadcasters in the last five years alone?

From 15 watts to 50 kilowatts, Harris FM transmitters are being shipped at a record pace. Why?

**Ask Jim Berry,
Chief Engineer,
WAIA-FM, Miami, Florida**

"We've had nothing but the greatest success. Our FM-25K ran four years non-stop on one tube. Sound quality is critical to us, and the Harris MX-15 exciter is remarkable. If we bought another transmitter tomorrow, this is the one we'd buy."

**Ask Warren Shulz,
Chief Engineer,
WFYR-FM, Chicago, Illinois**

"Our FM-25Ks have logged over 12,000 hours in alternate/main service at our Sears Tower site since December of 1982. When I am conducting an audio proof, it's encouraging to know that the FM-25K and the MX-15 are always performing better than spec. And any time help was needed, Harris service people were accommodating and pleasant."

**Ask Tom Jones,
Chief Engineer,
WBAM-FM, Montgomery,
Alabama**

"We're quite pleased with our FM-20K. Down time has been minimal. And I can count on immediate parts availability—not like the runaround you get from some manufacturers. I've been dealing with Harris for years; Harris is the best overall choice."

**Ask Steve Lampen,
Chief Engineer,
KJAZ-FM, Alameda,
California**

"After talking with other engineers, there was little question I wanted the Harris FM-2.5K right from the start. The transmitter worked perfectly after a difficult installation in a very tight location. It's very easy to tune. The exciter sounds clean and gorgeous on the air. Even non-technical listeners have noticed the difference."

Harris FM transmitters are available in eleven power ratings, including a brand new 3.5 kW model. All backed by manned, round-the-clock, non-stop emergency service. Ask the engineers you trust most. We're Harris Corporation, Broadcast Transmission Division, P.O. Box 4290, Quincy, Illinois 62305. 217-222-8200.

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For your information, our name is Harris.

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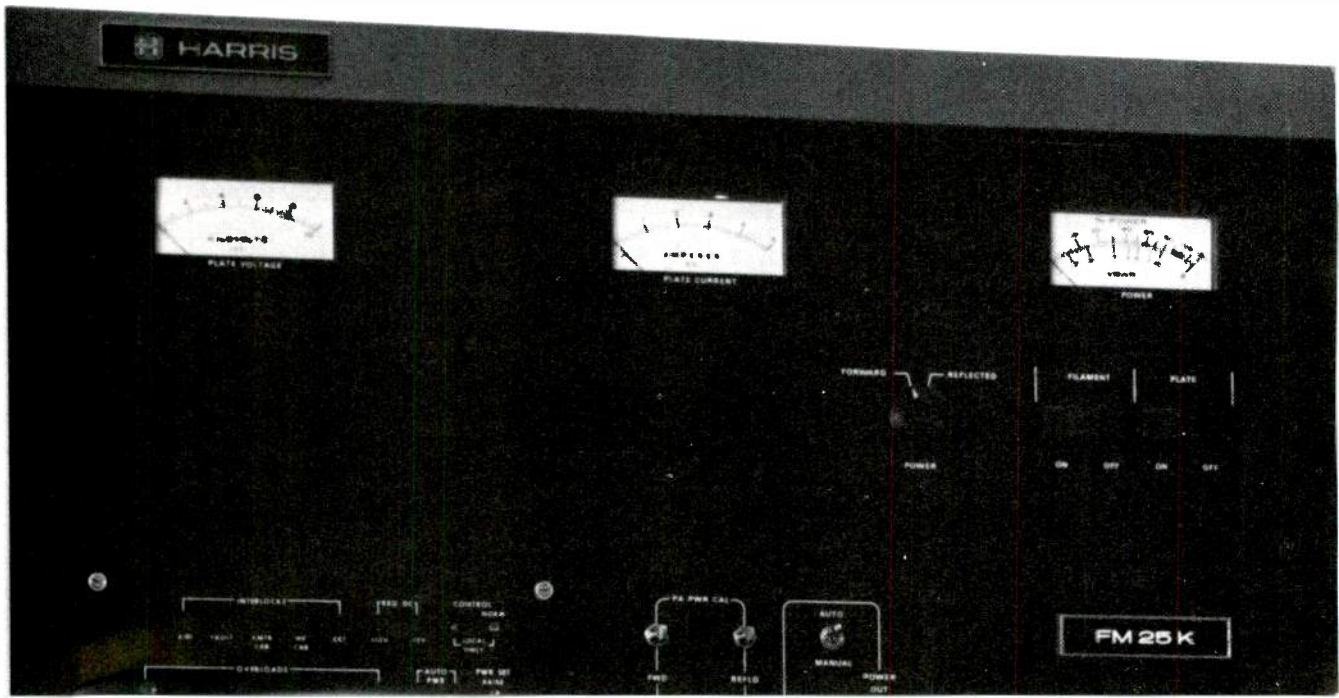

Aydin Controls, 414 Commerce Dr., Ft. Washington, PA 19034

Aydin Microwave Div., 75 E. Trimble Rd., San Jose, CA 95131

B

BASF, Crosby Dr., Bedford, MA 01730

BBL Industries, Inc., 2935 Northeast Pkwy., Atlanta, GA 30360

BGW Systems Inc., 13130 S. Yukon Ave., Hawthorne, CA 90250

B & I Electronics, Inc., 111 Perimeter Rd., Greenville, SC 29605

BIW Cable Systems, Inc., 65 Bay St., Boston, MA 02125

B & K Precision, Dynascan Corp., 6460 W. Cortland Ave., Chicago, IL 60635

BPI (Broadcast Programming Int'l.), Box 2027, Bellevue, WA 98009

BPI (Broadcast Programming Int'l.), 2212 4th Ave., Seattle, WA 98121

BSM Broadcast Systems, Inc., Box 8081, Spokane, WA 99203

Ted Hulbert (509) 448-0697

REGIONAL SALES CONTACTS:

AL: WKH Broadcast Eng. Serv. Co., 412 Susan St., Andalusia, AL 36420 (205) 222-5288 Bill Hoisington
AZ: Spencer Broadcast, 316 E. El Camino Dr., Phoenix, AZ 85068 (800) 221-6941 Charles Spencer
CA: Marcom, Box 66507, Scotts Valley, CA 95066 (408) 438-4273 Martin Jackson
CA: Peter L. Lude Broadcast Engineering, 926 Newman Dr., So. San Francisco, CA 94080 (415) 755-1342 Peter Lude
FL: Southeast Audio Services, 1791 Blount Rd. #206, Pompano Beach, FL 33069 (305) 974-1500 Joe Foglia
IL: Pyramid Audio Inc., 450 W. Taft Dr., So. Holland, IL 60473 (312) 339-8014 Rob Vukelich
IN: Allied Broadcast Equipment, Box 1487, Richmond, IN 47374 (317) 962-8596 Roy Ridge
LA: Audiomedia Association, 4657 Michoud Blvd., Suite 7, New Orleans, LA 70129 (504) 586-0140 Corey Meyer
MD: Bradley Broadcast, 15555-L Frederick Rd., Rockville, MD 20855 David Mathews
MI: Audio Broadcast Group, 2342 S. Division Ave., Grand Rapids, MI 49507 (616) 834-8651 David Veldsma
NJ: Landy Associates, 1890 E. Marlton Pike, Cherry Hill, NJ 08003 (609) 424-4600 James Landy
NM: Dyma Engineering Inc., 367 Main S.E., Box 1535, Los Lunas, NM 87031 (505) 865-6700 Wiley Cunningham
NY: Northeast Broadcast Lab, Inc., Box 1176, So. Glen Falls, NY 12801 (518) 793-2181 Bill Bingham
NY: Martin Audio Video Corp., 423 West 55th St., New York, NY 10019 (212) 541-5900 Courtney Spencer
TX: MID-COMM, 2231 E. Division, Arlington, TX 76011 Tim Smith
VA: David Green, Broadcast Consultants, Inc., Box 590, Leesburg, VA 22075 (703) 777-8660 Sherry Kirk
WA: Broadcast Supply West, 7012 27th St. W., Tacoma, WA 98466 (206) 565-2301 Tim Schwieger
WA: Broadcast Systems, 1718 N.E. 98th St., Seattle, WA 98115 (206) 525-6974 John Schneider
WA: Northwest Electronics, Inc., E. 730 1st Ave., Spokane, WA 99201 (509) 535-7651 R. O. Jones

The BTX Corp., 75 Wiggins Ave., Bedford, MA 01730

B-W Lighting Systems, (formerly Panoak Lighting), Box 470162, Tulsa, OK 74147

William Bal Corp., Box 875, Elizabeth, NJ 07207

Bald Mountain Lab, 230 Belleview Rd., Troy, NY 12180

Barco Industries, Video & Communications N.V., Th. Sevenslaan 106, B-8500 Kortrijk, Belgium

Bardwell & McAlister, Inc., 7051 Santa Monica Blvd., Hollywood, CA 90038

Barrett Associates, Inc., Box 4249, Oceanside, CA 92054

Bayly Engineering Ltd., Member of AEG-Telefunken Group, 167 Hunt St., Ajax, Ont., Canada L1S 1P6

Beaveronics, Inc., 8 Haven Ave., Port Washington, NY 11050

Belar Electronics Lab., Inc., Lancaster Ave. at Dorset, Devon, PA 19333

Harry Larkin (215) 687-5550

Belden, Fiber Optics, 2000 S. Batavia Ave., Geneva, IL 60134

W. Donahue (317) 983-5200

REGIONAL SALES CONTACTS:

IL: Belden Fiber Optic Dept., (312) 232-8900 Stewart Cudworth
CENTRAL Region: Belden, Box 1980, Richmond, IN 47375 (317) 983-5200 R. Schneidewind
EASTERN Regional: Belden, 100 Pennsylvania Ave., Suite 450, Framingham, MA 01701 (617) 872-7846 H. Hine
SOUTH CENTRAL Region: Belden, 14651 Dallas Pkwy., Suite 144, Dallas, TX 75240 (214) 788-4300 C. Parker
WESTERN Region: Belden, 2955 E. Main St., Suite 300, Irvine, CA 92714 (714) 474-1200 J. Lund

Bell & Howell, Audio Visual Div., 7100 McCormick Rd., Chicago, IL 60645

Beston/McInnis-Skinner, Box 937, Olathe, KS 66061

Beyer Dynamic, Inc., 5-05 Burns Ave., Hicksville, NY 11801

Tony Hawkins (516) 935-8000

REGIONAL SALES CONTACTS:

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CA: Meyer & Ross, 1485 Rollins Rd., Burlingame, CA 94010 (415) 348-6800 Mordy Foodym
CO: Chuck Stieff Sales, 17666 S. Weld Cnty. Rd., Platteville, CO 80651 (303) 587-2500 Chuck Stieff
FL: Michael Chafee Enterprises, 2215 Alpine Ave., Sarasota, FL 33579 (813) 366-9414 Michael Chafee
IL: New Horizons, 2211B Lakeside Dr., Bannockburn, IL 60015 (312) 234-5911 Tom Parnell
IN: A/V Marketing, 597 Industrial Dr., Carmel, IN 46032 (317) 846-034 Kurt Gish
KS: JSPR, Inc., Box 12165, Brookridge Sta., Overland Park, KS 66212 (913) 888-4980 Jack Shelton
MA: Pro Audio Associates, Inc., 33 'B' St., Burlington, MA 01803 (617) 229-6050 Dave Henderson
MA: R.G. Associates, Inc., Box 396, Millis, MA 02054 (617) 376-2044 Bob Provost
MI: Darnell Sales, 19021 W. McNichols, Detroit, MI 48219 (313) 534-9322 Gene Darnell
MN: Fruen & Associates, 1760 Copperwood Lane, Wayzata, MN 55391 (612) 475-2642 Bill Fruen
NY: Professional Audio Marketing, Box 765, Melville, NY 11747 (516) 367-8620 Stan Somers
NC: Applied Audio Marketing, 26 Audubon Inc., Asheville, NC 28804 (704) 658-2291 Bob Edsall
OH: Marketing Analysts, Inc., 6558 Masefield St., Worthington, OH 43085 (614) 436-2808 Jim McCandless
PA: Richard Lewis Sales, 222 S. Easton Rd., Glenside, PA 19038 (215) 886-1555 Richard Lewis
TX: Dobbs-Stanford Corp., 2715 Electronic Lane, Dallas, TX 75220 (214) 358-0800 Fred Dobbs
WA: Northmar, Inc., 1011 N.E. 69th St., Seattle, WA 98115 (206) 524-5170 Robert Entrop Sr.

Biddle Instruments, 510 Township Line Rd., Blue Bell, PA 19422

Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139

Birns & Sawyer Inc., 1026 N. Highland Ave., Los Angeles, CA 90038

BITTREE, 1337 Greenbriar Rd., Glendale, CA 91207

Blonder-Tongue Labs, Inc., 1 Jake Brown Rd., Old Bridge, NJ 08857

Bogen Div., Lear Siegler, Inc., Box 500, Paramus, NJ 07653

Bogen Photo Corp., Box 712, Fair Lawn, NJ 07410

Bogner Broadcast Equipment Corp., 401 Railroad Ave., Westbury, NY 11590

Bonneville Media Communications, 130 Social Hall Ave., Salt Lake City, UT 84111

Boonton Electronics Corp., 791 State Hwy. 10, Randolph, NJ 07869

Robert Bosch Corp., Video Equipment Div., Box 31816, Salt Lake City, UT 84131

Robert Bosch GmbH, Box 429, D-6100 Darmstadt, Fed. Rep. of Germany

Bowen Broadcast Service Co., Inc., 8343 Lynn Haven Ave., El Paso, TX 79907

Brabury Ltd., 5 Bone Lane, Newbury Berkshire, England RG14 5PG

Brand-Rex Co., Elec. & Industrial Cable Div., Box 498, Willimantic, CT 06226

Bretford Mfg. Co., 9715 Soreng Ave., Schiller Park, IL 60176

Walter S. Brewer Co., Inc., 4717-F S. Mingo Rd., Tulsa, OK 74146

Broadcast Aids, Inc., 20 Red Rose Dr., Levittown, PA 19056

Broadcast Audio Corp., 11306 Sunco Dr., Rancho Cordova, CA 95670

Broadcast Cartridge Service, 15131 Triton Lane, Suite 108, Huntington Beach, CA 92649

Broadcast Computer Systems Inc., 57 Elm Ave., Hackensack, NJ 07601

Broadcast Controls Div., Of Automated Broadcast Controls, 9155 Brookville Rd., Silver Spring, MD 20910

Broadcast Electronics, Inc., 4100 N. 24th; Box 3606, Quincy, IL 62305

Broadcast Microwave Services, Inc., 7322 Convoy Ct., San Diego, CA 92111

Broadcast Systems, Inc., 8222 Jamestown Dr., Austin, TX 78758

John Harms (512) 836-6011

REGIONAL SALES CONTACTS:

AL: Broadcast Systems, Inc., Box 179, Cropwell, AL 35054 (205) 525-5467 Byron Fincher
IL: Broadcast Systems, Inc., 1025 Sterling Cove #112, Palatine, IL 60067 (312) 934-1180 Leonard Barreca
MD: Broadcast Systems, Inc., 11816 Seven Locks Rd., Potomac, MD 20854 (301) 279-2261 Charles Riley
TX: Broadcast Systems, Inc., 8222 Jamestown Dr., Austin, TX 78758 (512) 836-6011 Chuck Balding
VA: Broadcast Systems, Inc., 14216 Chesterfield Dr., Woodbridge, VA 21191 (703) 643-1443 Les Hunt

Broadcast Technical Services, 990 Homer St., Suite 303, Vancouver, B.C., Canada V6B 2W7

Broadcast Technology, Inc., 33 Comac Loop, Ronkonkoma, NY 11779

Broadcast Video Systems, Ltd., 1050 McNicoll Ave., Agincourt, Ont., Canada M1W 2L8

Bert Verwey (416) 497-1020

Broadcasting Frequency Monitor Service, Box 6161, Texarkana, TX 75505

Bruel & Kjaer Instruments, Inc., 185 Forest St., Marlborough, MA 01752

Brush Industries, Inc., Box 638, Sunbury, PA 17801-0638

Bryston Ltd., 57 Westmore Dr., Rexdale, Ont., Canada M9V 3Y6

Brystonvermont Ltd., RFD #4, Box 2255, Montpelier, VT 05602

Bud Industries, Inc., 4605 East 355th St., Willoughby, OH 44094

Buhl Optical Co., 1009 Beach Ave., Pittsburgh, PA 15233

Richard W. Burden Associates, 20944 Sherman Way, Canoga Park, CA 91303

Burlington Audio Tapes, Inc., 106 Mott St., Oceanside, NY 11572

C

CAE Inc., Box 430, Hamburg, MI 48139

CBS Special Products, 51 West 52nd St., Room 861, New York, NY 10019

CBSI-Custom Business Systems, Inc., Box 67, Reedsport, OR 97467

CBX Inc., 147 E. Olive Ave., Monrovia, CA 91016

CMC Technology Corp., 2650 La-Fayette St., Santa Clara, CA 95050-2604

CMX/Orrox, Div. of Orrox Corp., 3303 Scott Blvd., Santa Clara, CA 95050

The CnB Studios, 3415 Beresford Ave., Belmont, CA 94002

CRL Audio, Circuit Research Labs, Inc., 2522 W. Geneva Dr., Tempe, AZ 85282

Bob Richards (800) 535-7648

CSI Electronics, Inc., 18248 E. Rogers Circle, Boca Raton, FL 33431

Cablewave Systems Inc., 60 Dodge Ave., North Haven, CT 06473

Caig Labs, Inc., Box J, Escondido, CA 92025

Calaway Engineering, 49 S. Baldwin Ave., Sierra Madre, CA 91024

California Microwave, 990 Almanor Ave., Sunnyvale, CA 94086

Calrec Audio, (Audio + Design/Calrec, Inc.) Box 786, Bremerton, WA 98310

Calzone Case Co., 225 Black Rock Ave., Bridgeport, CT 06605

The Camera Mart, Inc., 456 West 55th St., New York, NY 10019

Jeffrey Wohl (212) 757-6977

REGIONAL SALES CONTACTS:

NY: The Camera Mart Inc., 304 First St., Liverpool, NY 13088 (315) 457-3703 Dean Leeson

Canare Cable, Inc., 10834 Burbank Blvd., No. Hollywood, CA 91601

Ron Fuller (818) 506-7602

REGIONAL SALES CONTACTS:

CA: Pro Rep Co., 555 Pilgrim Dr., Suite A, Foster City, CA 94404 (415) 570-5055 Dick Meis

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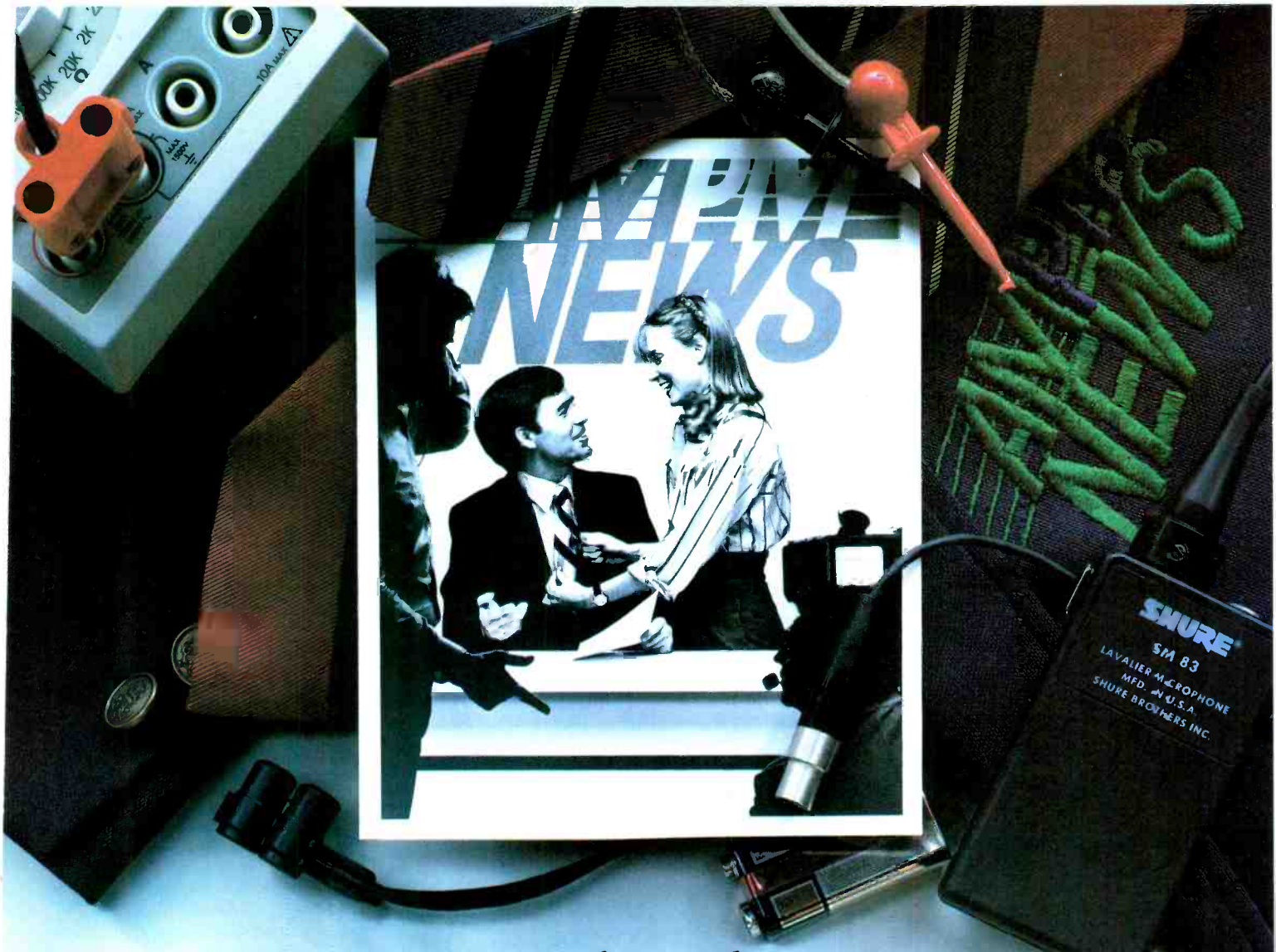

Our new lavalier mic makes everyone look good. Introducing the SM83.

People in news broadcasting have been using the same lavalier mic for a long time. But our new Shure SM83 is out to change all that. It's just what everyone has been asking for in an omnidirectional condenser microphone.

On-camera talent like the SM83 because its electronics provide for a dip in the mid-range, giving both male and female voices a smoother, more natural sound. And unlike its Japanese counterpart, the SM83 unplugs from the battery pack for easy storage.

Sound engineers appreciate the SM83 because its tailored frequency response requires less equalization. They like its low-frequency rolloff too, which quiets on-air rumbling and mechanical and clothing noise.

Set directors are impressed with the SM83's neat appearance on camera. The cord exits from the side and disappears from view, running down behind a tie, shirt or blouse.

Production assistants enjoy the SM83's mounting versatility. It comes with a single clip that works either vertically or horizontally, a double clip that holds two mics, and a universal mount that can be sewed, pinned or taped to clothing.

Repair technicians love the SM83's easy maintenance. The cartridge is easily accessible by unscrewing the end cap. And cable replacement requires only a screwdriver and tweezers; no soldering is necessary.

Field crews are also big fans of the SM83 because its electronic pack is powered by a standard 9-volt battery or by a mixer's phantom supply.

For more information on the Shure SM83, the little mic with big advantages, call or write Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60204. (312) 866-2553.

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Manufacturers' Addresses

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CO: Sliz & Associates, 1017 S. Boulder Rd., Louisville, CO 80027 (303) 666-4760 Stan Sliz
FL: Bill Bencsik & Associates, 3730 N.E. 42nd Lane, Ocala, FL 32670 (904) 732-9775 Bill Bencsik
IL: Steffey Marketing, 1955 Raymond Dr., Northbrook, IL 60062 (312) 480-3575 Bill Steffey
KS: R. M. Associates, Box 3251, Shawnee Mission, KS 66203 (913) 631-7607 Mike Eakins
MD: R. J. Marketing, 1010 Rockville Pike, Rockville, MD 20852 (301) 251-0330 Ronnie Wilson
MI: Audio Marketing Concepts, 2268 Westaire Court, Ann Arbor, MI 48103 (313) 663-9733 Donn Nelson
MN: Yore Co., 3564 Rolling View Dr., White Bear Lake, MN 55110 (612) 770-9760 Fred Yore
NH: Allen Cohen Sales Associates, Old Hinsdale Rd., Ashuelot, NH 03441 (603) 239-6284 Allen Cohen
NJ: Triad Marketing Associates, 54 Leonard Terrace, Wayne, NJ 07470 (201) 696-8625 Paul Ackel
NY: Upstate Marketing, 542 Swaggertown Rd., Glenville, NY 12302 (518) 399-6311 Frank Iaconis
NC: Applied Audio Marketing, 26 Audubon Dr., Asheville, NC 28804 (704) 658-2291 Bob Edsall
OH: McFadden Territory, 1093 Fishinger Rd., Columbus, OH 43321 (614) 459-1280 Michael Zajd
TX: Peregrine Southwest Reps, Inc., 5800 Corporate Dr., Suite D, Houston, TX 77036 (713) 772-6765 Dan Speegle
WA: Northmar, Inc., 1011 N.E. 69th St., Seattle, WA 98115 (206) 524-5170 Bob Entrop Jr.

Canon USA, Inc., Optics Div., 1 Canon Plaza, Lake Success, NY 11042

Jack Keyes; Gordon Tubbs (516) 488-6700

REGIONAL SALES CONTACTS:

CA: Canon U.S.A., Inc., 123 Paularino Ave. E., Costa Mesa, CA 92626 (714) 979-6000 Robert Low
IL: Canon USA, Inc., 140 Industrial Dr., Elmhurst, IL 60126 (312) 833-3070
TX: Canon U.S.A., Inc., 2035 Royal Lane, Suite 290, Dallas, TX 75229 (214) 620-2641 Ken Rice
CANADA: Canon Canada, Inc., 3245 American Dr., Mississauga, Ont., Canada L4V 1B8 (416) 678-2730

Capitol Magnetic Products, 6902 Sunset Blvd., Hollywood, CA 90028

Larry Hockemeyer, V.P. (213) 461-2701

REGIONAL SALES CONTACTS:

IL: Capital Magnetic Products, 1400 Renaissance Dr., Suite 309, Park Ridge, IL 60068 (312) 298-1806 Dick Dunlavy
NY: Capital Magnetic Products, 1370 Avenue of the Americas, New York, NY 10019 (212) 757-7470 Dennis Schleich

Capitol Production Music, 1750 N. Vine St., Hollywood, CA 90028

Cat Systems Inc., 401 East 74th St., New York, NY 10021

CATEL Telecommunications, 4800 Patrick Henry Dr., Santa Clara, CA 95054

Dwight Cavendish Co. Ltd., 2117 Chestnut Ave., Wilmette, IL 60091

CaVox Stereo Productions, 502 S. Isis, Inglewood, CA 90301

Celwave, Rt. 79, Marlboro, NJ 07746

REGIONAL SALES CONTACTS:

AZ: Celwave, 115 E. Watkins St., Phoenix, AZ 85004 (602) 252-8058 Ray Long
FL: Celwave, Hwy. 44 West, Box 389, Leesburg, FL 32749 (904) 787-9200 Jack Wilde
IL: Celwave, 941 N. Plum Grove Rd., Suite C, Schaumburg, IL 60195 (312) 843-7511 Gerry Anderson

Center Video Center, 5565 N. Elston Ave., Chicago, IL 60630

Central Dynamics, 147 Hymus Blvd., Pointe Claire, Que., Canada H9R 1G1

Brian Tee (514) 697-0810

REGIONAL SALES CONTACTS:

AL: Central Dynamics Corp., 401 Wynn Dr. N.W., Huntsville, AL 35805 (205) 837-5180 Joe Ryan, Reg. Sales Mgr.
CA: Central Dynamics Corp., 3760 Cahuenga Blvd., W., No. Hollywood, CA, 91604 (818) 766-8184 Jim Morrison, Reg. Sales Mgr.
FL: R & H Associates, Box 364, Safety Harbor, FL 33572 (813) 442-7505 Frank Fitzhenry, Sales Rep.
IL: Central Dynamics Corp., 331 W. Northwest Hwy., Palatine, IL 60067 (312) 991-4720 John Boland, Reg. Sales Mgr.
MD: Wiltronix Inc., 1685 Oakmont Ave., Washington Grove, MD 20880 (301) 258-7676 Dwight Wilcox, Sales Rep.
MA: Professional Video Systems, 1616 Soldier Field Rd., Boston, MA 02135 (617) 254-2101 Scott Beers, Distributor
NJ: RCA Broadcast Systems Div., Paintworks Corporate Center, Gibbsboro & Foster Rd., Gibbsboro, NJ 08026 (609) 435-2892 Gary Passanante, Dealer
NJ: A.F. Associates Inc., 100 Stonehurst Court, Northvale, NJ 07647 (201) 767-1000 Tom Canavan, Dealer
NY: Central Dynamics Corp., Honeywell Bldg., 570 Taxter, Rm. 570, Elmsford, NY 10523 (914) 592-5440 Dick DeBeradinis, Reg. Sales Mgr.
TX: Gene Sudduth Co. Inc., Route 3, Box 147, TX 75762 (214) 894-6303 Gene Sudduth, Jr., Sales Rep.
CANADA: Central Dynamics Ltd., 801 York Mills Rd., Suite 201, Don Mills, Ont., Canada M3B 1X7 (416) 446-1543 Bob Smith, Reg. Sales Mgr.
CANADA: Central Dynamics Ltd., 147 Hymus Blvd., Pointe Claire, Que., Canada H9R 1G1 (514) 697-0810 Jim Pelletier, Reg. Sales Mgr.

Centro Corp., 9516 Chesapeake Dr., San Diego, CA 92123

Century Precision Optics, 10713 Burbank Blvd., No. Hollywood, CA 91601

Century 21 Programming Inc., 4340 Beltwood Pkwy., Dallas, TX 75234

Cetec Antennas, 6939 Power Inn Rd., Sacramento, CA 95828

Bill Cunningham (916) 383-1177

Cetec Gauss, 9130 Glenoaks Blvd., Sun Valley, CA 91352

Cetec Ivie, 1366 W. Center, Orem, UT 84057

Cetec Vega, 9900 Baldwin Pl., El Monte, CA 91731

Paul Baughman (818) 442-0782

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CA: Brian Trankle & Assoc., 820 Black Mnt. Rd., Hills Borough, CA 94010 (415) 344-1133 Brian Trankle
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FL: Michael Chafee Enterproses, 4844 Greymoss Lane, Sarasota, FL 33583 (813) 921-4294 Michael Chafee
IL: New Horizons, 2211-B Lakeside Dr., Bannockburn, IL 60015 (312) 234-5911 Tom Parnell
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MI: Robert Milsk Co., 22420 Telegraph Rd., Southfield, MI 48034 (313) 354-3310 Steve Strahler
MN: Yore Co., 3564 Rolling View Dr., White Bear Lake, MN 55110 (612) 770-9760 Fred Yore
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TN: Wilson Audio Sales, 6602 Hwy. 100, Suite 205, Nashville, TN 37205 (615) 356-0372 Wally Wilson
TX: Dimension Marketing Corp., 11020 Audelia Rd., Suite B106, Dallas, TX 75243 (214) 348-9657 Terry Green
VA: Sphere Associates, 11250-14 Roger Bacon Dr., Reston, VA 22090 (703) 471-1230 Ted Bennett
WA: Northshore Mktg., 11000 Lake City Way N.E., Suite 310, Seattle, WA 98125 (206) 364-5444 Lew Barrett

Channel Master Satellite Systems, Industry Dr., Oxford, NC 27565

Channelmatic, Inc., 821 Tavern Rd., Alpine, CA 92001

Chester Cable, Drawer D, Chester, NY 10918

Wm. Dungan (914) 469-2141

Christie Electric Corp., 20665 Manhattan Pl., Torrance, CA 90501

Steve Heller; Diane Church (213) 320-0808

Chroma Digital Systems, 2065 Martin Ave., Suite 104, Santa Clara, CA 95050

Chyron Corp., Telesystems, 265 Spagnoli Rd., Melville, NY 11747

Cine 60, Inc., 630 9th Ave., New York, NY 10036

Don Civitillo (212) 586-8782

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GA: A.F.E.R., 1846 Briarwood Rd. N.E., Atlanta, GA 30329 (404) 633-4101
IL: Victor Duncan, Inc., 661 N. La Salle, Chicago, IL 60611 (312) 943-7300 Scott Kiefer
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MD: Professional Products, 4964 Fairmont Ave., Bethesda, MD 20014 (301) 657-2141 Phil Bolton
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NY MPCS, 514 West 57th St., New York, NY 10019 (212) 586-8782 Marvin Charyn
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Cinema Products Corp., 2037 Granville Ave., Los Angeles, CA 90025

Cipher Digital, Inc., 150 Huntington Ave., Boston, MA 02115

Walter Hickman (617) 267-1148

Clear-Com Intercom Systems, 1111 17th St., San Francisco, CA 94107

Gerry Brill (415) 861-6666

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CA: Western Audio Sales, 99 E. Magnolia St., Suite 315, Burbank, CA 91502 (213) 843-3002 Michael Klickstein
TX: Tenicki & Associates, 5719 Kirby St., Suite 17, Houston, TX 77005 (713) 528-2005 Randy Tenicki

Clyde Electronics Ltd., Ranken House, Anderston Cross Centre, Glasgow, Scotland G2 7LB

COARC, Box 2, Rt. 217, Mellenville, NY 12544

Coastcom, 2312 Stanwell Dr., Concord, CA 94520

Coherent Communications, 13756 Glenoaks Blvd., Sylmar, CA 91342

Cohu, Inc., Electronics Div., Box 85623, San Diego, CA 92138

Colorado Video Inc., Box 928, Boulder, CO 80306

ColorGraphics Systems, Inc., 5727 Tokay Blvd., Madison, WI 53719

Terry Kelly (608) 274-5786

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AUSTRALIA: Magna Techtronics Pty. Ltd., 14 Whiting St., Artarmon, N.S.W. Australia 2064 61-2-438-3377 Bob Clemesha
CANADA: MSC Video, 254 Wildcat Rd., Downsview, Ont., Canada M3J 2N5 (416) 661-4180 David Codling
ENGLAND: CCL Associates, Ltd., Beechwood House, Depot Rd., Newmarket, Suffolk U.K CB8 0HA 0638-667278 Ashley Coles
FINLAND: Oy Hedengren AB, Lauttasaarentie 50, Helsinki 20 Finland SF-00200 3580-670211 Kimmo Keskinen
ITALY: Comtech Video Electronics SRL, 20052 Monza, MI/Italy - Via Caccini 12 039-360105 Carmelo Catalano
JAPAN: Nihon Dynatech, 25-5 Nishi-Gotanda 7 chome, Shinagawa-ku, Tokyo Japan 141 (03) 490-2871 Jerry Levin
SWEDEN: Dynatech Svenska AB, Nasbyvagen 7, Taby Sweden S-18330 46-8-768-0965 Patrick Alin

Colortran, Inc., 1015 Chestnut St., Burbank, CA 91506

Comad Inc., Box 10667, Pensacola, FL 32504

Comark Communications, Inc., Box 267, Southwick, MA 01077

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Comark Communications, Inc., Sales Headquarters, Box 275, Colmar, PA 18915 (215) 822-0777 Stuart M. Kravitz

Comex Systems, (See Granite Telecom Corp.),

Commerce Airborne Div., IFR Avionics, Inc., 16425 Hart St., Suite 106, Van Nuys, CA 91406

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Communitronics Ltd., 160 Wilbur Place, Bohemia, NY 11716

Comprehensive Video Supply Corp., 148 Veterans Dr., Northvale, NJ 07647

Compu-Prompt, 940 N. Orange Dr., Suite 209, Los Angeles, CA 90038

Compucon, Inc., Box 809006, Dallas, TX 75380-9006

Computer Broadcasting Inc., 6085 Dawn Dr., Rohnert Park, CA 94928

Computer Concepts Corp., 8375 Melrose Dr., Lenexa, KS 66214

Computer Graphics Lab, Inc., 405 Lexington Ave., 59th Floor, New York, NY 10174

Comrex Corp., 60 Union Ave., Sudbury, MA 01776

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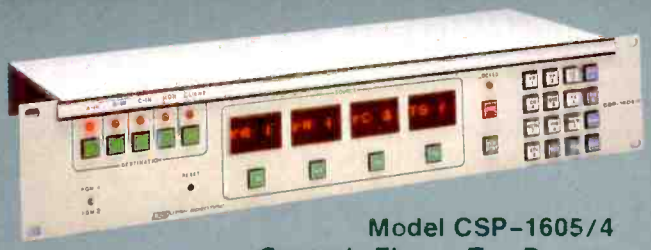
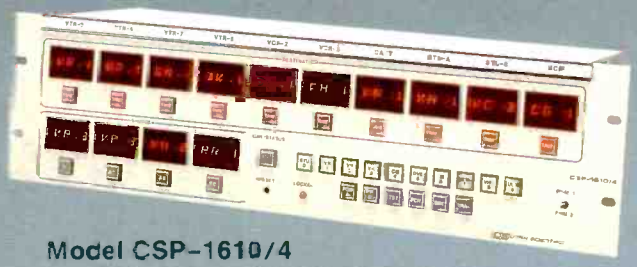
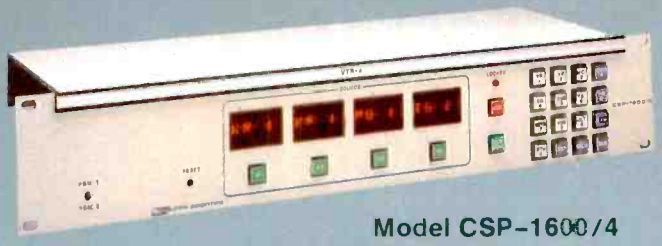
FOUR-LEVEL ROUTER CONTROLS from UTAH SCIENTIFIC



Model CSP-1605/4
Controls Five or Ten Busses



Model CSP-1610/4
Controls Ten or Twenty Busses



Model CSP-1600/4
Controls One or Two Busses

Model CSP-16160/4
Full Matrix Controller and Diagnostic Panel

This new series of microprocessor-based panels has been designed by Utah Scientific to meet the needs of the broadcast and tele-production industries for individual control of source selection on multiple switching matrices (levels).

Each panel includes four alphanumeric displays to indicate either current *Status* (steady display) or a *Preset* source selection (flashing display) on each switching level. An alternate-action *Clear* button associated with each display plus an *All Clear* button permits toggling the displays between *Preset* and *Status* modes.

The touchpad features sixteen *group name* selections (beware of panels allowing for only ten) which, with either one or two *numeral* keystrokes, accommodates up to 1600 possible source names. Each panel can be provided with a *Program Select* switch that doubles the number of controlled busses at no extra charge.

Multi-bus panels provide instantaneous statusing of all four levels each time a new destination is identified. Instantaneous confirmation of changed status is also provided each time a new Take Command is entered.

The model CSP-16160/4 panel is specially programmed for maintenance/diagnostic duties as well as for full matrix control. It operates in either *alphanumeric* (source and destination names) or *numeric* (matrix input and output numbers) modes and can perform various diagnostic routines to permit rapid isolation of system faults.

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Comtech Antenna Corp., 3100 Communications Rd., St. Cloud, FL 32769

Comtech Data Corp., 350 N. Hayden Rd., Scottsdale, AZ 85257

Jerry Conn Associates Inc., Box 444, Chambersburg, PA 17201

Connectronics Corp., 652 Glenbrook Rd., Stamford, CT 06906

Conrac Div., Conrac Corp., 600 N. Rimsdale Ave., Covina, CA 91722

Consolidated Elec. Wire & Cable Corp., 11044 King St., Franklin Park, IL 60131

Continental Electronics Mfg. Co., Box 270879, Dallas, TX 75227

Vernon Collins (214) 381-7161

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IL: John D. Abdnour, Box 575, Streator, IL 61364 (815) 672-8585
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VA: Scientific Associates, Inc., 9512A Lee Hwy., Fairfax, VA 22031 (703) 385-0600 Don George
WI: Stapleman Corp., 7911 N. Rockledge, Glendale, WI 53209 (414) 352-5777 Chuck Stapleman

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Convergence Corp., 1641 McGaw, Irvine, CA 92714

Cool Light Co., Inc., 5723 Auckland Ave., No. Hollywood, CA 91601

Corporate Comm. Consultants, Inc., 4250 Veterans Memorial Hwy., Holbrook, NY 11741

Cortland Cable Co., Box 330, Cortland, NY 13045-0330

Countryman Associates Inc., 417 Stanford Ave., Redwood City, CA 94063

Michael Cox Electronics Ltd., Hanworth Trading Estate, Hampton Rd. West, Feltham, Middlesex, England TW13 6DH

Crosspoint Latch Corp., 95 Progress St., Union, NJ 07083

George Pires, Pres. (201) 688-1510

Crouse-Hinds Co., Aviation Lighting, Box 1200, Windsor, CT 06095

Crow of Reading Ltd., Box 36, Reading Berks, England RG1 2NB

John Crowe Productions, Ten Greenway Plaza, Houston, TX 77046

John Crowe Productions, 3 Dallas Comm. Complex, #102, Irving, TX 75039

Crown International, Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517

Cubicomp Corp., 3165 Adeline St., Berkeley, CA 94703

Cumming Corp., 8714 Woodley Ave., Sepulveda, CA 91343

D

dbx, Inc., 71 Chapel St., Newton, MA 02195

D.O. Industries, Inc., 317 E. Chestnut St., East Rochester, NY 14445

Peter W. Dahl Co., Inc., 4007 Fort Blvd., El Paso, TX 79930

Da-Lite Screen Co., Inc., Box 137, Warsaw, IN 46580

Dalsat, Inc., Box 1960, Plano, TX 75074

Data Communications Corp., Broadcast Div., 3000 Directors Row, Suite 508, Memphis, TN 38131

Datatek Corp., 1121 Bristol Rd., Mountainside, NJ 07092

Rick Rainey (201) 654-8100

Datatronix, Inc., 2100 Reston Ave., Reston, VA 22091

Dataworld Inc., 1302 18th St. N.W., Suite 502, Washington, DC 20036

Datum Inc., 1363 S. State College Blvd., Anaheim, CA 92806

Davis Electronics Co., Box 128, Sierra Madre, CA 91024-0128

Delcom Corp., 6019 South 66th East Ave., Tulsa, OK 74145

Delta-Benco-Cascade Ltd., 124 Belfield Rd., Rexdale, Ont., Canada M9W 1G1

Delta Electronics Inc. (VA), 5730 Gen. Washington Dr., Alexandria, VA 22312

Joseph Novak (703) 354-3350

Denrad Tech. Group, Inc., Box 225, Denison, TX 75020

Design Line Inc., 6204 Benjamin Rd. #209, Tampa, FL 33614

Desisti Lighting, Desmar Corp., 328 Adams St., Hoboken, NJ 07030

Devlin Productions, Inc., 150 West 55th St., New York, NY 10019

De Wolfe Music Library, 25 West 45th St., New York, NY 10036

Dictaphone Corp., 120 Old Post Rd., Rye, NY 10580

Dielectric Communications, A Unit of General Signal, Route 121, Raymond, ME 04071

Digital Barcode Systems, Inc., 1401-D N. Kraemer Blvd., Anaheim, CA 92806

Digital Entertainment Corp., 555 West 57th St., Suite 1530, New York, NY 10019

Digital Services Corp., 3622 N.E. 4th St., Gainesville, FL 32601

Digital Video Systems Corp., 716 Gordon Baker Rd., Willowdale, Ont., Canada M2H 3B4

DigiVision, Inc., 11722 Sorrento Valley Rd., San Diego, CA 92121

Dilor Industries Ltd., Box 2169, Squamish, B.C., Canada V0N 3G0

Diner+Allied Film & Video Services, 620 Third St., San Francisco, CA 94107

Discwasher, Box 6021, Columbia, MO 65205

Di-Tech Inc., 48 Jefryn Blvd., Deer Park, NY 11729

Dixson Instruments, Box 1449, Grand Junction, CO 81502

Dolby Laboratories, Inc., 731 Sansome St., San Francisco, CA 94111

Dorrough Electronics, 5221 Collier Place, Woodland Hills, CA 91364

DowKey Div., Of Kilovac Corp., Box 4422, Santa Barbara, CA 93103

Drake-Chenault Enterprises, Inc., Box 1629, Canoga Park, CA 91304

Drummex Inc., 500 Lauzon St.; Box 426, Drummondvile, Que., Canada J2B 6W3

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Dukane Corp., 2900 Dukane Dr., St. Charles, IL 60174

Dunn Instruments, Inc., 544 Second St., San Francisco, CA 94107

The Durafilm Co., 137 N. LaBrea Ave., Hollywood, CA 90036

Durcom, 319 Cooke St., Plainville, CT 06062

DYMA Engineering, Inc., Box 1535, Los Lunas, NM 87031

Dynair Electronics, Inc., 5275 Market St., San Diego, CA 92114

Robert A. Jacobs (619) 263-7711

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Dynatech Data Systems, 7644 Dynatech Ct., Springfield, VA 22153

Dale Graver (703) 569-9000

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CA: Winco Sales, Inc., Box 338, San Carlos, CA 94070 (415) 592-0357 Bob Vaughn
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E

EECO Inc., 1601 E. Chestnut Ave., Santa Ana, CA 92701

Sam Villari (714) 835-6000

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CANADA: Corvis Communications Inc., 400 Esna Park Dr., Unit 8, Markham, Ont., Canada L3R 3K2 (416) 475-7575
EUROPE: Seltech Int'l. Ltd., Rose Industrial Estate, Cores End Rd., Bourne End, Bucks England SL8 5AT (06285) 29131

EEG Enterprises, Inc., 1 Rome St., Farmingdale, NY 11735

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CANADA: EEV Canada Ltd., 67 Westmore Dr., Rexdale, Ont., Canada M9V 3Y6 (416) 745-9494 Dave Clissold
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Portable and flexible, General Electric projectors are being used in a great variety of applications, including both rear and front projection. Ask our applications experts whether yours can be added to the growing list, which includes:

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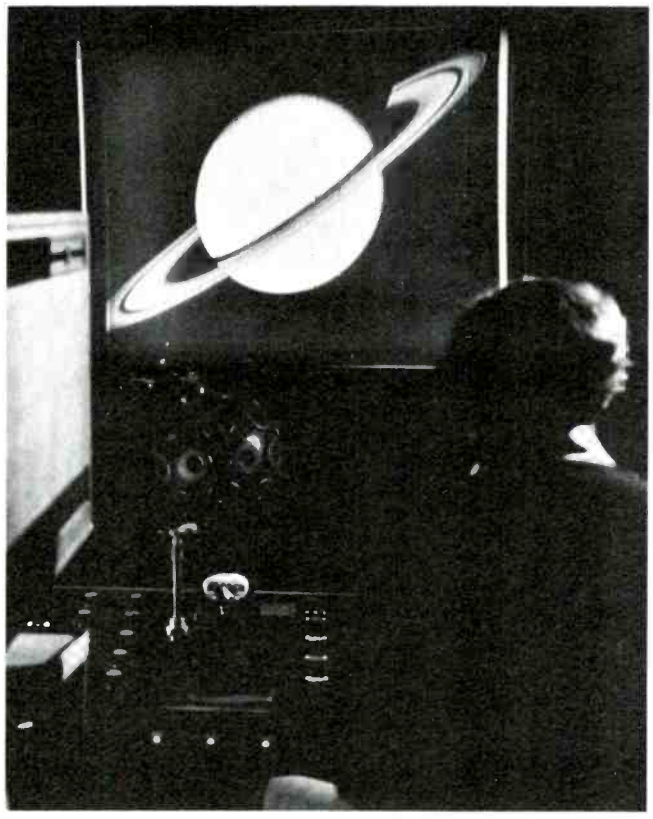
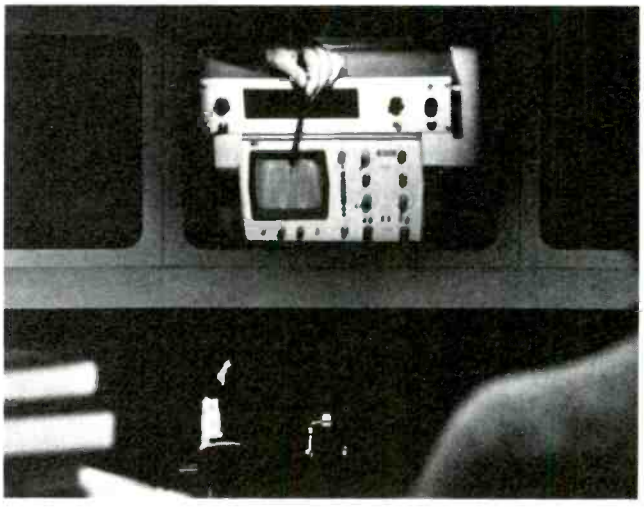
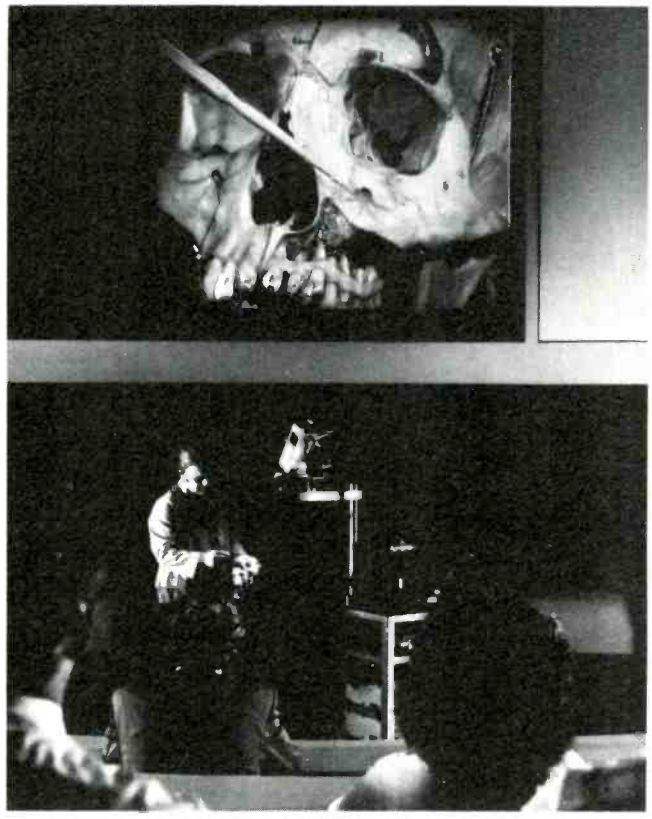
Call or write: General Electric Company, Projection Display Products Operation, Electronics Park 6-206, Syracuse, NY 13221. Phone: (315) 456-2152. TWX 710-541-0498



SELL-OUT CROWDS at Fiske Planetarium, Boulder, watched live NASA transmission presented by General Electric projector.



ENGINEERING INSTRUCTION displayed by General Electric projector in 820-seat auditorium at University of Cincinnati.



MINUTE DETAIL ENLARGED by General Electric projector for 150-student classes at Upstate Medical Center, Syracuse.

GENERAL ELECTRIC

Circle (63) on Reply Card

What you see above is yet another installment of TV's longest-running horror series: "The Lost Commercial."

The villain is the antiquated 2-inch cart machine—notorious for making valuable commercial air time vanish into thin air. And its appetite for destruction seems endless. Statistics show it's not unusual for a station to squander upwards of $15 million yearly on makegoods alone.

But the nightmare is ending. Because Sony announces the first real advance in cart machine technology in over a decade. The new Betacart™ multicassette system.

THE CART MACHINE VS. THE SMART MACHINE.

What the old cart machine tried to do by mechanical means, the Sony Betacart achieves through superior intelligence.

Microprocessors keep constant track of 40 cassettes. They maintain the alignment of the system's four BVW-11 decks and its elevator. They run self-check diagnostic routines.

And, in the belief that an ounce of prevention is worth many times its weight in makegoods, they solve problems before they occur—such as warning a technician that he's about to remove a cassette that's due to air shortly.

The Betacart is communicative in other ways, too. It's smart enough to guide your technicians through its operation, and will even interface directly with your station's main computer.

MAINTAINING MACHINERY VS. MAINTAINING PROFITS.

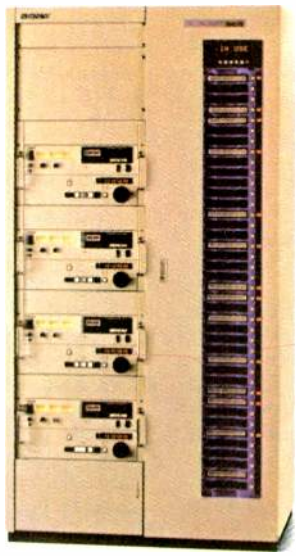
The end result of all this electronic

THE MACHINE INSPIRED BY BILLIONS OF DOLLARS WORTH OF COMMERCIAL FAILURES.

sophistication is the kind of mechanical simplicity that virtually eliminates breakdowns—not to mention the makegoods, excessive downtime and high maintenance costs that are generally part of the package.

And, as its name implies, the Sony Betacart uses Betacam cassettes—which cost less than a third of what 2-inch cartridges cost. Its format also makes the system ideal for ENG use during newscasts—thanks to its compatibility with the Betacam™ camera/recorder, along with its multiple video and audio outputs and freeze/instant-start capabilities.

All these advantages, plus its low initial cost make the Sony Betacart multicassette an investment that will pay for itself quickly. And it will keep paying off in new ways. Its stereo capability, for example, will allow you to capitalize on the coming introduction of stereo TV broadcasting.



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After all, to err may be human. But there's nothing divine about having to forgive a machine.

SONY® Broadcast

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Elcom-Bauer, 6199 Warehouse Way, Sacramento, CA 95826

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Harris Corp., Broadcast Microwave, 1680 Bayport Ave., San Carlos, CA 94070

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High Tech Marketing Co., Box 2056, Shawnee Mission, KS 66201

Hipotronics Inc., Drawer A, Brewster, NY 10509

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Holaday Industries, 14825 Martin Dr., Eden Prairie, MN 55344

R. L. Hoover, Consulting Telecommunications Eng., 11704 Seven Locks Rd., Potomac, MD 20854

Hoppmann Corp., Box 601, Chantilly, VA 22021

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Carl Phillis (213) 849-1104

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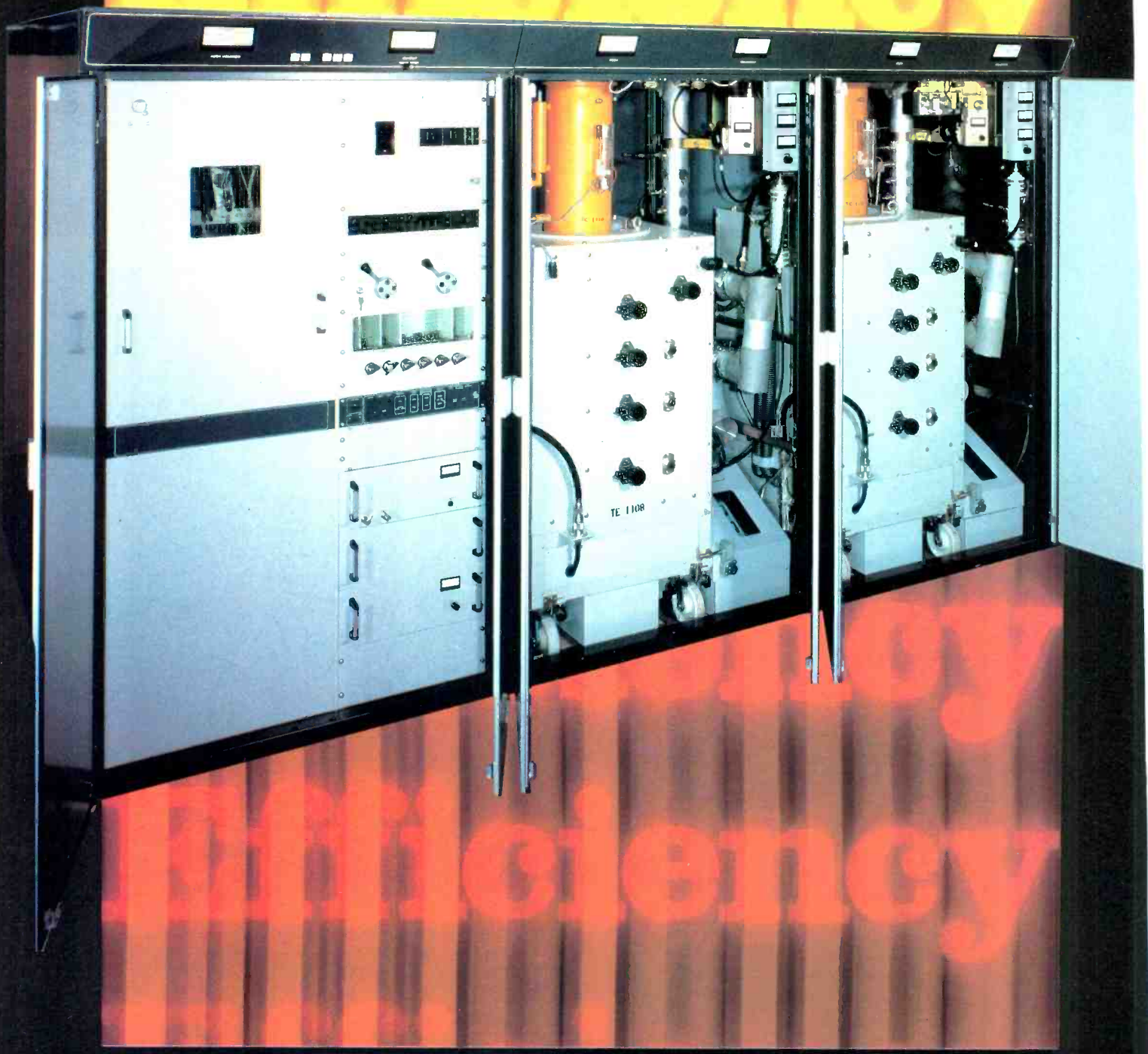

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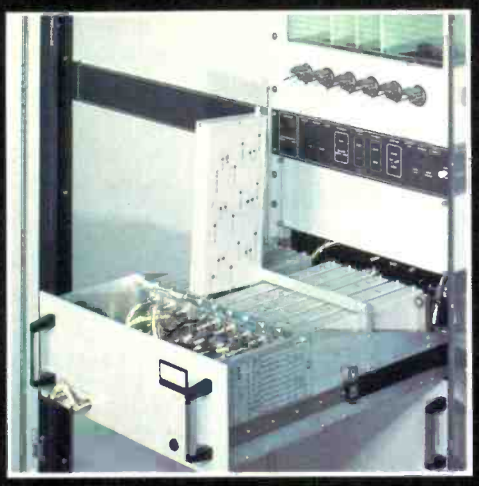

Pye TVT UHF transmitters cover peak sync powers from 10 to 110kW. All incorporate a highly sophisticated i.f. modulated drive system with solid state control logic for unattended operation and modern safety features. (You can, if desired, update the existing exciter of your current transmitter). All cover the whole UHF frequency range.

Pye TVT is constantly striving for state-of-the-art perfection. To stay even further ahead.

Reader enquiry no. 100

A world of experience

Monitors of quality & economy

High stability, quality, reliability – at a very reasonable price. These are the reasons for the international success of the Philips LDH6200 14" color monitors.

These rugged yet stylish monitors have a high specification and many operational features only found on more expensive units. And monitor to monitor matching is excellent.

Reader enquiry no. 102

Radio Transmitters

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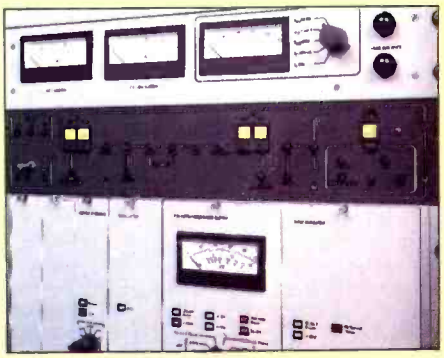
Designed to work unattended in a variety of operational configurations, the range meets or exceeds the world's most exacting broadcast standards.

Reader enquiry no. 103



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Now to extend its capability, Philips has introduced the LDK14-RGB. This camera retains all the quality and virtue of its famous family while offering the extra facility of full bandwidth RGB outputs for chroma-key in addition to the normal CVBS video outputs.

Reader enquiry no. 104

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VA: Midwest Corp., 1395 Air Rail Ave., Virginia Beach, VA 23455 (804) 464-6256 Elijah Midkiff
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Miles Air Products Ltd., 411 Birchmont Rd., Scarborough, Ont., Canada M1K 1N3

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Multi-Track Magnetics, Inc., #3 Industrial Ave., Upper Saddle River, NJ 07458

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Northwest Monitoring Service, Box 1042, Pendleton, OR 97801

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Ocean Realm Television, 2333 Brickell Ave., Miami, FL 33129

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One Pass Film & Video, One China Basin Bldg., San Francisco, CA 94107

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P

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Packaged Lighting Systems, Box 285, Walden, NY 12586

PAG Power, A Div. of PAG Ltd., 565 Kingston Rd., London, England SW20 8SA

Paladin Corp., 3543 Old Conejo Rd. #102, Newbury Park, CA 91320

Paltex Ltd., 2942 Dow Ave., Tustin, CA 92680

Panasonic Co., Technics, One Panasonic Way, Secaucus, NJ 07094

Panasonic Industrial Co., Audio Video Systems Div., One Panasonic Way, Secaucus, NJ 07094

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Pep Inc., 25 West 54th St., New York, NY 10019

Perma Power Electronics, Inc., 5615 Howard Ave., Chicago, IL 60648

Perrott Eng. Labs, Inc., 7201 Lee Hwy., Falls Church, VA 22046

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Pinzone Communications Products Inc., 10142 Fairmount Rd., Newbury, OH 44065

Pioneer Technology Corp., 1021 N. Lake St., Burbank, CA 91502

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Polar Research, Inc., Box 781, Thief River Falls, MN 56701

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Practical Technology, Box 449, Carmel Valley, CA 93924

Precision Echo, 3105 Patrick Henry Dr., Santa Clara, CA 95054

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Procart, 7012 27th St. West, Tacoma, WA 98466

Professional Audio Services, 3837 East Loop 820 So., Ft. Worth, TX 76119

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Quickscan Systems Ltd., 9465 Wilshire Blvd., Beverly Hills, CA 90212

R

R-Columbia Products Co., Inc., 2008 St. Johns Ave., Highland Park, IL 60035

RCA American Communications, 400 College Rd. E., Princeton, NJ 08540

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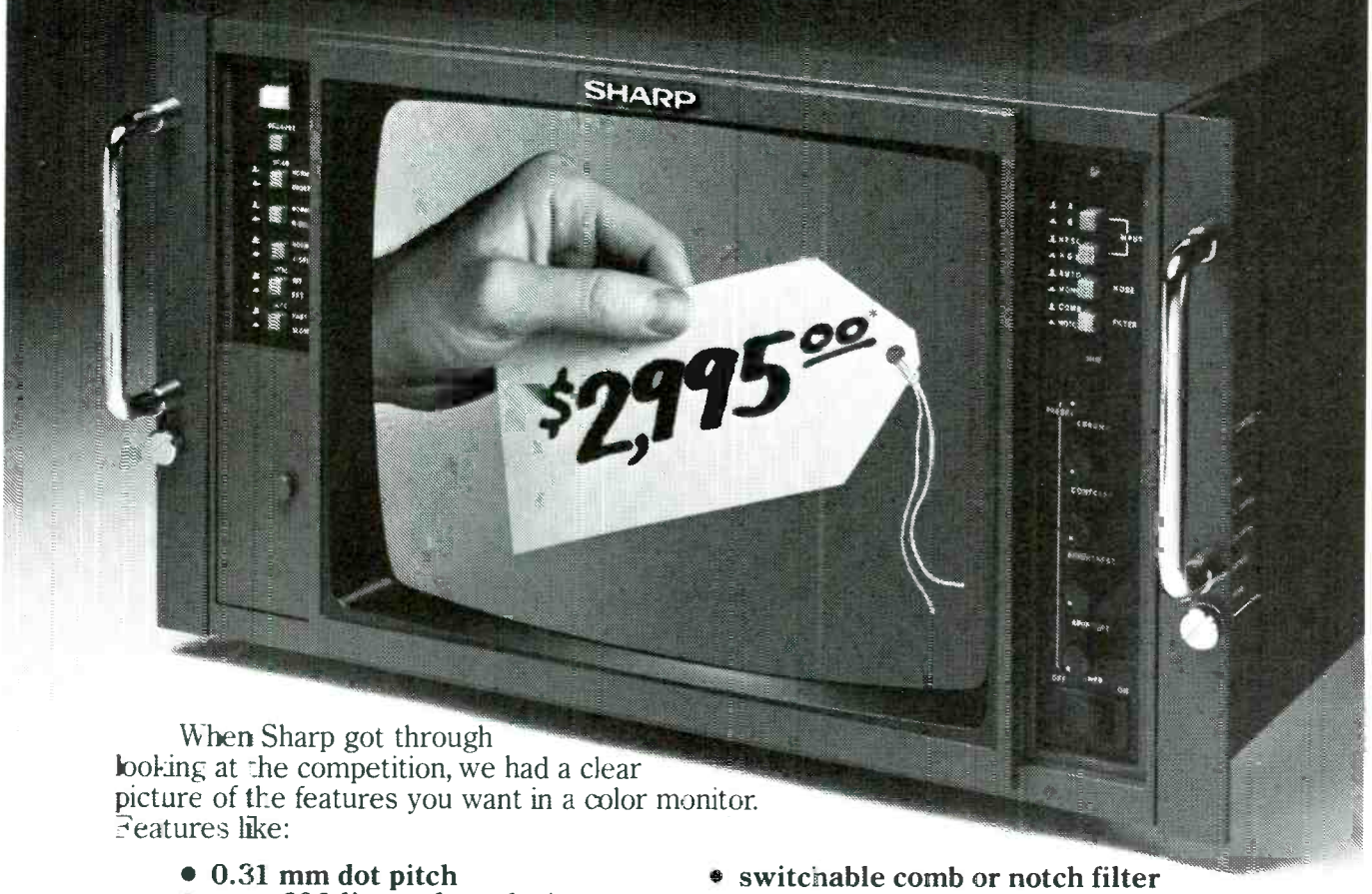

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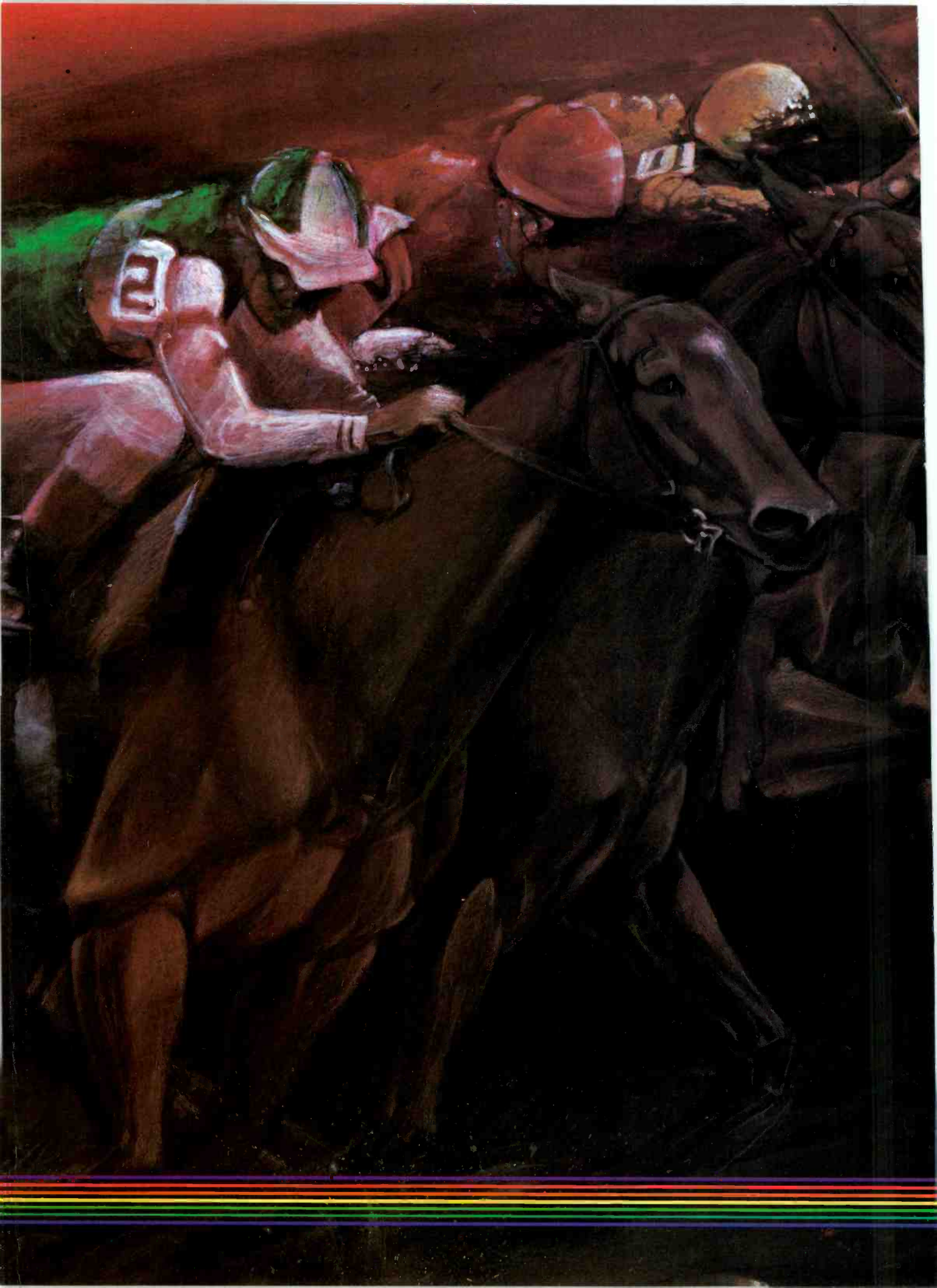

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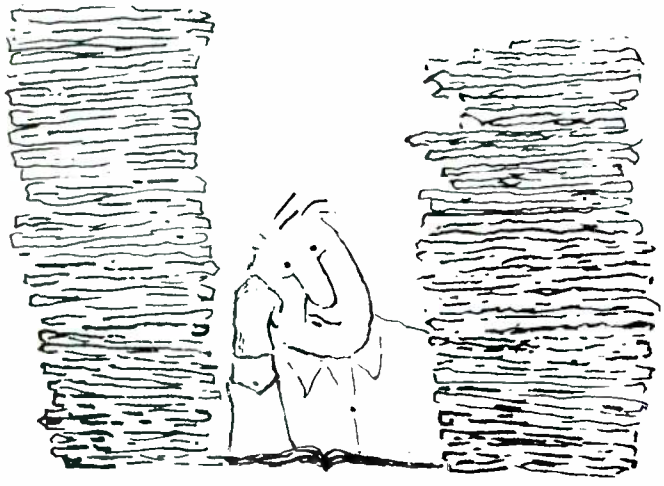

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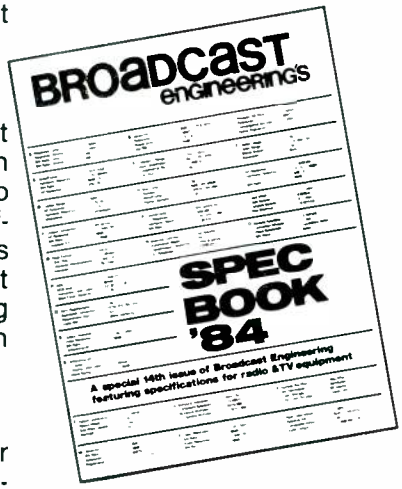

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IN: Allied Broadcast Equipment, 635 South 'E' St., Richmond, In 47374 (317) 962-8596 Roy Ridge
MD: David Green Broadcast Consultants, Box 8782, BW Airport, MD 21240 (301) 796-1500 David Green
MD: Recording Consultants, Inc., 8550 Second Ave., Silver Spring, MD 20910 (301) 587-1800 Jay Kingery
MA: Industrial Components Corp., 2551 Boston Rd., No. Wilbraham, MA 01067 (413) 596-3854 Steve Welch
NY: Boynton Studio, Melody Pines Farm, Morris, NY 13808 (607) 263-5695 Roger Boynton
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NY: David Bain Associates, Box 1014, Port Washington, NY 11050 (516) 883-4818 Mrs. Rosemary Bain
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TN: Broadcast Equipment & Supply Co., Rt. 1, Weaver Pike, Bluff City, TN 37618 (615) 878-2531 Clifton Droke
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WA: Broadcast Supply West, 7012 27th St. West, Tacoma, WA 98466 (206) 565-2301 Irving Law, Jr.

Stantron Div., Wyco Metal Products, 6914 Beck Ave., No. Hollywood, CA 91605

Guy Tessier (213) 875-0800

Star Case Mfg. Co. Inc., 649 Superior, Munster, IN 46321

Steenbeck, Inc., 9554 Vassar Ave., Chatsworth, CA 91311

Steiger, Hurray & Associates Inc., Broadcast Tech. Consultants, 6816 Westview Dr., Cleveland, OH 44141

Storeel Corp., 2050-C Carroll Ave., Suite 2, Atlanta, GA 30341

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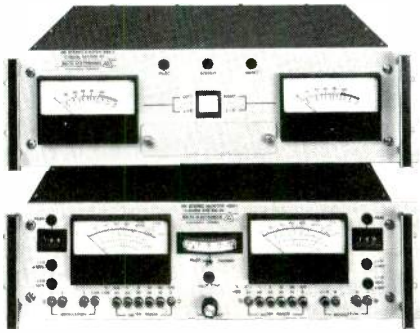
DELTA BROADCAST PRODUCTS



ASE-1/ASM-1

AM Stereo without compromise. The AM Stereo Exciter and Modulation Monitor provides a C-QUAM™ quadrature modulated stereo signal featuring low distortion and channel separation greater than 35 dB throughout the audio spectrum. The ASE-1 generates a signal to produce a phase modulated transmitter carrier. An L + R audio signal AM's this carrier to produce the C-QUAM signal, the only signal completely compatible with all C-QUAM, multimode and envelope detector receivers.

C-QUAM is a registered trademark of Motorola, Inc

RCS-1V

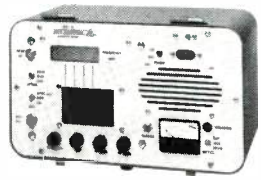
This Remote Control System calls you when it needs help! The RCS-1 combines microprocessor technology with easy operation. Features include direct interface boards for antenna monitors, patented remote modulation bargraphs, automatic logging, and synthesized speech telephone interface. Additional input and control boards to expand remote control capabilities can be added at any time.

DAM-1/AAM-1

The Digital and Analog Antenna Monitors measure the parameters of directional antenna systems. Readings are: relative current; and current ratio and current phase to a reference antenna. The DAM-1 accepts samples from 12 towers with a ±1° phase and ±2% current accuracies displayed on digital readouts. The AAM-1 can monitor up to 8 antennas with ratio and phase measurements displayed on front panel meters.

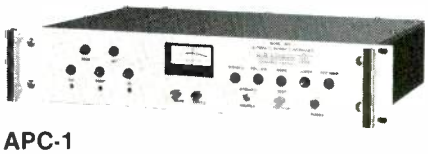
AMC-1/FMC-1

The only modulation control systems which provide a completely closed loop around the transmitter. The Amplitude and Digital Modulation Controllers sample actual modulation levels after the PA output network assures precise adjustment for optimum modulation levels. Both the AMC-1 and FMC-1 keep count of overmodulation bursts for signal control through a linear attenuator.



RG-3/RG-4

High output/super sensitive Receiver/Generator. The Receiver/ Generators combine a two-watt RF output and a correlation detector circuit that virtually eliminates interference problems. The RG-3 operates in the 500 kHz to 1.65 MHz frequency range while the RG-4 operates in the 100 kHz to 30 MHz range. Both can be used with the OIB series bridges for accurate null detector readings.

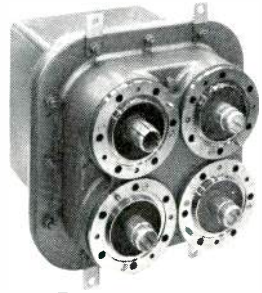


APC-1

Your insurance against over- and under-power operation. The Automatic Power Controller continuously monitors the transmitter output power, making automatic power adjustments via the transmitter loading control. The APC assures proper power levels at all times.

OIB-1/OIB-3/CPB-1

Full power impedance measuring. The Operating Impedance Bridges measure the impedance of radiators, networks and the like while operating under normal power. The OIB-1 measures VSWR and impedance up to 400 ± j300 ohms. The OIB-3 extends the range to 1000 ± j900 ohms, and has an RF amplifier for improved nulling. The Common Point Impedance Bridge is permanently installed for continuous monitoring of the common point during network adjustment. An optional TCA ammeter can be installed in its front panel.



6730E/6740B

Fast, efficient coaxial transfer switches. The coaxial transfer switches are designed to switch transmitters, transmission lines, antennas, dummy loads and auxiliary equipment quickly and easily. Either manually or remotely controlled, the switches are fully interlocked to prevent switching with RF power applied. The 6730E switch uses 1-5/8 inch connectors, the 6740B switch uses 3-1/8 inch connectors.

TCA/TCT

Simplifies antenna current and phase sampling. TCA Ammeter Systems provide accurate, modulation-free current readings on a variety of meter types. Torodial Current Transformers provide current and phase samples, and are available with three output voltage ranges, as well as high voltage models.

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Telcom Research, 1163 King Rd., Burlington, Ont., Canada L7R 3X5

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Teledac Inc., 1575 Taschereau, Longueuil, Que., Canada J4K 2X8

Teledyne Energy Systems, 110 W. Timonium Rd., Timonium, MD 21093

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Tennaplex Systems Ltd., 21 Concourse Gate, Nepear, Ont., Canada K2E 7S4

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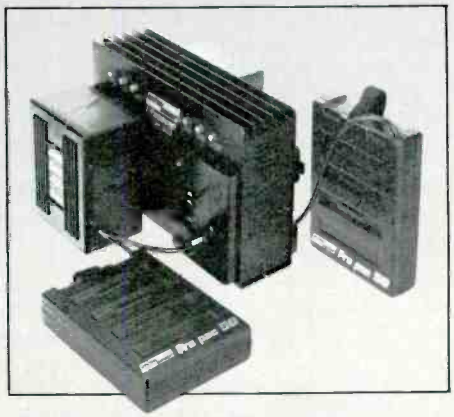

Lifesaver 8 Hour Quad, LSQ4, can charge any combination of up to 4 Pro Pac 90 VTR batteries or Snap-On® batteries. The Pro Pac 90 can also be safely charged in one hour with the Lifesaver Fast Charger, LSFC. The Lifesaver chargers prolong battery life and keep batteries fully topped indefinitely.

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Transimage Int'l., Transimage House, 245 Hanworth Rd., Hounslow, Middlesex, England TW3 3UA

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REGIONAL SALES CONTACTS:

CO: Videomedia, Inc., 1422 Alexander Rd., Colorado Springs, CO 80909 (303) 471-0147 Robert Toler
UT: Videomedia, Inc., 1723 E. Wilson, Salt Lake City, UT 84108 (801) 466-6755 Brad Richlin
ENGLAND: Videomedia Europe, 34 The Quadrant, Richmond, Surrey U.K. TW9 1DN 01-940-6188 Brian Conners

VideoStar Connections, Inc., 3390 Peachtree Rd. N.E., Atlanta, GA 30326

Videotek, Inc., 125 N. York St., Pottstown, PA 19464

Daniel Antonellis (215) 327-2292

REGIONAL SALES CONTACTS:

AZ: Videotek, Inc., 9625 North 21st Dr., Phoenix, AZ 85021 (602) 997-7523 Emery Grady

VideoTeleCom, 1428 N. Ontario St., Burbank, CA 91505

VideoTeleCom, 1305 Pratt Court, Raliegh, NC 27606

Vidicraft Inc., H&V Video Image Enhancer, 0704 S.W. Bancroft St., Portland, OR 97201

Viking Cases, 10480 Oak St. N.E., St. Petersburg, FL 33702

W. Vinten Ltd., Western Way, Bury St. Edmunds, Suffolk, England

Vir James, Consulting Engineers, 3137 W. Kentucky Ave., Denver, CO 80219

Visual Information Institute, Box 33, Xenia, OH 45385-0033

Vital Industries Inc., 3700 NE 53rd Ave., Gainesville, FL 32601

Linda Buickel (904) 378-1581

VIZ Test Equipment, Div. of VIZ Mfg. Co., 335 E. Price St., Philadelphia, PA 19144

W

WSI Corp., Box B, Bedford, MA 01730

Wallach & Associates Inc., Box 18167, Cleveland, OH 44118

Ward-Beck Systems Ltd., 841 Progress Ave., Scarborough, Ontario, M1H 2X4 Canada

Arthur Schubert, Jr. (416) 438-6550

REGIONAL SALES CONTACTS:

MA: Ward-Beck Systems Ltd., 755 Washington St., Annisquam, MA 01930 (617) 283-7507 Bill McFadden
TX: Ward-Beck Systems Ltd., 4012 Mendenhall Dr., Dallas, TX 75234 (214) 247-5999 Duke McLane

Waters Mfg. Inc., Longfellow Center, Wayland, MA 01778

Weaver/Steadman, Camera Support Systems, 1646 20th St., Santa Monica, CA 90404

Wegener Communications Inc., 150 Technology Park, Norcross, GA 30092

Weinschel Engineering, One Weinschel Lane, Gaithersburg, MD 20877

West Coast Audio, Inc., 1951 Gardena Ave., Glendale, CA 91204

Western Broadcast Systems Inc., 1010 W. Fremont Ave., Sunnyvale, CA 94087

Western Group, Mini-TP/Nova II, 3250 Wilshire Blvd. #1101, Los Angeles, CA 90010

Western Union, Video Services, One Lake St., Upper Saddle River, NJ 07458

Western Wireless Works, Box 2203, Apache Junction, AZ 85220

Westinghouse Electric Corp., Ind'l. & Govt't. Tube Div., Westinghouse Circle, Horseheads, NY 14845

Westinghouse Electric Corp., Semiconductor Div., Youngwood, PA 15697

Westlake Audio, Professional Products Mfg. Group, 2696 Lavery Court, Unit 18, Newbury Park, CA 91320

Wheatstone Broadcast Group, 5 Collins Rd., Bethany, CT 06525

Wheelit, Inc., Box 7350, Toledo, OH 43615

White Instruments, Inc., Box 698, Austin, TX 78767

Emory Straus (512) 892-0752

REGIONAL SALES CONTACTS:

AZ: Steve Fisher Associates, Box 14896, Phoenix, AZ 85063 (602) 247-7865 Steve Fisher
CA: Wes Alderson Co., 8548 Washington Blvd., Culver City, CA 90230 (213) 837-1398 Wes Anderson
CA: Dick Schnepp Associates, 15649 Kalisher St., Granada Hills, CA 91344 (213) 366-9597 Dick Schnepp
CA: Warren Associated Sales Reps, 2338 Calle Del Mundo, Santa Clara, CA 95054 (408) 988-7762 Donald Warren
CT: The Smith Co., 85 Prospect Ave., Hartford, CT 06106 (203) 523-0512 George Smith
FL.: Bencsik Associates, 3730 N.E. 42nd Lane, Ocala, FL 32670 (904) 732-9775 Bill Bencsik
IL: Ziskind Associates, 5420 Newport Dr., Suite 52, Rolling Meadows, IL 60008 (312) 577-1624 Burt Ziskind
IN: Pro Marketing Systems Inc., 9628 Day Dr., Indianapolis, IN 46280 (317) 846-9591 Pete Finney
MI: Shalco Inc., 570 Livernois Ave., Ferndale, MI 48220 (313) 547-4771 Bill McCall
MO: Rancilio Associates, Box 28869, St. Louis, MO 63123 (314) 631-3326 Chuck Rancilio
NJ: Metrorep Sales Inc., 57 South St., Freehold, NJ 07728 (201) 462-1221 Sam Helms
NY: L S M, 27 Orchard Park, Box 68, Phelps, NY 14532 (315) 548-4891 Gordon LeRoy
OH: Audio Marketing Associates, 9770 Whitewood Rd., Brecksville, OH 44141 (216) 526-2426 Bruce Hagen
PA: Richard S. Pass Associate, 27 Oxford Dr., Langhorne, PA 19047 (215) 757-6100 Richard Pass
TN: Wilson Audio Sales, 6602 Hiway 100, Suite 205, Nashville, TN 37205 (615) 356-0372 Wally Wilson
TX: Rep Tech Inc., Box 878, Terrell, TX 75160 (214) 222-2131 Bob Partridge
WA: Gemini Electronics Marketing, 115 4th Ave. S., Suite B, Edmonds, WA 98020 (206) 776-3121 Dean Nordquist
CANADA: Gulton Industries Ltd., Box 520, Gananogue., Ont., Canada K7G 2V1 (613) 382-2141 Mark Simmons

Whitmor Waveguides, 13161 Sherman Way, No. Hollywood, CA 91605

Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036

Wide Range Electronics, 2119 Schuetz Rd., St. Louis, MO 63146

Product Directory begins on page 38

The best there is!

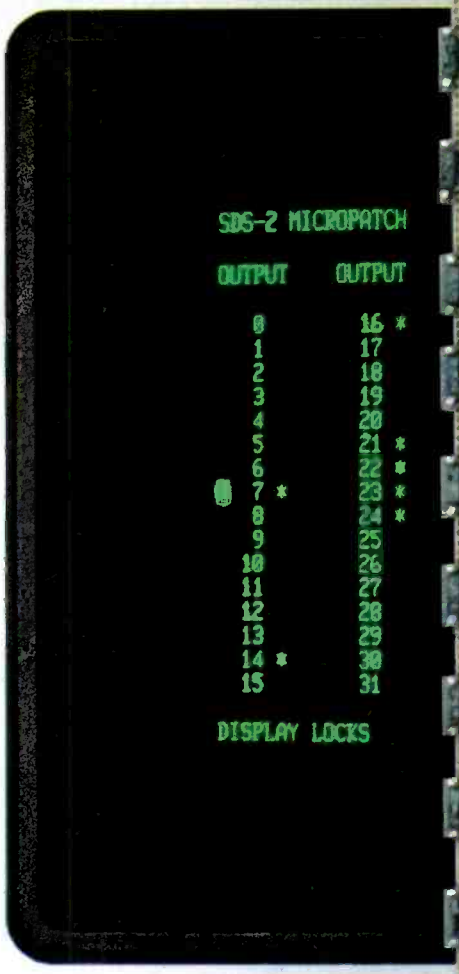
The SDS-2 Signal Distribution System

The perfect blend of hardware and software for versatile, flexible and truly expandable signal routing.

Compare these features:

- Classical design...one crosspoint for every path.
- Highest density crosspoint array.
  - 2048 crosspoints in only 8 RUs.
  - 96x96 video plus audio with redundant power supplies in only 72 RUs.
- Field expandable from 32x32 up to 512x512.
- Reliable Hybrid circuits for video crosspoints.
- Audio processing fully balanced.
- MicroPatch™ software includes Breakaway, Status Display, I/O Locks, Real Time Salvos... standard with the SDS-2.
- Control...varied and flexible for easy expansion and system reconfiguration.
- The most competitive cost per crosspoint.

Find out why the SDS-2 is the best there is. Call or write today.



CENTRAL DYNAMICS

Central Dynamics, 401 Wynn Drive, Huntsville, AL 35805 (205) 837-5180
New York: (914) 592-5440, Chicago: (312) 991-4720, Los Angeles: (213) 766-8185
Montreal: 147 Hymus Blvd., H9R 1G1 (514) 697-0810. Toronto (416) 446-1543

Circle (74) on Reply Card

Final Inspection Approval

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Wilk Power & Video Inc., 16255 Ventura Blvd., Suite 1001, Encino, CA 91436

Wilkinson Radio Div., Television Tech. Corp., 2360 Industrial Lane, Broomfield, CO 80020

The Will-Burt Co., TMD Div., Box 900, Orrville, OH 44667-0900

Martin R. Williams, P.E., 7401 East 14th St., Indianapolis, IN 46219

Winsted Corp., 9801 James Circle, Minneapolis, MN 55431

Randy Smith (800) 328-2962

REGIONAL SALES CONTACTS:

CA: Progressive Marketing, 1521 Placentia Ave., Anaheim, CA 92806 (714)) 774-4820

FL: Mort Press Video, Inc., 1800 Sans Souci Blvd., Suite 305, No. Miami, FL 33181 (305) 895-2262 Mort Press

IL: GO Video Sales, 1195 S. Wilson Dr., Lake Forest, IL 60045 (312) 295-6726 Gary Olson

MA: F.M. Valenti, Inc. & Associates, One Saunders Ledge, Nahant, MA 01908 (617) 592-5300 Fran Valenti

NY: Skip Dunn Sales, Box 448, New Rochelle, NY 10801 (914) 576-6003 Skip Dunn

TX: Active Marketing, Inc., 2815 Valley View, Suite 125, Dallas, TX 75234 (214) 243-2564

Wireworks Corp., 380 Hillside Ave., Hillside, NJ 07205

Wold Communications, 10880 Wilshire Blvd., #2204, Los Angeles, CA 90024

Wolf Coach Inc., 7 'B' St., Auburn, MA 01501

Woodward Measurement Lab, 9108 New Delaware Rd., Mt. Vernon, OH 43050

Frank Woolley & Co., 529 Franklin St., Reading, PA 19602

World Tower Co. Inc., Box 405, Mayfield, KY 42066

World Video Inc., Box 117, Boyertown, PA 19512

Y

Yamaha International Corp., Combo Products Div., Box 6600, Buena Park, CA 90622

Robert Davis (714) 522-9312

Yardney Battery Div., 82 Mechanic St., Pawcatuck, CT 06379

Z

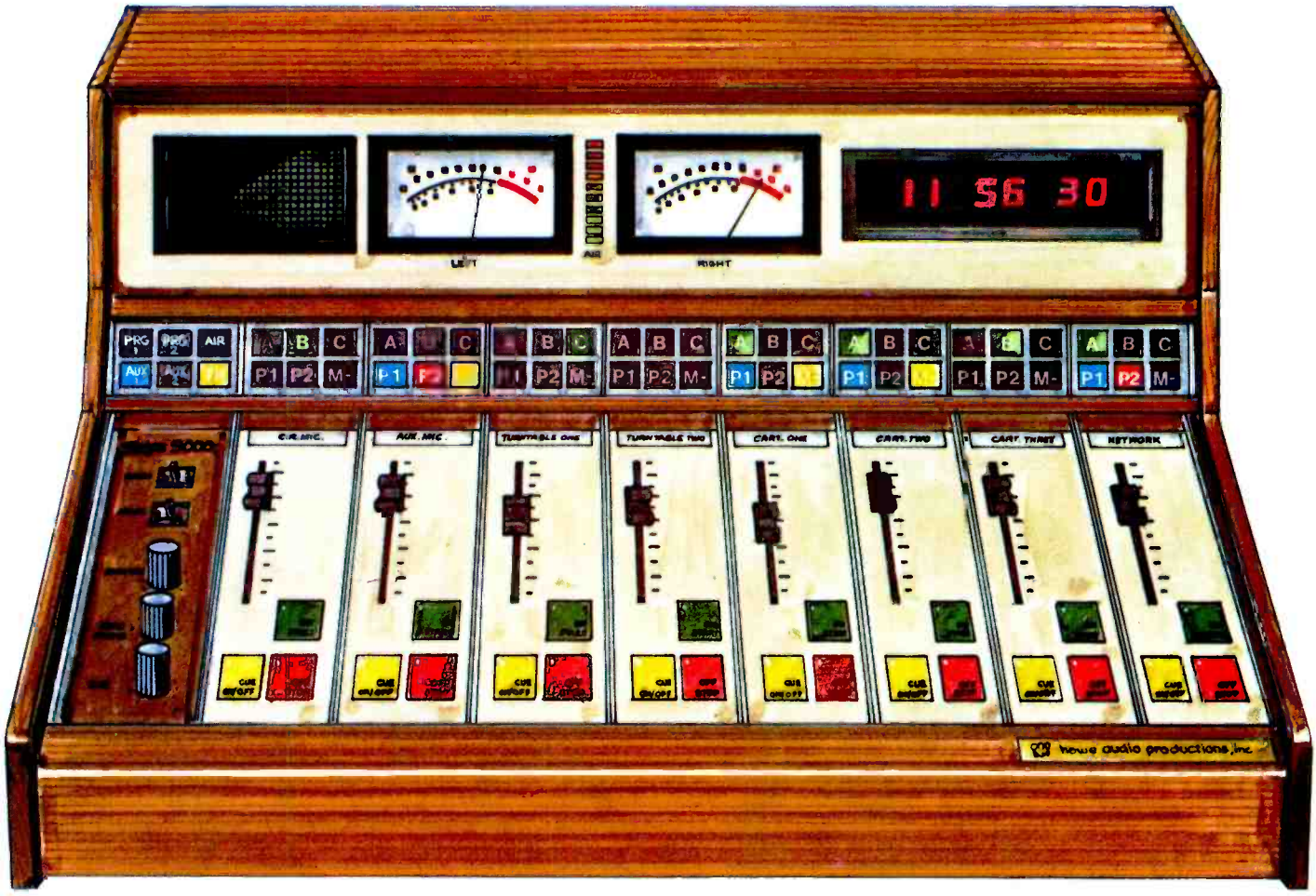
The Zei-Mark Corp., Box 182, Brookfield Center, CT 06805

Zellan Enterprises, Ltd., 250 West 57th St., New York, NY 10107

Ziehl Electronic Service, 8611 Dale Rd., Gasport, NY 14067

Product Directory begins on page 38

Series 9000...
the expandable solution!

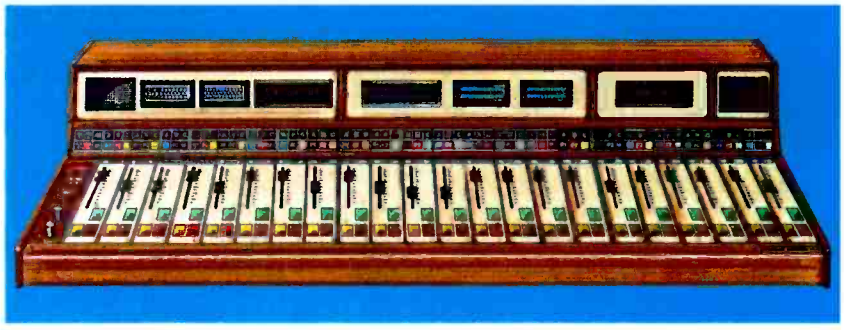


There isn't another audio console that compares with the Series 9000 by Howe Audio!

- **Sealed membrane switches** and the best quality faders available. TTL Digital Logic for machine controls that is assignable to the input you have selected on each fader.
- **Monitor Control Section.** Volume controls for monitors, headphones, and cue. Stereo/Mono monitor select and meter select switch.
- **Input and output selects.** 3 inputs and 3 outputs for each channel, including mix-minus.
- **Cue Speakers.** Built in on the front of the console. Smaller units have 1, larger units have 2.
- **Metering through regular Analog V.U. Meters.** Optional Vacuum Fluorescent meters also available.
- **Your Choice of a Clock or Timer** standard in smaller units, both standard in larger units.

howe audio productions, inc.
3085 A Bluff Street
Boulder, Colorado 80301
303/444-4693
For more information: 800/525-7520

...the only Modular Audio Console without a Main Frame!



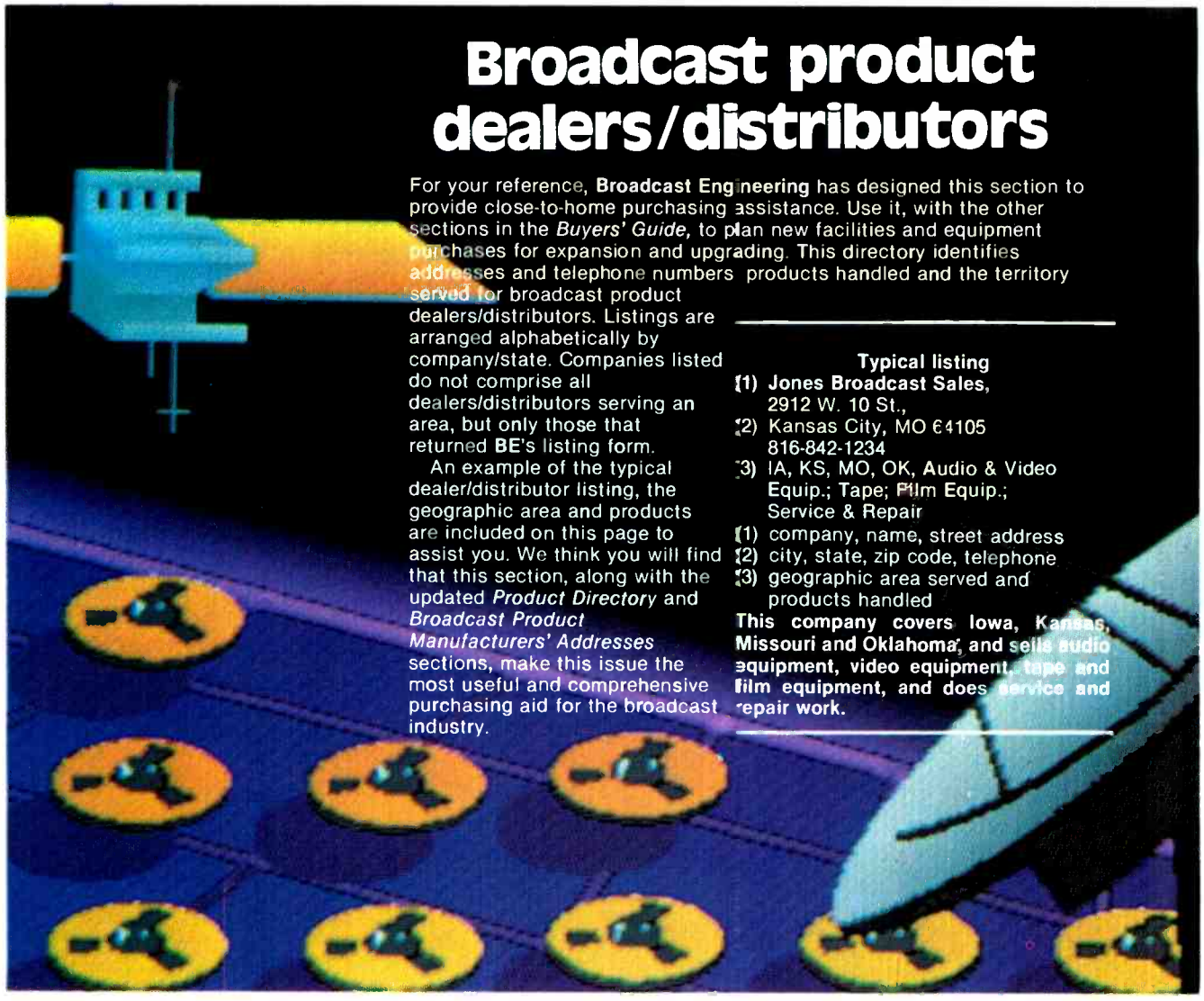
The **Series 9000** consoles are available in sizes from 8 to 22 channels.

Howe Audio Series 9000 . . . a new concept in consoles. The only modular consoles that do not require the broadcaster to purchase an expensive mainframe. This means a substantial savings to you, yet still affords you the ability to add on channels and features at a later time.

The **Series 9000** consoles are expandable at any time by adding more channel modules, adding to the metering section, and adding options such as another clock or timer, another cue speaker, etc.

Circle (75) on Reply Card

Broadcast product dealers/distributors



For your reference, **Broadcast Engineering** has designed this section to provide close-to-home purchasing assistance. Use it, with the other sections in the *Buyers' Guide*, to plan new facilities and equipment purchases for expansion and upgrading. This directory identifies addresses and telephone numbers of broadcast product dealers/distributors. Listings are arranged alphabetically by company/state. Companies listed do not comprise all dealers/distributors serving an area, but only those that returned **BE**'s listing form.

An example of the typical dealer/distributor listing, the geographic area and products are included on this page to assist you. We think you will find that this section, along with the updated *Product Directory* and *Broadcast Product Manufacturers' Addresses* sections, make this issue the most useful and comprehensive purchasing aid for the broadcast industry.

products handled and the territory served

Typical listing

(1) **Jones Broadcast Sales,**
2912 W. 10 St.,
(2) Kansas City, MO 64105
816-842-1234
(3) IA, KS, MO, OK, Audio & Video Equip.; Tape; Film Equip.; Service & Repair

(1) company, name, street address
(2) city, state, zip code, telephone
(3) geographic area served and products handled

This company covers Iowa, Kansas, Missouri and Oklahoma, and sells audio equipment, video equipment, tape and film equipment, and does service and repair work.

Key to products handled

AUDIO EQUIPMENT (including recorders, microphones, mixers, consoles, cart machines, turntables, processing devices, etc.)
VIDEO EQUIPMENT (including cameras, videotape recorders, production switchers, monitors, lights, etc.)
TEST AND MEASUREMENT EQUIPMENT (audio and video)
TRANSMITTERS, ANTENNAS AND TRANSMISSION SYSTEMS (including towers ATS, STL, MDS, etc.)
TAPE (including video and audio recording tape, etc.)
VACUUM TUBES (including video camera, transmitter, TWT, etc.)
FILM EQUIPMENT (including cine cameras, processing equipment, film projectors, etc.)
VANS AND ACCESSORIES
SERVICE AND REPAIR
SYSTEM DESIGN (including studio installation, etc.)
USED EQUIPMENT (including leasing, rentals, etc.)

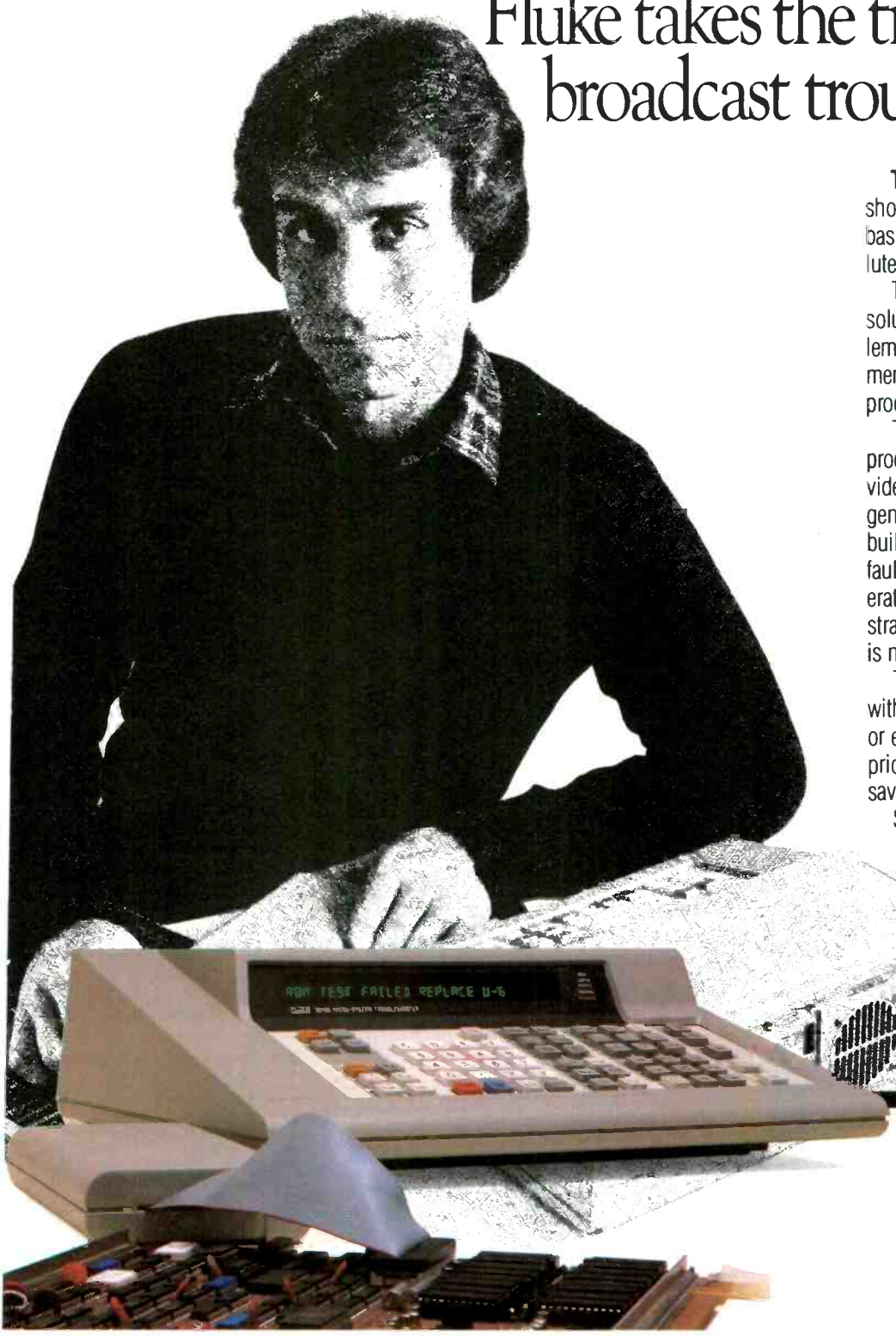
Key to geographical area code

AK	Alaska	MS	Mississippi
AL	Alabama	MT	Montana
AR	Arkansas	NC	North Carolina
AZ	Arizona	ND	North Dakota
CA	California	NE	Nebraska
CO	Colorado	NH	New Hampshire
CT	Connecticut	NM	New Mexico
DC	District of Columbia	NV	Nevada
DE	Delaware	NY	New York
FL	Florida	OH	Ohio
GA	Georgia	OK	Oklahoma
GU	Guam	PA	Pennsylvania
HI	Hawaii	PR	Puerto Rico
IA	Iowa	RI	Rhode Island
ID	Idaho	SC	South Carolina
IL	Illinois	SD	South Dakota
IN	Indiana	TN	Tennessee
KS	Kansas	TX	Texas
KY	Kentucky	UT	Utah
LA	Louisiana	VA	Virginia
MA	Massachusetts	VI	Virgin Islands
MD	Maryland	VT	Vermont
ME	Maine	WA	Washington
MI	Michigan	WI	Wisconsin
MN	Minnesota	WV	West Virginia
MO	Missouri	WY	Wyoming

(Abbreviations for Canadian provinces)

ALTA	Alberta
BC	British Columbia
MAN	Manitoba
NB	New Brunswick
NF	Newfoundland
NS	Nova Scotia
ONT	Ontario
PEI	Prince Edward Island
QUE	Quebec
SASK	Saskatchewan
YUK	Yukon Territory

Fluke takes the trouble out of broadcast troubleshooting.



The Fluke 9010A. Now, a fast troubleshooter that cuts critical microprocessor-based equipment downtime to an absolute minimum.

The Fluke 9010A offers a refreshing solution to the broadcast engineer's problem of repairing microprocessor equipment by converting costly downtime to productive uptime.

The 9010A plugs into the microprocessor socket of your camera, VTR, video router, video switcher or graphics generator. It has a complete array of built-in preprogrammed tests to make fault isolation fast and foolproof. And operation characteristics so clear and straight-forward that no lengthy training is needed for effective troubleshooting.

The result is fast, easy, low-cost repairs without complicated hardware hookups, or excessive board inventories. All at a price that can pay for itself with time savings alone.

So, if your position involves the testing and repair of broadcast equipment, contact your local Fluke representative or call our toll-free hotline **1-800-426-0361** for more information on the Fluke 9010A. And take the trouble out of broadcast troubleshooting.

IN THE U.S. AND NON-EUROPEAN COUNTRIES:
John Fluke Mfg. Co., Inc.
P.O. Box C9090, M/S 250C
Everett, WA 98206
(206) 356-5400, Tlx: 152662

IN EUROPE:
Fluke (Holland) B.V.
P.O. Box 5053, 5004 EB
Tilburg, The Netherlands
(013) 673973, Tlx: 52237

FLUKE®

ALABAMA

Gray Communications Consultants, Inc., 209 Oxmoor Circle, Suite 708, Birmingham, AL 35209 (205-942-2824) AL Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems, Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.; Tape

ALASKA

Alaska Electronics Supply, Inc., 2020 E. Dowling Rd. Units 1 & 2, Anchorage, AK 99507 (907-563-3774) AK Audio Equip.; Test & Measurement Equip.; Tape; Vacuum Tubes

NVS Systems, Inc., 8300 King St., Anchorage, AK 99502 (907-349-3523) AK Audio & Video Equip.; Test & Measurement Equip.; Tape; Film Equip.; Service & Repair; System Design

ARIZONA

E.A.R. Professional Audio, 2641 E. McDowell, Phoenix, AZ 85008 (602-267-0600) AZ, CA, CO, NV, NM, VT Audio Equip.; Tape; Systems Design; Used Equip.

ROH'S Inc., 4553 E. Broadway, Tucson, AZ 85711 (602-795-8573) AZ, NM Audio & Video Equip.; Tape; System Design

Spencer Broadcast, Inc., 316 E. El Camino Dr., Phoenix, AZ 85020 (602-242-2211; 800-221-6941) AZ, CA, CO, NV, NM, TX, UT Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; System Design

ARKANSAS

Gray Communications Consultants, Inc., 5105 McClanahan Dr., Suite J-1, North Little Rock, AR 72116 (501-758-3234) AR, TN Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.; Tape

Radcom, Inc., Hwy. 23 South, Rt. 1, Box 28-B, Eureka Springs, AR 72632 (501-253-8556) Worldwide Audio Equip.; Transmitters, Antennas & Transmission Systems; System Design

CALIFORNIA

Accurate Sound Corp., 3515 Edison Way, Menlo Park, CA 94025 (415-365-2843) U.S.A., Canada, GU, PR, VI Audio Equip.; Tape; System Design; Used Equip.

Advanced Marketing, Box 97, Redwood City, CA 94064 (415-365-3944) CA, NV, OR, WA Audio & Video Equip.; Test & Measurement Equip.; Vans & Accessories

Advanced Technology Div. of Symbolized Systems, Inc., 23950 Craftsman Rd., Calabassas, CA 91302 (818-999-1393; CA Only 800-232-2142; Nat'l. 800-432-3641) U.S.A. Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Film Equip.; Service & Repair; System Design; Used Equip.

Audio Engineering Associates, 1029 N. Allen Ave., Pasadena, CA 91104 (213-798-9127) Southern-CA Audio Equip.

Audiolab Electronics, Inc., 3725 Esperanza Dr., Sacramento, CA 95825 (916-485-0500) Worldwide Audio Products; AM-FM-TV Communications & Microwave Frequency Measurement Service: Two-Way Communication Equip. Sales & Service; Rental; Satellite Systems

A-Vidd Electronics Co., 2210 Bellflower Blvd., Long Beach, CA 90815 (213-598-0444; 714-821-0870) Southern-CA Audio & Video Equip.; Test & Measurement Equip.; Tape; Service & Repair; System Design; Used Equip.; Complete Sales & Service, Installation, Rentals, Editing; Personal Computers & Accessories

A-Vidd Electronics Co., 4930 Campus Dr., Newport Beach, CA 92660 (714-851-1295) Southern-CA Audio & Video Equip.; Test & Measurement Equip.; Tape; Used Equip.; Complete Sales & Service, Installation, Rentals, Editing; Personal Computers & Accessories

A-Vidd Electronics Co., 1126 W. Foothill Blvd., Upland, CA 91786 (714-981-8884; 818-966-4586) Southern-CA, Las Vegas NV Audio & Video Equip.; Test & Measurement Equip.; Tape; System Design; Used Equip.; Complete Sales, Service, Installation, Rentals, Editing; Personal Computers & Accesssories

Barrett Associates Inc., 3205 Production Ave., Oceanside, CA 92054 (619-433-5600) U.S.A. Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes

Birns & Sawyer, Inc., 1026 N. Highland Ave., Los Angeles, CA 90038 (213-466-8211) Worldwide Film Equip.; 16mm & 35mm; Service & Repair; Used Equip.

Broadcast Cartridge Service, 15131 Triton Lane, Suite 108, Huntington Beach, CA 92649 (714-898-7224) U.S.A. Tape; Broadcast Cartridges Reel-to-Reel; Alignment Tools, Storage Systems; Reloading Service; Fone Box

Richard W. Burden Associates, 20944 Sherman Way, Canoga Park, CA 91303 (818-340-4590) AK, AZ, CA, CO, Hi, ID, NV, NY, OR, UT, WA, WY Audio Equip.; Transmitters, Antennas & Transmission Systems; Cable FM Modulators

Cara Int'l. Ltd., Inc., 22642 Greenwood Ave., Torrance, CA 90505 (213-325-6522) AZ, CA, NV, UT Audio Equip.; Test & Measurement Equip.

CeCo Communications Inc. of CA, 2750 Bell Flower Blvd., Suite 118, Long Beach, CA 90815 (213-425-6481) Worldwide Broadcast Tubes; Electron Tubes; Broadcast Types, High Power, Transmitting Tubes; Receiving Tubes; Industrial Tubes; Vacuum Tubes

COMM-WEST, Communications West, Inc., Box 255321, Sacremento, CA 95865 (916-332-8700) AZ, CA, NV Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; System Design; Used Equip.

Communications Co., 3940 Noell St., San Diego, CA 92110 (619-297-3261) CA Audio Equip.; System Design

Computer Broadcasting Inc., 6085 Dawn Dr., Rohnert Park, CA 94928 (707-585-0266) U.S.A. Computers; Printers & Other Support Supplies

ECD Industries, Inc., 2034 Armacost Ave., Los Angeles, CA 90025 (213-820-3009; 800-421-7152) U.S.A. and Canada Electronic Tubes; Semiconductors

The ENG Shop, 214 1/2 Cedar Ave., Inglewood, CA 90301 (213-419-0309) AR, CA, CO, HI, MT, NV, OR, UT, WA, WY Video Equip.

Film Processing Corp., 3602 Crenshaw Blvd., Los Angeles, CA 90016 (213-737-8273) Worldwide Audio Magnetic Recording Film; Audio Tape; Video Tape; Editorial Supplies-Leaders, Cans, Reels, etc.

Alan Gordon Enterprises Inc., 1430 Cahuenga Blvd., Hollywood, CA 90078 (213-466-3561; 818-985-5500) U.S.A., AK, HI, Canada, Central & So. America, Far East, India, Europe Audio Equip.; Video Lighting & Camera Supports; Film Equip.; Service & Repair; Used Equip.

J.N.D. Inc., 131 Bolinas, Fairfax, CA 94930 (415-459-3186) CA, NV Audio Equip.

MARCOM, Box 828, Hollywood, CA 90078 (213-703-0381) AK, AZ, CA, HI, NV, OR, WA Audio & Video Equip.; Transmitters, Antennas & Transmission Systems; System Design

MARCOM, Box 66507, Scotts Valley, CA 95066 (408-438-4273) AK, AZ, CA, HI, NV, OR, WA Audio & Video Equip.; Transmitters, Antennas & Transmission Systems; Tape; Film Equip.; System Design

Martel Electronics, Inc., 920 E. Orangethorpe #D, Anaheim, CA 92801 (714-871-7102) U.S.A. Audio Equip. including all types of Recorders, Microphones, Mixers, & Audio Tape

Meyer, Ross & Fleming, Inc., 1485 Rollins Rd., Burlingame, CA 94010 (415-348-6800) CA, HI, NV CA, HI, NV Audio & Video Equip.; Test & Measurement Equip.

Nalpak Video Sales Inc., 3928 S. Sepulveda, Suite 8, Culver City, CA 90230 (213-391-0491) U.S.A. and Canada Video Equip. & Accessories; Test Equip.

Olesen, 1535 Ivar Ave., Hollywood, CA 90028 (213-461-4631) U.S.A. Video Equip.; Studio Installations

Pacific Coast Marketing, 14125 Capri Dr., Los Gatos, CA 95030 (408-370-3505) CA, NV Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems

Pacific Recorders & Eng. Corp., 2070 Las Palmas Dr., Carlsbad, CA 92008 (619-438-3911) U.S.A. and Canada Audio Equip.; System Design

Shoreline, Ltd., 3459 Cahuenga Blvd. W., Hollywood, CA 90068 (213/851-1236) AZ, CA, CO, HI, ID, MT, NV, NM, ND, OR, SD, TX, UT, WA, WY, Audio & Video Equip.; Test & Measurement Equip.

Sound Genesis, 2001 Bryant St., San Francisco, CA 94110 (415-285-8900) AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA Audio for Video; Tape; Service & Repair; System Design; Used Equip.

Sound Investment Enterprises, Box 4139, Thousand Oaks, CA 91359 (818-991-3400 AL, AZ, AR, CA, CC, FL, HI, IL, IN, IA, KS, LA, MI, MS, MO, NV, NM, NC, OK, OR, SC, TN, TX, UT, WY Audio Equip.; Systems Design

Sprague Magnetics, Inc., 15904 Strathern St. #12, Van Nuys, CA 91406 (213-994-6602) AZ, CA, FL, GU, HI, IL, MI, MN, NE, NJ, NY, NC, PA, PR, TN, TX, VI, WA, Alta., B.C., Ont., Que. Replacement Tape Heads; Recorder Care Products

Stage Lighting Distributors, 1653 N. Argyle Ave., Hollywood, CA 90028 (213-466-8324) U.S.A. and Canada Video Equip.; Lighting & Controls; System Design

See advertisement on page 159

R-42 diversity receiver • Now with GaAsFET's.

Improved sensitivity and system range, with ultralow noise.

Cetec Vega's top-of-the-line PRO PLUS R-41 and R-42 wireless-microphone receivers have quickly become the worldwide standard of excellence. Overall quality of the PRO PLUS wireless system is equal to wired microphone systems, with respect to dynamic range, signal-to-noise ratio, distortion, etc. *We invite your comparisons.* Check these features of the new, improved PRO PLUS receivers:

- **GaAsFET front end.** Provides the highest achievable sensitivity for maximum system range. Also incorporates a high-performance helical filter.
- **Lowest distortion.** 0.25% maximum, 0.15% typical.
- **Measurably the highest signal-to-noise ratio and widest dynamic range.** Quiet as a wire. With DYNEX II (a new standard in audio processing), SNR is 101 dB (108 dB A-weighted). System dynamic range is 133 dB including transmitter adjustment range, from input for maximum nondistorting gain compression to noise floor.
- **"Infinite gain" receiver.** Improved performance in the critical threshold region, superior handling of multipath conditions, better SNR, and constant receiver audio output level.
- **Professional audio circuits.** Output is adjustable from +20 dBm to -60 dBm in four ranges. Also featured are selectable phasing and 0.2-watt independent headphone amplifier.
- **True dual-receiver diversity.** The R-42 diversity system is the most reliable method to avoid dropouts. The R-41 nondiversity receiver has all of the other features of the R-42.

PRO PLUS wireless-microphone systems achieve the highest performance possible with today's advanced technology.

Write or call for further information and location of your nearest dealer: Cetec Vega, P.O. Box 5348, El Monte, CA 91734. (818) 442-0782.

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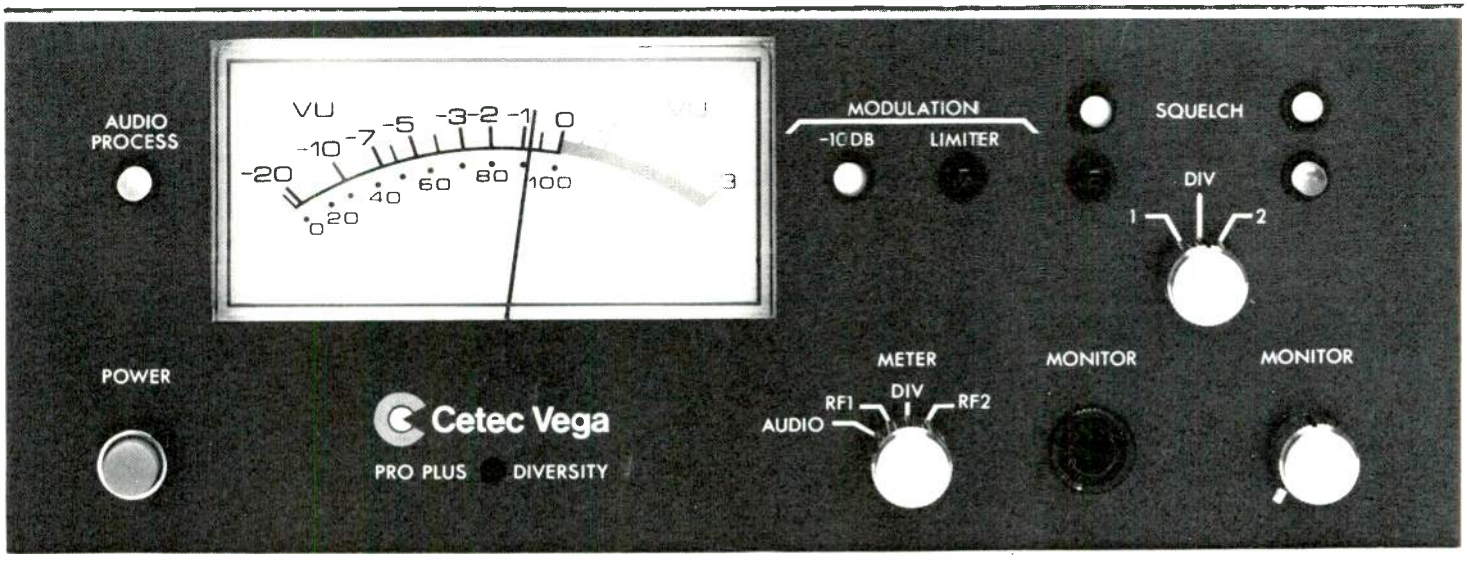

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Studio Film & Tape Inc., 6670 Santa Monica Blvd., Hollywood, CA 90038 (213-466-8101) U.S.A. and Canada Audio & Video Tape, All Formats

Studiobuilders, 919 N. Victory Blvd., Burbank, CA 91502 (213-842-9526) CA Audio & Video Equip.; Studio Installation

System Associates, 5801 Uplander Way, Culver City, CA 90230 (213-641-2042) North America Brokers of Used Broadcast TV Equip.; Video Equip.; Test & Measurement Equip.; Film Equip.; Vans & Accessories

Taber Mfg. & Eng. Co., 2468 Embarcadero Way, Palo Alto, CA 94303 (415-493-3811) U.S.A. and Canada Audio Equip.

Television Associates, Inc., 2410 Charleston Rd., Mountain View, CA 94040 (415-967-6040) Northern-CA Broadcast Professional & Industrial Products; Video Equip.; Video Production & Duplication Facilities

Video Communications Corp., 333 Paseo Tesoro, Walnut, CA 91789 (714-594-2442) AZ, CA, NV Audio & Video Equip.; Test & Measurement Equip.; Service & Repair; System Design

Videomedia, Inc., 211 Weddell Dr., Sunnyvale, CA 94089 (408-745-1700) AZ, CA, CO, ID, MT, NV, NM, OR, UT, WY Editing Systems; Color Cameras; Monitors; Time Base Correctors; Video Tape Recorders, Projectors & Tape; Sync & Character Generators; Lighting; System Design, Fabrication & Training

See advertisement on this page and 155

Videotape Products, Inc., 320 N. Madison Ave., Los Angeles, CA 90004 (213-664-1144) Worldwide Video Equip.; Tape; Test & Measurement Equip.

West Coast Audio, Inc., 1951 Gardena Ave., Glendale, CA 91204 (818-502-1980) U.S.A. Audio & Film Equip.

Western Broadcast Systems Inc., 1010 W. Fremont Ave., Sunnyvale, CA 94087 (408-730-1600) AK, CA, HI, NV, OR, WA Audio & Video Equip.; Test & Measurement Equip.; Tape; Film Equip.; Service & Repair; System Design

Westlake Audio, Professional Audio Sales Group, 7265 Santa Monica Blvd., Los Angeles, CA 90046 (213-851-9800) Worldwide Audio & Video Equip.; Tape; Service & Repair; System Design; Used Equip.

COLORADO

Audities/2001, 2377 E. Mississippi Ave., Denver, CO 80210 (303-777-4595) AZ, CO, ID, MT, NM, UT, WY Audio & Video Equip.; Test & Measurement Equip.; Tape

Burst Communications, Inc., 7310 S. Alton Way, Suite C, Englewood, CO 80112 (303-773-9499) AZ, CO, NM, UT, WY Audio & Video Equip.; Test & Measurement Equip.; Tape; Film Equip.; Service & Repair; System Design

Colorado Magnetics, Box 713, Colorado Springs, CO 80901 303-635-3660) AZ, CA, CO, FL, ID, KS, MO, MT, NE, NV, NM, ND, OH, OK, OR, SD, TX, UT, WA, WY Tape Cartridges; Broadcast Supplies

Didier/Denver, Inc., Box 1599, Evergreen, CO 80439 (303-674-6000) CO, ID, KS, MT, NE, NM, UT, WY Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Equip.

Film/Video Equipment Service Co., 1875 S. Pearl St., Denver, CO 80210 (303-778-8616) AK, AZ, CA, CO, DC, FL, KS, LA, MN, MS, MO, MT, NE, NV, NM, ND, SD, TN, TX, UT, WY Audio & Video & Film Equip.; Service & Accessories

CONNECTICUT

Audiotechniques Inc., 652 Glenbrook Rd., Stamford, CT 06906 (203-359-2312; Sales: 800-243-2598) CT, DE, DC, ME, MD, MA, NJ, NY, PA, RI, VT, VA Audio Equip.; Test & Measurement Equip.; Tape; Service & Repair; System Design; Used Equip.

National Video Services, Commerce Park, Finance Dr., Danbury, CT 06810 (203-792-3862) CT, DC, ME, MA, NH, NJ, NY, PA, RI, VT Video Equip.; Vacuum Tubes; Service & Repair; System Design; Remanufacture a Wide Band Video Recorder For Medical Use.

Radio Research Instrument Co., Inc., 2 Lake Ave. Extension, Danbury, CT 06810 (203-792-6666) U.S.A. Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Used Equip.

DISTRICT OF COLUMBIA

Comex Corp., Box 17011, Dulles Int'l. Airport, Washington, DC 20041 (703-471-4215) Central & South America, Caribbean MMDS/ITFS Systems; Satellite Earth Stations & Associated Origination Equip.; Engineer, Furnish & Install

Instrucom, Inc., 655 15th St. N.W., Suite 310, Washington, DC 20005 (202-223-1759) DE, DC, MD, NC, VA, WV Customized Control; Telemetering & Alarm Systems; Telecommunications Systems & Test Equip. AD, DC; Telephone Radio Surge Protection Systems

FLORIDA

Barbizon Delta Corp., 1125 N. 53rd Ct., Australian Industrial Park, West Palm Beach, FL 33407 (305-844-5973) AL, FL, GA, LA, PR, MS, SC Lighting Equip. for Motion Pictures, TV & Theatre; Lamps; Color Media; Sockets; Lighting Heads & Accessories

Beattie & Associates, Inc., 3317 Barrow Hill Trail, Tallahassee, FL 32312 (904-893-1382) AL, FL, GA Audio & Video Equip.; Transmitters, Antennas & Transmission Systems; Sales, Service & Installation. Turnkey LPTV Systems; All Solid State FM Transmitters up to 5 KW.

See advertisement on this page

Bencsik Associates Inc., 3730 N.E. 42nd Ave., Ocala, FL 32670 (904-732-9775) FL, PR Audio Equip.

Broadcast International, Inc., 1229 N.E. 37th St., Ft. Lauderdale, FL 33334 (305-564-4422) Worldwide Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Service & Repair; System Design; Used Equip.

Comad Inc., Box 10667, Pensacola, FL 32504 (904-434-9782) U.S.A. Audio & Video Equip.

Control Technology, Inc., 2322 Davie Blvd., Ft. Lauderdale, FL 33312 (305-587-2716; Outside FL 800-327-4121) U.S.A. Audio Tape Recorders; Consoles, Mixers; Turntables, Preamps; Mics & Accessories; Power Amps; Speakers, Audio Processing & Loggers; Tape, Cartridges, Heads & Accessories; Studio Furniture; STL Systems; Transmitters, Transmission & Antennas

Design Line Inc., 6204 Benjamin Rd., #209, Tampa, FL 33614 (813-884-1461) U.S.A Audio Equip.; System Design

Electrex Co., 18680 Northeast 2nd Ave., Miami, FL 33179 (305-651-5752) U.S.A. and Latin America Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape, Vacuum Tubes; System Design

See advertisement on page 234

Ellis Tower Co., Inc., Box 23217, Ft. Lauderdale, FL 33307 (305-566-6432) AL, AR, CT, DE, DC, FL, GA, IL, IN, IA, KY, LA, ME, MD, MA, MI, MN, MS, MO, NH, NJ, NY, NC, OH, PA, PR, RI, SC, TN, VT, VA, VI, WV, WI Transmitters, Antennas & Transmission Systems

Gray Communications Consultants, Inc., 1031 N.W. 91st Terrace, Gainesville, FL 32601 (904-376-2435; 378-2986) FL Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.; Tape

Gray Communications Consultants, Inc., 1657 N.W. 79th Ave., Miami, FL 33126 (305-591-3637) FL, PR, VI, Caribbean, Central & South America, West Indies Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.; Tape

Gray Communications Consultants, Inc., 1605 S. Bumby Ave., Orlando, FL 32806 (305-896-7414) FL Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.; Tape

Gray Communications Consultants, Inc., 5401 Southern Comfort Blvd., Tampa, FL 33614 (813-885-1411; 823-6840) FL, PR, VI, Caribbean, Central & South America, West Indies Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.; Tape

International Wholesalers of Miami, Inc., 17866 Ipco Rd., No. Miami, FL 33162 (800-327-0596) U.S.A., PR Audio & Video Equip.

Lita Broadcasting Distributors, 7154 N.W. 72nd Ave., Miami, FL 33166 (305-887-1223) FL, Central & South America, Caribbean Audio Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes

Media Concepts, Inc., 559 49th St. S., St. Petersburg, FL 33707 (813-321-2122) Worldwide Audio & Video Equip.; Tape; Service & Repair; System Design

Midwest Corp., Communications Systems Div., 3331 Northwest 82nd Ave., Miami, FL 33122 (305-592-5355) AL, FL, GA, PR, VI, Central & South America, Caribbean Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vans & Accesssories; Service & Repair; System Design

Midwest Corp., Communications Systems Div., 6302 Benjamin Rd., Suite 403, Tampa, FL 33614 (813-885-9308) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Film Equip.; Vans & Accessories; Service & Repair; System Design; Rental & Leasing Equip.

Pro Audio General Store, Inc., 1378 NW 100th Ave., Coral Springs, FL 33065 (305-752-0330) AL, AZ, AR, CO, DC, FL, GA, IL, IN, IA, KY, LA, MI, MN, MS, MO, MT, NE, NY, NC, ND, OH, OK, SC, TN, TX, UT, VA, WV, WI Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Service & Repair; System Design; Used Equip.

Recording Studio Equip. Co., 14205 N.E. 18th Ave., No. Miami, FL 33181 (305-945-9774) U.S.A.; Export to So. America, Europe, Caribbean Professional Audio Equip.

Southeast Electronics, Inc., 1125 Rosselle St.; Box 41308, Jacksonville, FL 32203 (904-356-3007) AL, FL, GA Audio & Video Equip.; Transmitters; Tape; Service & Repair; System Design; Used Equip.

Stage Equipment & Lighting, Inc., 124 Candace Dr., Maitland, FL 32741 (305-831-1772) AL, FL, Caribbean, Central & South America Video Equip.; Service & Repair; Used Equip.

Stage Equipment & Lighting, Inc., 12231 N.E. 13th Court; Box 61000F, Miami, FL 33161 (305-891-2010) AL, FL, GA, Caribbean, Central & South America Video Equip.; Lamps; Service & Repair; Used Equip.

GEORGIA

Allied Broadcast Equipment, 4405 Mall Blvd., Suite 314, Union City, GA 30291 (404-964-1464) Worldwide Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas, Transmission Systems; Tape; Vacuum Tubes; Service & Repair; System Design

Crescendo Associates, 125 Simpson St. N.W., Atlanta, GA 30313 (404-223-0108) AL, FL, GA, MS, NC, SC, TN Audio & Video Equip.

Gary Communications Consultants, Inc. (Headquarters), Box 3229, Albany, GA 31708 (912-883-2121) AL, AR, FL, GA, LA, NC, TN, TX Audio & Video Equip.; Tape; Film Equip.; System Design

Gray Communications Consultants, Inc., 3684 Clearview Ave., Doraville (Atlanta), GA 30340 (404-455-3121) AL, GA, NC, SC, TN Audio & Video Equip.; Test & Measurement Equip.; Tape; Vans & Accessories; Service & Repair; Systems Design; Film Equip.

Midwest Corp., Communications Systems Div., 522 Armour Circle, N.E., Atlanta, GA 30324 (404-875-3753) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.

Provisional Battery Co., Inc., 3874 Green Industrial Way, Atlanta, GA 30341 (404-451-7171) U.S.A. AK, HI; Canada, Caribbean Video & Film Equip.; Service & Repair

Radford Associates, 3203 Lanier Dr., Atlanta, GA 30319 (404-237-6097) AL, FL, GA, KY, MS, NC, SC, TN, WV Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Transmission, Antennas Systems

Technical Industries Inc. of Georgia, 6000 Peachtree Rd., N.E., Atlanta, GA 30341 (404-455-7610; 800-554-5440) GA, SC Audio & Video Equip.; Test & Measurement Equip.; Tape; Vans & Accessories; Service & Repair; System Design

Vica Associates, 4296-A Memorial Dr., Decatur, GA 30032 (404-292-7506) AL, FL, GA, MS, NC, SC, TN Audio & Video Equip.

HAWAII

Broadcast Services Inc., 2877 Kalakaua Ave., Honolulu, HI 96815 (808-521-6311) HI Audio Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Service & Repair; System Design; Used Equip.

John J. Harding Co., Ltd., 2825 Ualena St., Honolulu, HI 96819 (808-836-0941) HI and Pacific area Audio & Video Equip; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; System Design

Hawaii Broadcast Associates, Box 1344, Honolulu, HI 96807 (808-947-7470) HI and U.S. Possessions in the Pacific Microwave Receivers & Transmitters; Earth Stations

Omega Pacific, 222 Kaelepulu Dr., Kailua, HI 96734 (808-533-7655) HI Video Equip.; Transmitters, Antennas & Transmission Systems

Prorep Hawaii Corp., Box 10151, Honolulu, HI 96816 (808-732-0639) HI Audio & Video Equip.

IDAHO

Hall Electronics, Box 5031, Boise, ID 83705 (208-343-3088) CO, ID, MT, UT, WY Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; System Design; Used Equip.

ILLINOIS

Allied Broadcast Equipment, 5097 N. Elston Ave., Suite 303, Chicago, IL 60630 (312-794-0224) IL, MI, MN, WI Audio Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Vacuum Tubes; Service & Repair; System Design

Center Video Center, 5565 N. Elston Ave., Chicago, IL 60630 (312-637-1600; Outside IL 800-621-4354) U.S.A. Audio & Video Equip.; Test & Measurement Equip.; Tape; Service Repair; Used Equip.

Columbia Video Systems, The Columbia Bldg., Laurel & 2nd, Highland Park, IL 60035 (312-433-6010) IL, IN, IA, MI, WI Video Equip.; Tape

J. Deerwester Communications, Broadcast Supply Div., Rt. 3 Cabintown Rd., Bloomington, IL 61701 (309-828-9143) AL, AK, AZ, AR, CA, CO, CT, DE, DC, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NV, NH, NJ, NM, NY, NC, ND, OH, OK, OR, PA, SC, SD, TN, TX, UT, VT, VA, WA, WV, WI, WY Audio Equip.; Video(Limited Supply) Equip.; Test Equip.; Transmitters, Antennas & Transmission Lines; Audiocarts; Film Equip.; System Design; Some Used Equip.

Victor Duncan, Inc., 661 N. LaSalle, Chicago, IL 60610 (312-943-7300) U.S.A. and Canada Film & Video Production Equip.; Test Equip.; Transmitters, Antennas & Transmission; Tape; Vacuum Tubes; Vans & Accessories; Service & Repair; System Design; Used Equip.

GO Video Sales, Inc., 1195 S. Wilson Dr., Lake Forest, IL 60045 (312-295-6726) IL, Davenport-IA, MN, ND, SD, WI Video Equip.


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Harris Corp., Broadcast Group, Box 4290, Quincy, IL 62305 (217-222-8200) U.S.A. Audio & Video Equip.

Joseph Electronics, 8830 Milwaukee Ave., Niles, IL 60648 (312-297-4200) IL, IN, WI, Nat'l. by Mail Order Test Equip.; Tools; Cases; Wire; Connectors; Batteries; Camera Tubes; Hardware; Components; Chemicals; Cabinets; Solder & Equip.; Audio & Video Products

Ottawa Equipment Co., 6838 N. Ottawa Ave., Chicago, IL 60631 (312-774-5115) IL, IN, WI, Export Audio Equip.; Tape; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; System Design

Plastic Reel Corp. of America, 365 E. Illinois St., Chicago, IL 60611 (312-661-0851) IL, IN, IA, KY, MI, MN, MO, NE, ND, OH, SD, TX, WI Supplies for film & video including inspection & cleaning equip. & storage racks; Projector Lamps; Film Rewinds-manual mot.

Pro Audio General Store, Inc., 746 Cypress Lane, Carol Stream, IL 60188 (312-231-7120) AL, AZ, AR, CO, DC, FL, GA, IL, IN, IA, KS, KY, LA, MD, MI, MN, MS, MO, MT, NE, NY, NC, ND, OH, OK, SC, SD, TN, TX, UT, VA, WV, WI Audio Equip.; Transmitters, Antennas & Transmission Systems; Service & Repair; System Design

Ram Broadcast Systems, 249 N. Eric Dr., Palatine, IL 60067 (312-358-3330) U.S.A. Audio Equip.; Tape; Systems Design

Richardson Electronics, Ltd., 3030 N. River Rd., Box 424, Franklin Park, IL 60131 (800-323-1770) Worldwide Vacuum Tubes

Roscor Corp., 6160 Oakton, Morton Grove, IL 60053 (312-966-3010; 539-7700) IL, IN, IA, KY, MI, OH, WI Audio & Video Equip.; Test & Measurement Equip.; Tape; Vans & Accessories; Film Equip.; Service & Repair; System Design; Used Equip.

Swiderski Electronics, Inc., 1200 Greenleaf Ave., Elk Grove Village, IL 60007 (312-364-1900) IL, IN, IA, MI, MO, WI Complete line of Audio & Video Equip.; Service & Repair; System Design; Rent & Leasing; Computerized Editing Systems; Vans & Accessories

INDIANA

Allied Broadcast Equipment, #One, 635 South E St., Richmond, IN 47374 (317-962-8596; Int'l. calls 317-935-1704) Worldwide Worlds largest independent distributor of Audio & RF Broadcast & Professional Equipment

American Horizon, Div. Keltron, Inc., 1491 N. Fruitridge Ave., Terre Haute, IN 47804 (812-466-7227) Continental U.S.A. Satellite Receiving Equip.

Midwest Corp., Communications Systems Div., 8455 Keystone Crossing, Suite 101, Indianapolis, IN 46240 (317-251-5750) IN All Major Audio & Video Equip.; Vans, Trucks, Mobile Units; System Design

PRO Marketing Systems, Inc., 9628 Day Dr., Indianapolis, IN 46280 (317-846-9591) IL, IN, KY, West-OH, East-WI Audio: Amps, Mics, Mixing Consoles, Multi-Track Tape Recorders; Control Room Monitors; Loudspeakers; Voice Warning Projectors; Test Equip.: Noise Floor, Cross-Talk, Eraser Depth, THD, IMD, DFD etc.; Film Audio Delay Equip.; System Design; Used Equip.

IOWA

Sitler's Supplies, Inc., 702 E. Washington; Box 10, Washington, IA 52353 (319-653-2123) U.S.A. Film Equip.

Triangle Audio Visual, 6336 Hickman Rd., Des Moines, IA 50322 (515-278-2929) IA, MN, NE, ND, SD Audio & Video Equip.; Test & Measurement Equip.; Tape; Vacuum Tubes; Film Equip.; Service & Repair; System Design; Used Equip.

KANSAS

BMA-Broadcasting Marketing Associates, 13417 West 78th Place, Shawnee Mission, KS 66216 (913-631-3439) IA, KS, MO, NE Audio & Video Equip.; Test & Measurement Equip.

Professional Studio Distributors, 1056 Porter, Wichita, KS 67203 (316-267-1573) AR, CO, IA, KS, MO, NE, OK Audio Equip.; Video & Audio Tape; Floppy Discs; Wind Audio Cassettes

See advertisement on this page

RSC Electronics, Inc., 131 Laura; Box 1220, Wichita, KS 67201 (316-267-5213) KS, OK Audio & Video Equip.; Test & Measurement Equip.; Tape; Vacuum Tubes

Smith Audio-Visual, Inc., 623 Kansas Ave.; Box 1216, Topeka, KS 66601 (913-235-3481) KS, Western-MO including St. Joseph and K.C. Audio & Video Equip.; Transmitters, Antennas & Transmission Systems; Tape; Service & Repair; System Design; Used Equip.

Theatrical Services Inc., 128 S. Washington, Wichita, KS 67202 (316-263-4415) AZ, AR, CO, IA, KS, MO, NE, OK, TX Studio Lighting & Dimming Equip.

KENTUCKY

Cercone Vincent Associates, Inc., Erlanger, KY 41018 (606-341-0077) IN, KY, OH, PA, WV Install, Design & Service Lighting Systems & Related Equip.; Rentals are available through our Subsidiary, Performance Lighting & Production Services, Inc.

Bruce L. Dawson & Associates, Central American Terminal-Bowman Field, Louisville, KY 40205 (502-456-6666, 6693) IN, KY, OH, West-PA, WV Audio & Video Equip.; Transmitters, Antennas & Transmission Systems

Midwest Corp., Div. Headquarters, One Sperti Dr., Edgewood, KY 41017 (606-331-8990) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.

Midwest Corp. Communications, 2035 Regency Rd., Lexington, KY 40503 (606-277-4994) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas; Tape; Vans & Accessories; Service & Repair; System Design; Used Equip.

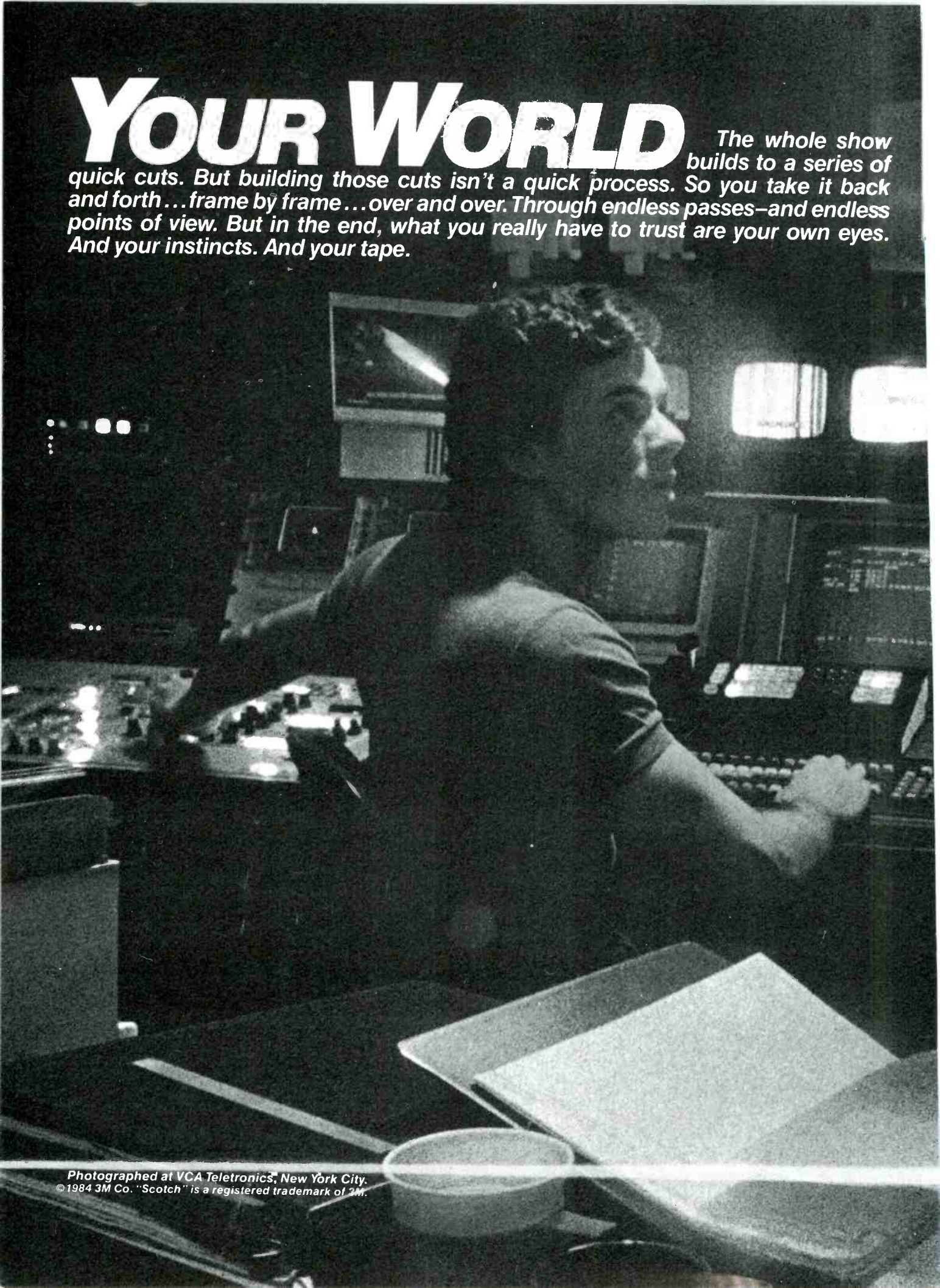
Midwest Corp. Communications, 1804 Cargo Court, Louisville, KY 40299 (502-491-2888) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Vans & Accessories; System Design; Used Equip.

LOUISIANA

Wm. B. Allen Supply Co., Inc., Allen Sqr., 300 Block N. Rampart St., New Orleans, LA 70112 (504-525-8222; 800-535-9593; LA only: 800-462-9520) Nationwide Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes

Audiomedia Associates, Box 29264, New Orleans, LA 70189 (504-586-0140) AL, AR, FL, LA, MS, TX Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Service & Repair; System Design

Gray Communications Consultants, Inc., 5441 Pepsi St., New Orleans, LA 70123 (504-733-7265) AL, FL-Panhandle, LA, MS Audio & Video Equip..; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Film Equip.; Vans & Accesso-


YOUR WORLD
The whole show builds to a series of quick cuts. But building those cuts isn't a quick process. So you take it back and forth...frame by frame...over and over. Through endless passes–and endless points of view. But in the end, what you really have to trust are your own eyes. And your instincts. And your tape.
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MARYLAND

Associated Sales Reps, Inc., 8969 Yellow Brick Rd., Baltimore, MD 21237-2303 (301-574-0550) DE, DC, MD, NJ, PA, VA Audio & Video Equip.; Test & Measurement Equip.; Tape

Bradley Broadcast Sales, 15555-L Frederick Rd., Rockville, MD 20855 (301-762-9222; 800-732-7665) U.S.A. and possessions Audio Equip,; Transmitters, Antennas, Transmission Systems; Tape; Service & Repair; System Design

David H. Brothers Co., Inc., 19 Old Court Rd., Baltimore, MD 21208 (301-764-7189) DC, MD, VA Audio & Video Equip.; Tape; Vacuum Tubes

David Green Broadcast Consultants Corp., Box 8782, BWI Airport, MD 21240 (800-54-RADIO; 301-796-1500) U.S.A., Canada, GU, PR, VI Audio Equip.; Radio Test; Transmitters, STL, RPU; Supply Items

Midwest Corp. Communications, 4720-B Boston Way, Lanham, MD 20801 (301-577-4903) North America Audio & Video Equip.; Test & Measurement Equip.; Tape; Transmitters & Antennas; Vacuum Tubes; Vans & Accessories; Service & Repair; System Design; Used Equip.

Peirce-Phelps, Inc., 12288 Wilkins Ave., Rockville, MD 20852 (301-984-7979) U.S.A., GU, PR, VI Audio & Video Equip.; Tape; Vans & Accessories; Service & Repair; System Design

Products Int'l., 8931 Brookville Rd., Silver Spring, MD 20910 (301-587-7824) U.S.A. and Canada Equip., Tools, Supplies, Training for Electronic PC Boards Maintenance & Repair

RCI-Recordihg Consultants Inc., 8550 Second Ave., Silver Spring, MD 20910 (301-587-1800) DE, DC, MD, PA, VA, WV Audio Equip.; Tape; Service & Repair; System Design; Used & Rental Equip.

Sel-Tronics, Inc., 717 Ellsworth Dr., Silver Spring, MD 20910 (301-589-3391) DC, MD, VA Audio & Video Equip.; Test & Measurement Equip.

Theatre Service & Supply Corp., 1792 Union Ave., Baltimore, MD 21211 (301-467-1225) U.S.A. Lighting Equip. for Studio & Location; Scenic Hardware & Paints; Gaffers Tape; Rigging Equip. for Lighting & Scenery; Rear & Front Projection Screens; Portable Platforms; Bulbs for Studio Lighting

Wiltronix, Inc., 16850 Oakmont Ave., Box 364, Washington Grove, MD 20880 (301-258-7676) DE, DC, KY, MD, PA, VA, WV Audio & Video Equip.; Test & Measurement Equip.; Transmission Systems

MASSACHUSETTS

Barbizon Light, 3 Draper St., Woburn, MA 01801 (617-935-3920) FL, GA, ME, MA, MI, NH, NY, RI, VT Video & Film Lighting Equip. & Supplies

Lake Systems Corp., 55 Chapel St., Newton, MA 02160 (617-244-6881) Turnkey Communications Systems; TV Station Automation Featuring La-Kart

Landy Associates, Inc., 1605 Trapelo Rd., Waltham, MA 02154 (617-890-6325) CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT, VA Audio & Video Equip.; Test & Measurement Equip.; Film Equip.; Tape; Vacuum Tubes; Service & Repair; System Design

QSI Systems, Inc., 12 Linscott Rd., Woburn, MA 01888 (617-938-1403) CT, ME, MA, NH, RI, VT Video Equip.

MICHIGAN

Audio Broadcast Group, Inc., 2342 S. Division Ave., Grand Rapids, MI 49507 (616-452-1596) U.S.A. Audio Equip.; Transmitters, Antennas & Transmission Systems; System Design; Used Equipment

CM Sales, 2005 Orchard Lake Rd., Pontiac, MI 48053 (313-334-4920) MI Audio & Video Equip.; Test & Measurement Equip.; Cases

Victor Duncan, Inc., 32380 Howard St., Detroit, MI 48071 (313-589-1900) U.S.A. and Canada Film & Video Production Equip.; Test Equip.; Transmitters, Antennas & Transmission; Tape; Vacuum Tubes; Vans & Accessories; Service & Repair; System Design; Used Equip.

H. M. Dyer Electronics, Inc., 48647 Twelve Mile Rd., Novi, MI 48050 (313-349-7910) IL, IN, IA, MI, MN, MO, OH, WI Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vans & Accessories, Used Equip.

General TV Network, 13225 Capital Ave., Oak Park, MI 48237 (313-548-2500) MI, Northwest-OH Audio & Video Equip.; Test & Measurement Equip.; Tape; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.

Key Marketing, 41940 Joy Rd., Plymouth, MI 48170 (313-453-8720) MI Audio Equip.

Midwest Corp., 12621 160th Ave., Big Rapids, MI 49307 (616-796-5238) U.S.A. Audio & Video Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Vans & Accessories; Service & Repair; System Design; Used Equip.

Midwest Corp., Communications Systems Div., 1328 Wheaton Ave., Troy, MI 48084 (313-689-9730) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.

T. R. Pitts Co., 905-B Washington St., Iron Mountain, MI 49801 (906-774-4242; 800-772-9431) U.S.A. Complete equip. & supplies for the cable TV industry including some services.

Sound Solutions Inc., 5701 Canton Center Rd., Canton, MI 48187 (313-455-5557) IL, IN, MI, OH Audio Equip.; Tape; System Design

Thalner Electronic Labs, Inc., 7235 Jackson Rd., Ann Arbor, MI 48103 (313-761-4506; Area 313 Only 800-552-5275) MI, OH Audio & Video Equip.; Tape; Test & Measurement Equip.; Service & Repair; System Design; Used Equip.

MINNESOTA

AVC Systems, Inc., 2709 East 25th St., Minneapolis, MN 55406 (612-729-8305) IL, IN, IA, KS, KY, MI, MN, MO, NE, ND, SD, WI Audio Equip.; Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Used Equip.

Emmons Associates, Inc., 1121 Riverwood Dr., Burnsville, MN 55337 (612-890-8920) IA, MN, ND, SD, WI Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Service & Repair

T. R. Pitts Co., 501 W. 5th St.; Box 57, Winona, MN 55987 (507-452-2629; Outside MN: 800-533-8092; MN Only: 800-642-2384) U.S.A. Complete equip. & supplies for the cable TV industry including some services.

Video Midwest, Inc., 5050 West 78th St., Minneapolis, MN 55435 (612-831-2248) IA, MN, ND, SD, WI Video Equip.; Test & Measurement Equip.; Video & Audio Tape; Vacuum Tubes; Service & Repair; System Design; Used & Rental Equip.; Duplications

MISSOURI

Centurian Marketing Associates, 124 Manchester Rd.; Box 1011, Ballwin, MO 63011 (314-227-7229) Southern-IL, IA, KS, MO, NE Audio Professional Products

Delcom Corp. of St. Louis, 2349 Grissom, St. Louis, MO 63146 (314-432-1164; 800-331-5461) Continental U.S. Total Video Systems, Featuring Custom System Design; Installation; Computerized Wiring & Tracing Documentation; Custom & Standardized Cabinetry

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Television Engineering Corp., 580 Goddard Ave., Chesterfield, MO 63017 (314-532-4700) U.S.A. and Canada Audio & Video Equip.; Test & Measurement Equip.; Tape; System Design; Used Equip.; Vans & Accessories

Video Masters, Inc., Box 1963; 1616 Broadway, Kansas City, MO 64141 (816-474-8530) AR, IL, IA, KS, MO, NE Audio & Video Equip.; Test Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Service & Repair; System Design

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The Source Inc., 320 6th St. So.; Box 2487, Great Falls, MT 59403 (406/761-2420) MT, Northern-WY Audio & Video Equip.; Test & Measurement Equip.; Tape; Antennas

Video Int'l. Publishers, Inc., 118 6th St.; Box 1219, Great Falls, MT 59403 (406-727-7133) ID, MT, ND, SD, WA, WY Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; System Design; Used Equip.

NEVADA

Cinema Services, 3050 Sheridan St., Las Vegas, NV 89102 (702-876-4667) AZ, NV, NM, UT Video Equip.; Film Equip.; Used Equip.

NEW HAMPSHIRE

Associated Systems, Box 5211, Manchester, NH 03108 (603-472-2297) CT, ME, MA, NH, NY, RI, VT Audio & Video Equip.; Test & Measurement Equip.

NEW JERSEY

A.F. Associates, 100 Stonehurst Ct., Northvale, NJ 07647 (201-767-1000) Worldwide Audio & Video Equip.; Test & Measurement Equip.; Film Equip.; Vans & Accessories; System Design

Avtec Industries, Inc., 5 Audrey Place, Fairfield, NJ 07006 (201-882-9460) USA, Egypt, Nigeria, Saudi Arabia Audio & Video Equip.; Test Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Film Equip.; Service & Repair; Used Equip.

Broadcast Video Marketing Corp., 275 Rt. 18, East Brunswick, NJ 08816 (201-390-0770) CT, DE, DC, MD, NJ, NY, PA, VA Video Equip.; Cases; Standards Converters

Calvert Electronics Inc., 1 Branca Rd., East Rutherford, NJ 07073 (Outside NJ 800-526-6362; In NJ 201-460-8800) Worldwide Camera Pickup Tubes & CCDs; Capacitors, Transmitting, Mica & Vacuum; Microwave Components; Semiconductors; Vacuum Tubes

See advertisement on page 28

Chemigraphic Products Corp., 301 Veterans Blvd., Rutherford, NJ 07070 (201-438-7445) CT, DE, DC, ME, MD, MA, MI, NH, NJ, NY, NC, OH, PA, VT, VA, Canada: NB, NF, NS, Ont., PEI, Que. Carts, Equip. Transport; Vans & Accessories

Comprehensive Video Supply Corp., 148 Veterans Dr., Northvale, NJ 07647 (201-767-7990) Worldwide Audio & Video Equip.; Test & Measurement Equip.; Tape; Vans & Accessories

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 Audio & Video Equip.; Test & Measuring Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Film Equip.; Vans & Accessories, System Design

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, VA Audio & Video Equip.; Test & Measuring Equip.; Film Equip.; Tape; Tubes; Vans & Accessories; Service & Repair; System Design

Multi-Track Magnetics, Inc., #3 Industrial Ave., Upper Saddle River, NJ 07458 (201-327-9400) Worldwide Film Equip.; System Design

Tele-Measurements, Inc., 145 Main Ave., Clifton, NJ 07014 (201-473-8822) CT, DE, DC, NJ, NY, PA, VA Audio & Video Equip.; Test & Measuremnt Equip.; Satellite Communications; Tele-Conferencing; Service & Repair; System Design

Thor Electronics Corp., 321 Pennsylvania Ave., Linden, NJ 07036 (201-486-3300) Worldwide Vacuum Tubes

Turner Engineering, 14 Morris Ave., Mountain Lakes, NJ 07046 (201-263-0023) CT, DE, NJ, NY, PA Audio & Video Equip.; Test & Measuring Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Service & Repair; System Design; Used Equip.

VMI-Visual Methods Inc., Box 644, Westwood, NJ 07675 (201-666-3950) U.S.A. Video Equip.

NEW MEXICO

Black's Communications Consultants, 120 W. Picacho, Las Cruces, NM 88005 (505-524-9681) CO, NM, TX Audio Equip.; Video Equip.; Test & Measurement Equip.; Tape; Film Equip.; Vans & Accessories; Service & Repair; Systems Design; Used Equip.

DYMA Engineering, Inc., Box 1535, Los Lunas, NM 87031 (505-865-6700) AZ, CA, CO, KS, NV, NM, OK, TX, UT Audio & Video Equip.; Test Equip.; Transmitters, Antennas & Transmission Systems; Tape; Film Equip.; Vans & Accessories; System Design; Some Used Equip.

NEW YORK

Acoustilog, Inc., 19 Mercer St., New York, NY 10013 (212-925-1365) CT, NJ, NY Audio Equip.; Test & Measurement Equip.; Service & Repair; Used Equip.

Adcom Communications Inc., 555 West 57th St., New York, NY 10019 (212-265-1760) CT, NJ, NY Video Equip.; Test & Measurement Equip.; Tape; Service & Repair; System Design; Used Equip.

Alpha Electronics, Inc., 1365 39th St., Brooklyn, NY 11218 (212-633-2800; 800-221-5802) U.S.A. Vacuum Tubes

Audio-Video Corp., 213 Broadway, Menands (Albany), NY 12204 (518-449-7213) CT, MA, NY, North-PA, VT Audio & Video Equip.; Test & Measurement Equip.; Tape; Vacuum Tubes; Vans & Accessories; Service & Repair; System Design; Used Equip.

Audiotechniques Inc., 1619 Broadway, 4th Flr., New York, NY 10019 (212-586-5989; Sales: 800-223-2486) CT, DE, DC, ME, MD, MA, NJ, NY, PA, RI, VT, VA Audio & Video Equip.; Test & Measurement Equip.; Tape; Service & Repair; System Design; Used Equip.

Avtech Electronics Inc., (fomerly Team Electronics), 24-16 Queens Plaza South, Long Island City, NY 11101 (212-937-9200; 800-221-1300) U.S.A. and Canada Audio & Video Tape; Vacuum Tubes

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 All Types of Lamps and Sockets; Gaffer's Tape; Hot Mill Gloves; Light Control & Diffusion Media; Color Media; Dimming Equip.

Boynton Studio Inc., Melody Pines Farm, Morris, NY 13808 (607-263-5695) U.S.A.; BC, MAN, NB, NS, ONT, PEI, QUE, SASK Audio Equip.; Test Equip.; Transmitters, Antennas & Transmission Systems; Tape; Service & Repair; System Design; Used Equip.

The Camera Mart, Inc., 456 West 55th St., New York, NY 10019 (212-757-6977) CT, DE, DC, MA, NH, NJ, NY, PA, VT Audio & Video Equip.; Test & Measurement Equip.; Tape; Film Equip.; System Design; Used Equip.

CeCo Communsications Inc., 2115 Avenue X, Brooklyn, NY 11235 (212-646-6300; 800-221-0860) Worldwide Broadcast Tubes; Electron Tubes-Semiconductors; Broadcast Types, High Power Transmitting Tubes; Receiving Tubes; Industrial Tubes; Vacuum Tubes

Darmstedter Associates, 41 R. Oswego St., Baldwinsville, NY 13027 (315-638-1261) NY Audio Equip.

D.O. Industries, 317 E. Chestnut St., East Rochester, NY 14445 (716-385-4920) U.S.A. and Canada Audio Equip.

Electronic Applications, Inc., 25 West 54th St., New York, NY 10019 (212-246-2490) CT, DE, DC, ME, MD, MA, NJ, NY, PA, RI, VT, VA Video Equip.

R F Gain, Ltd., 116 S. Long Beach Rd., Rockville Centre, NY 11570 (516-536-8868; 800-645-2322) Worldwide Vacuum Tubes

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 Audio & Video Equip.; Film Equip.; Tape Equip.; Optics; TV Equip.; Transmitters (AM-FM-TV-STL), Antennas (AM-FM-TV); System Design

Laumic Co., Inc., 306 East 39th St., New York, NY 10016 (212-889-3300) CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT, VA Audio & Video Equip.; Test & Measurement Equip.; Tape; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.

Levit Electronics, Inc., 200 Park Ave. S., New York, NY 10003 (212-777-5517; 800-221-2945) Worldwide Vacuum Tubes

MM Editing Systems, Inc., 118 East 25th St., New York, NY 10010 (212-460-8810) AL, AR, CT, DE, DC, FL, GA, IL, IN, KS, LA, ME, MD, MA, MI, MN, MS, MO, NE, NH, NJ, NY, NC, OH, OK, PA, PR, RI, SC, TN, VT, VA, WI Editing Systems for all Film Formats; Film to Video Transfer Modules

MPCS Video Industries, Inc., 514 West 57th St., New York, NY 10019 (212-586-3690) U.S.A. Audio & Video Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Vacuum Tubes; Vans & Accessories; Service & Repair; System Design; Used Equip.

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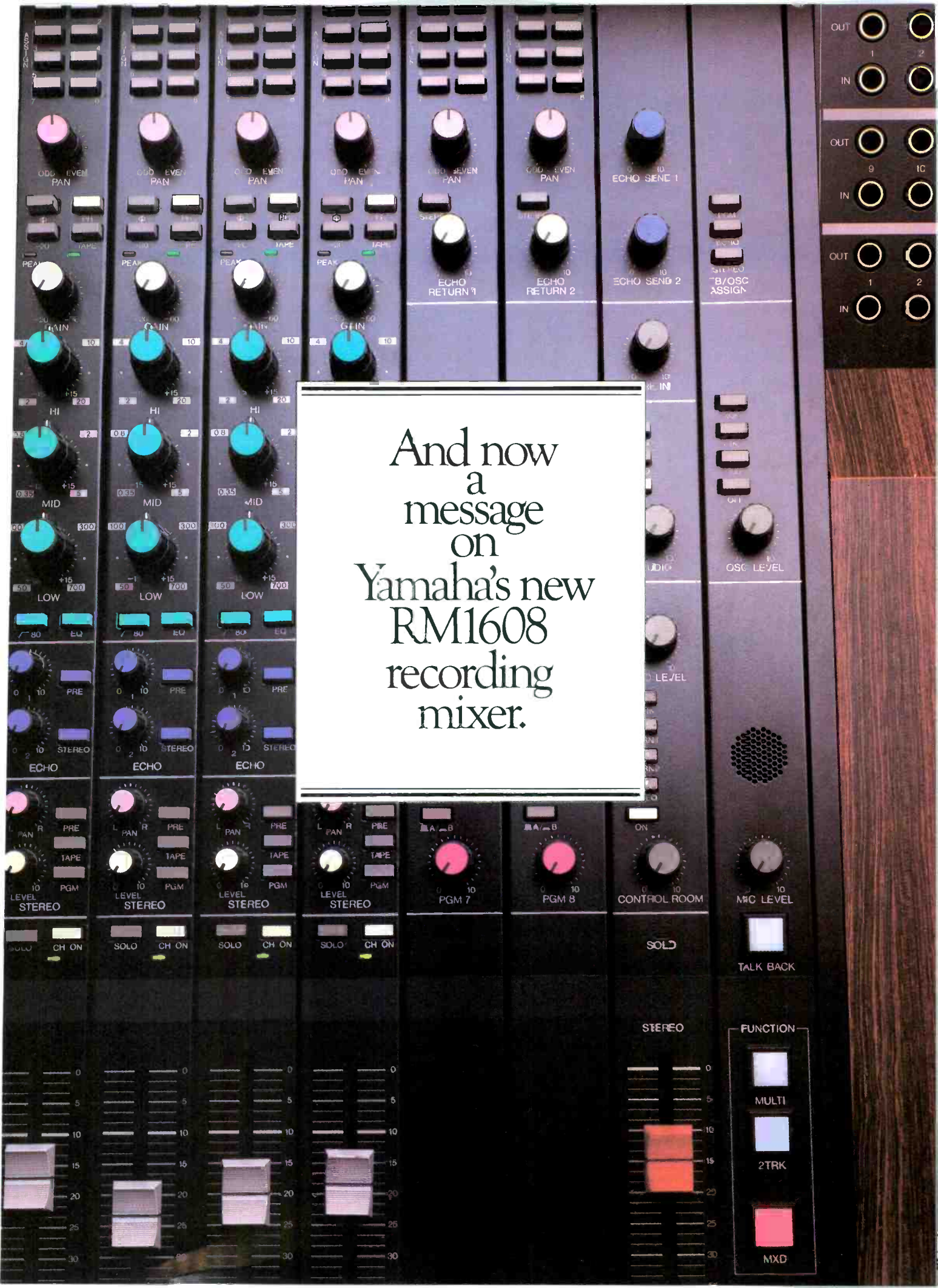
Microphonics, Box 37, Brooklyn, NY 11204 (212-438-6400; 800-431-3232) U.S.A. Nationwide Audio & Video Equip.; Tape; Vacuum Tubes

L. Matthew Miller Associates Ltd., 48 West 21st St., 11th Floor, New York, NY 10010 (212-741-8011; 800-221-9328) U.S.A., PR Audio & Video Equip.; Test & Measure-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–95dB	residual output noise: all Faders down.
–80dB	(84dB S/N) PGM Master volume control at maximum and all CH PGM assign switches off.
–64dB	(68dB S/N) PGM Master volume control at maximum and one CH Fader at nominal level.
–73dB	(77dB S/N) STEREO Master Fader at maximum and all CH STEREO level controls at minimum level.
–64dB	(68dB S/N) STEREO Master Fader at maximum and one CH STEREO level control at nominal level.
–80dB	(70dB S/N) ECHO SEND volume at maximum and all CH ECHO volumes at minimum level.
–75dB	(65dB S/N) ECHO SEND volume at maximum and one CH ECHO volume at nominal level.

CROSSTALK
–70db at 1kHz: adjacent Input.
–70db at 1kHz: Input to Output.

MAXIMUM VOLTAGE GAIN (INPUT GAIN "–60")

PGM	74dB: MIC IN to PGM OUT.	ECHO	70dB: MIC IN to ECHO SEND.
	24dB: TAPE IN to PGM OUT.	C/R	74dB: MIC IN to C/R OUT.
	34dB: ECHO RETURN to PGM OUT.		24dB: 2 TRK IN to C/R OUT.
	14dB: PGM SUB IN to PGM OUT.	STUDIO	74dB: MIC IN to STUDIO OUT.
STEREO	74dB: MIC IN to STEREO OUT.		24dB: 2 TRK IN to STUDIO OUT.
	24dB: TAPE IN to STEREO OUT.		
	34dB: ECHO RETURN to STEREO OUT.		

CHANNEL EQUALIZATION
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HIGH PASS FILTER –12dB/octave cut off below 80Hz.

OSCILLATOR Switchable sine wave 100Hz, 1kHz, 10Hz

PHANTOM POWER 48V DC is applied to XLR type connector's 2 pin and 3 pin for powering condenser microphone.

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Hum and Noise are measured with a –6dB/octave filter at 12.47kHz; equivalent to a 20 kHz filter with infinite dB/octave attenuation.
*0dB is referenced to 0.775V RMS.
• Sensitivity is the lowest level that will produce an output of –10dB (245mV), or the nominal output level when the unit is set to maximum gain.
• All specifications subject to change without notice.

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Richardson Electronics-East, 116 S. Long Beach Rd., Rockville Center, NY 11570 (800-645-2322) Worldwide Vacuum Tubes

SAGA-Sheldon A. Goodman Associates, Box 186, Oswego, NY 13126 (315-343-5739) CT, ME, MA, NH, NY, RI, VT Audio Equip.; Tape

The Ken Schaffer Group, Inc., 21 West 58th St.-Penthouse, New York, NY 10019 (212-371-2335) Worldwide Audio Equip.; Transmitters & Antennas; System Design; Used Equip.

Sharb Electronics, 192-08 90th Ave., Hollis, NY 11423 (212-479-3011) Worldwide Electron Tubes; Complete Line of CCTV Products; Cameras, Monitors and Accessories

Singer Products Co., Inc., 875 Merrick Ave., Westbury, NY 11590 (516-683-3000) Worldwide except U.S.A. and Canada Audio & Video Equip.; Test & Measurement Equip.; Transmitters & Antennas; Vacuum Tubes; System Design

Stage Lighting Distributors, 346 West 44th St., New York, NY 10036 (212-489-1370) U.S.A. and Canada Video Equip.; Lighting & Controls; System Design

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Studio Film & Tape Inc., 630 Ninth Ave., New York, NY 10036 U.S.A. and Canada Audio & Video Tape, All Formats

Tape City Int'l. Inc., 404 Park Ave. S., New York, NY 10016 (212-679-1606; 800-223-1586) CT, NJ, NY, Mail Order in U.S.A. Audio & Video Equip.; Tape; Service & Repair; Used Equip.

Temtron Electronics Ltd., 15 Main St., East Rockaway, NY 11518 (516-599-6400; 800-645-2300) U.S.A. Audio & Video Equip.; Test & Measurement Equip.; Vacuum Tubes

United Research Lab Corp., 16 East 52nd St., New York, NY 10022 (212-751-4663) Worldwide Audio Equip.; Test & Measurement Equip.; Tape; Service & Repair

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Midwest Corp. Communications, 2848 Suite E, Interstate 85 S., Charlotte, NC 28208 (704-399-6336) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Vans & Accessories; Service & Repair; System Design; Used Equip.

Southern Coastal Marketing Services, Inc., 800 N. Polk St., Pineville, NC 28134 (704-889-4508) NC, SC, VA Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Service & Repair; System Design; Used Equip.

Technical Video Systems, Inc., 215 N. Broad St., Winston-Salem, NC 27101 (919-748-0916) NC, SC, TN Video Equip.

NORTH DAKOTA

Audiovisual Inc. Formerly Known As OMF Audiovisual, Inc., 1818 E. Broadway, Bismarck, ND 58501 (701-258-6360) CO, ID, IA, KS, MN, MT, NE, ND, SD, WI, WY Audio & Video Equip.; Test & Measuring Equip.; Transmitters; Tape; Vacuum Tubes; Film Equip.; Service & Repair; System Design; Used Equip.

OHIO

Audio Marketing Association, 9470 Whitewood Rd., Brecksville, OH 44141 (216-526-2426) IN, KY, OH, PA, WV Audio Equip.; Test & Measurement Equip.

Cartwright Communications Co., 7812 Red Sky Dr., Cincinnati, OH 45242 (513-489-1755; Outside OH 800-543-8614; OH 800-582-2641) U.S.A., AK, HI Antennas; Batteries; Duplexers; Hand Tools; Power Supplies; Remotes; RF Amps; Sirens & Lights; Test Equip.; Tone Equip.; Transmission Line; Two-Way Radios & Accessories; Wattmeters; Satellite TV Equip.

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KAVCO, Div. of Daycom Corp., 3931 Image Dr., Dayton, OH 45414 (513-898-2003) IL, IN, KY, MI, OH, WV Audio & Video Equip., Test & Measurement Equip.; Vans & Accessories; Service & Repair; System Design

Midwest Communications Corp., Communications Systems Div., 7500 Wall St., Cleveland, OH 44125 (216-447-9745) NY, OH, PA Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antenna Systems; Tape; Turnkey Mobile Units; System Design & Installation; Service Dept.; Rentals

Midwest Communications Corp., Communications Systems Div., 4410 Westerville Rd., Columbus, OH 43229 (614-476-2800) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas; Tape; Vans & Accessories; Service & Repair. System Design; Used Equip.

Pinzone Communications Products Inc., 10142 Fairmount Rd., Newbury, OH 44065 (304-296-4493) Worldwide Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems

OKLAHOMA

Walter S. Brewer Co., Inc., 4717-F S. Mingo Rd., Tulsa, OK 74146 (918-665-6820) Worldwide Lighting for Video; System Design

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Doug Brown Enterprises, Inc., 1703 E. Skelly Dr., Tulsa, OK 74105 (918-747-3618) Worldwide Audio Equip.; Test & Measurement Equip.; Tape; Service & Repair; System Design; Used Equip.

Delcom Corp., 6019 S. 66th E. Ave., Tulsa, OK 74145 (918-494-9500; Outside OK 800-331-5461) Continental U.S. Total Video Equip. Featuring Custom System Design; Professional & Broadcast Equip. Installation; Computerized Wiring & Tracing Documentation; Custom & Standard Cabinetry

Hill Radio Equipment Co., 203 Alawhe Rd., Rt. 8, Claremore, OK 74017 (918-341-5240) U.S.A. Audio Equip.; Audio Test Equip.; Audio Recording Tapes; Towers-STL-TSL-Remote

OREGON

Custom Video Systems of Oregon, Inc., 1963 N.W. Kearney St., Portland, OR 97209 (503-295-6963) OR Audio & Video Equip.; Test Equip.; Tape; Vans & Accessories; Service & Repair; System Design; Used Equip.

Frontier Communications Corp., Box 750, Portland, OR 97207 (503-246-8080) AK, AZ, CA, CO, HI, ID, MT, NV, OR, UT, VI, WA, WY Audio Equip.; Transmitters, Antennas & Transmission Systems; Service & Repair; Systems Design

United Radio Supply Inc., Box 14040, Portland, OR 97214 OR, WA Test & Measurement Equip.; Vacuum Tubes

PENNSYLVANIA

Alpha Video & Electronics Co., 28 E. Mall Plaza, Carnegie, PA 15106 (412-923-2070) MD, NY, OH, PA, WV Audio & Video Equip.; Test & Measurement Equip.; Transmitters; Tape; Vans & Accessories; Service & Repair; System Design

Audio Associates, 814 W. Broad St., Bethlehem, PA 18018 (215-856-6013) U.S.A. Audio Equip.; Test & Measuring Equip.; Transmitters, Antennas & Transmission Lines; Tone Arms & Cartridges; Processing Equip.; Power Distribution & Preamps; Studio Furniture & Accessories; Used Equip. & Trade-Ins

Cercone Vincent Associates, Inc., 2741 Noblestown Rd., Pittsburgh, PA 15205 (412-922-0900) IN, KY, OH, PA, WV Install, Design & Service Lighting Systems & Related Equip.

Jerry Conn Associates, Inc., Box 444, Chambersburg, PA 17201 (717-263-8258) U.S.A. Regional sales rep for top quality products and national distributor for all your distribution needs from drop materials to standby 63 channel tuneable modulators.

Eagle Hill Electronics Inc., 41 Linden Ave., Rutledge, PA 19070 (215-544-8879) Worldwide Audio Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Service & Repair

EMCEE Broadcast Products, Box 68, White Haven, PA 18661 (717-443-9575) Worldwide Transmitters, Antennas & Transmission Systems

Lerro Electrical Corp., 3125 N. Broad St., Philadelphia, PA 19132 (215-223-8200) DE, DC, MD, NJ, PA, VA Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.

See advertisement on page 17

Midwest Corp., Communications Systems Div., 535 Rochester Rd., Pittsburgh, PA 15237 (412-781-7707) PA Audio & Video Equip.; Test & Measuring Equip.; Tape; Film Equip.; Vans & Accessories; Service & Repair; System Design

Richard S. Pass Associates, Inc., 27 Oxford Dr., Langhorne, PA 19047 (215-757-6100) DE, DC, MD, Southern-NJ, Eastern-PA, VA Audio Equip.; Test & Measurement Equip. (Spectrum Analyzers) ENG Mixers & Associated Equip.

Peirce-Phelps, Inc., 490 S. St. Johns Rd., Camp Hill, PA 17011 (717-761-0240) U.S.A., GU, PR, VI Audio & Video Equip.; Tape; Vans & Accessories; Service & Repair; System Design

Peirce-Phelps, Inc., 2000 North 59th St., Philadelphia, PA 19131 (215-879-7171) U.S.A., GU, PR, VI Audio & Video Equip.; Tape; Vans & Accessories; Service & Repair; System Design

Radio Systems Inc., 5113 W. Chester Pike, Edgemont, PA 19028 (215-356-4700) U.S.A. Audio Equip.; Tape; Transmitters, Antennas & Transmission Systems; System Design; Service & Repair

Steinberg Electronics Inc., 2520-22 N. Broad St., Philadelphia, PA 19132 (215-223-9400; 800-523-0894) Worldwide Audio & Video Equip.; Test & Measurement Equip.; Tape; Vacuum Tubes

Val-Tronics, Inc., Penn Park Bldg., Pittston, PA 18640 (717-655-5937) U.S.A. Cart Machines; Consoles; Transmitters; Audio Carts; Tape Recorders & Turntables; Microphones; Optimods; Antennas; Transmission Lines; Cabinets; Phono Cartridges; Replacement Heads; Amplifiers; Dummy Loads

TENNESSEE

Broadcast Equipment & Supply Co., Inc., Box 3141, Bristol, TN 37625 (615-878-2531) U.S.A. Audio Equip.; Tape

Centel Systems, Inc., 3675 New Getwell Rd., Suite 12, Memphis, TN 38118 (901-365-1361) AR, MS, TN Audio & Video Equip.; Transmitters, Antennas & Transmission Systems; Intercom Systems; Lighting & Accessories; Test & Measurement Equip.; Cases; Satellite Earth Terminals

Gray Communications Consultants, Inc., 100 Greenbriar Dr., Knoxville, TN 37919 (615-523-3107) NC, TN Audio & Video Equip.; Test & Measurement Equip.; Tape; Film Equip.; Vans & Accessories; Service & Repair; System Design

Midwest Corp., 2405 Windsor Ave., Bristol, TN 37621 (615-968-2289) U.S.A. Audio & Video Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Vans & Accessories; Service & Repair, System Design; Used Equip.

Midwest Corp., Communications Systems Div., A7-156 Space Park S., Antioch Pike, Nashville, TN 37211 (615-331-5791) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Tape; Transmitters, Antennas & Transmission Systems; Film Equip.; Service & Repair; Vans & Accessories; System Design; Used Equip.

Wilson Audio Sales, 6602 Hwy. 100, Suite 205, Nashville, TN 37205 (615-356-0372) AL, GA, MS, NC, SC, TN Audio Equip.

TEXAS

Allied Broadcast Equipment, 1201 East 15th, Suite 309, Plano, TX 75074 (214-423-8667) Worldwide Audio Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Vacuum Tubes; Service & Repair; System Design

Broadcast Systems Inc., 8222 Jamestown Dr., Austin, TX 78758 (800-531-5232) U.S.A. All major Video Equip.

Crouse-Kimzey Co., Box 9830, Ft. Worth, TX 76107 (817-737-9911) U.S.A. Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape

Victor Duncan, Inc., 6305 N. O'Connor #100, Irving, TX 75039-3510 (214-869-0200) U.S.A. and Canada Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.

G.P. Enterprises, Inc., Box 912, Arlington, TX 76010 (817-467-2990; 467-0051) AZ, AR, CO, IA, KS, LA, MN, MO, MT, NE, NM, ND, OK, SD, TX, WI, WY Audio & Video Equip.; Test & Measurement Equip.; Film Equip.; Vans & Accessories; Used Equipment

MZB&Assoc., 4203 Beltway, Dallas, TX 75234 (214-233-5535) AR, KS, LA, MO, NE, NM, OK, TX Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Film Equip.; Vans & Accessories; Service & Repair; System Design; Used Equip.

Magnetic Media, 4801 Keller Springs Rd., Dallas, TX 75248 (214-931-0404) AR, CO, LA, NM, OK, TX Video Equip.; System Design

Micro Controls Inc., Box 728, Burleson, TX 76028 (817-295-0965) U.S.A. and Canada Antennas, Transmitters & Transmission Systems

Peregrine Southwest Reps, 5800 Corporate, D-5, Houston, TX 77036 (713-772-6765) AR, LA, MS, OK, West-TN, TX Broadcast & Production Consoles; Dig. Processors & Delays; Cabinets & Enclosures; Monitors; Speakers, Mics; Wire & Cable; Instrument Pickups; Mic Stands & Accessories

Professional Audio Services, 3837 East Loop 820 South, Ft. Worth, TX 76119 (817-451-7643; 800-433-7668; TX Only 800-233-8273) Worldwide Complete Line of Audio Equip. & Supplies

SAVCO Broadcast Equipment Inc., Box 850427, Richardson, TX 75085 (214-234-1841) AL, AR, KS, LA, MI, MO, OK, TX Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; System Design

The Gene Sudduth Co., Inc., Box 293, Flint, TX 75762 (214-894-6303) AR, LA, OK, TX Audio & Video Equip.; Test & Measurement Equip.

The Gene Sudduth Co., Inc., Box 1116, Paris, TX 75460 (214-785-5764) AR, LA, OK, TX Audio & Video Equip.; Test & Measurement Equip.

Tenicki & Associates, 2600 S.W. Freeway, Suite 814, Houston, TX 77098 (713-528-2005) AR, LA, OK, TX Audio Equip.

UAR Professional Systems, 8535 Fairhaven, One studio Center, San Antonio, TX 78229 (512-690-8888) U.S.A. Audio Equip.

UTAH

Libra Programming Inc., 1954 East 7000 South, Salt Lake City, UT 84121 (800-453-3827) U.S.A Computer Software-Radio Broadcast System & Related Accounting Software Packages; Computer Hardware

RIA Corp., 50 E. Malvern, Salt Lake City, UT 84115 (801-486-8822 or 484-1701) AZ, CA, CO, ID, LA, MS, MO, MT, NV, OK, TX, UT, WY Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Film Equip.; Tape; Service & Repair; System Design

VIRGINIA

Alpha Audio, 2049 W. Broad Street, Richmond, VA 23220 (804/358-3852) DC, MD, NC, VA, WV Audio Equip.; Tape

Midwest Corp., 4129 Q Townhouse Rd., Richmond, VA 23228 (804-262-5788) U.S.A. Audio & Video Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Vans & Accessories; Service & Repair; System Design; Used Equip.

Midwest Corp. Communications, 1395 Air Rail Ave., Virginia Beach, VA 23455 (804-464-6256) AL, DE, DC, GA, MD, NC, SC, VA Audio & Video Equip.; Transmitters & Antennas; Tape; Vans & Accessories; Service & Repair; System Design

The definition of the best color camera tubes in the world.

No matter how you define your color camera needs, you will want to be certain you have chosen the best tube for the job. And no technical appraisal can be complete without EEV Leddicons.

Take lag or smearing. Because Leddicons incorporate a unique light bias arrangement, shading is minimal. So is differential lag. The result is that a football in flight will always look like a football — not a flying saucer!

As for color imagery, you simply cannot improve on Leddicons. Extended reds have a precisely-engineered response with an infra-red filter providing cut-off exactly where you want it.

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You'll certainly want to avoid blemishes. That's why all Leddicons must satisfy the most exacting manufacturing, testing and quality control standards. And it shows — in the fact that Leddicons average less spotting than other tubes!

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And what about microphony? With EEV's unique anti-microphonic mesh assembly, Leddicons provide the cleanest pictures — even from cameras operating in areas of high ambient acoustic noise.

As for choice, there's simply none better than Leddicons. That's because the range covers fully-interchangeable sizes and types to suit virtually every type of studio, EFP and ENG camera used in the world today.

When you add up all the facts about Leddicons, there is only one conclusion — namely, the definition of the best tubes for your camera.

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EEV, Waterhouse Lane, Chelmsford, Essex CM1 2QU, England. Tel: 0245 261777. Telex: 99103.

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Old Dominion Broadcast Eng. Service, 1101 Front St., Richmond, VA 23222 (804-321-4506) Worldwide Audio Equip; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Service & Repair; System Design; Used Equip.

Robert Slye Electronics, 3415 N. Washington Blvd., Arlington, VA 22201 (703-525-7272) DC, MD, VA Audio & Video Equip.; Test & Measurement Equip.; System Design

WASHINGTON

Allied Broadcast Equipment, 1112 South 344th St., Suite 312, Federal Way, WA 98003 (206-927-4337) Worldwide Audio Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Service & Repair; System Design

Bennett Engineering Associates, Inc., Box 76, Mercer Island, WA 98040 (206-232-3550) AK, WA Engineering Consultants-Electronic & Communication Systems

Bennett Engineering Sales Corp., Box 76, Mercer Island, WA 98040 (206-232-3555) ID, MT, OR Engineering Consultants-Electronic & Communication Systems

Broadcast Supply West, 7012 27th St. West, Tacoma, WA 98466 (206-565-2301) Worldwide Audio Equip.; Test & Measurement Equip.; Tape

Custom Video Systems, Inc., 17521 15th Ave. N.E., Seattle, WA 98155 (206-365-5400) AK, WA Audio & Video Equip.; Test & Measurement Equip.; Tape; Vans & Accessories; Service & Repair; System Design; Used Equip.

Northshore Marketing, 11000 Lake City Way N.E., Seattle, WA 98125 (206-524-8672) AK, ID, MT, OR, WA Audio & Test & Measurement Equiip.

Northwest Broadcast Systems, Member R.F. Specialties Group, 1718 N.E. 98th St., Seattle, WA 98115 (206-525-6974) AK, ID, MT, OR, WA Transmitters, Antennas & Transmission Systems

See advertisement on this page

WEST VIRGINIA

Midwest Corp. Communications, 300 First Ave., Nitro, WV 25143 (304-722-2921) U.S.A., GU, PR, VI Audio & Video Equip.; Test & Measurement Equip.; Transmitters & Antennas; Tape; Vacuum Tubes; Vans & Accessories; Service & Repair; System Design; Used Equip.

WISCONSIN

Electronic Industries Inc., 19 E. Irving Ave., Oshkosh, WI 54901 (414-235-8930; 800-558-0222) U.S.A. Audio Equip.; Test & Measurement Equip.; Transmitters & Antennas & Transmission Systems; Tape; Vacuum Tubes

Full Compass Systems, Ltd., 6729 Seybold Rd., Madison, WI 53719 (608-271-1100; Outside WI: 800-356-5844; WI: 800-362-5445) Worldwide Audio & Video Equip.; Test & Measurement Equip.; Tape; Service & Repair; System Design; Used Equip.

WYOMING

Hall Electronics, 637 Wilderness Dr., Gillette, WY 82716 (307-682-9486) Eastern-CO, Eastern-MT, All-WY Audio Equip.; Test & Measurement Equip.; Transmitters; Antennas; Transmission Line; System Design; Used Equip.

CANADA

BCB Electronic Sales, 12295 Highway 50; Box 315, Bolton, Ont., Canada L0P 1A0 (416-857-0790) Canada Video Equip.

Black & McDonald Ltd., 101 Parliament St., Toronto, Ont., Canada M5A 2Y7 (416-366-2541) Canada Transmitters, Antennas & Transmission Systems

Caveco Equipment Ltd., 1121 Bellamy Rd. N., Unit 10, Scarborough, Ont., Canada M1H 3B9 (416-438-6230) Canada Audio Equip.; Tape; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Used Equip.

Comad Communications, 1535 Meyerside Dr., Unit 1, Mississauga, Ont., Canada L5T 1M9 (416-676-9171) Canada Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes

Dilor Industries Ltd., Box 2169; 37749 Second Ave., Squamish, B.C., Canada V0N 3G0 (604-892-9301) U.S.A. and Canada Audio Equip.: Supply & Install Full Entertainment/Broadcast Sound Systems & Related Components; Used Equip.: Long Term Lease Financing For Both Audio & Video Lighting

Glentronix (1977) Ltd., 160 Duncan Mill Rd., Don Mills, Ont., Canada M3B 1Z5 (416-444-8497) U.S.A. and Canada Audio & Video Equip.; Test & Measurement Equip.; Video Head Re-Working; Cable Strippers; Clock Drivers & Clocks

Incospec Electronics, Inc., 4651 Boul des Grandes Prairies, St. Leonard, Que., Canada H1R 1A5 (514-322-5540) Canada Test & Measurement Equip.; System Design

Lumitrol, Ltd., 253 Merton St., Toronto, Ont., Canada M4S 1A7 (416-485-4817 or 4826) Canada Video Studio; Lights, Dimmers, Drapes, Grids; Studio Grids, Power Distribution

Nortec West Ltd., 7056-B Farrell Rd. S.E., Calgary, Alta, Canada T2H 0T2 (403-252-8141) Alta, B.C., Man., Sask. Audio & Video Equip.; Film Equip.; Service & Repair

Pineway Electronics Ltd., 1875 Leslie St., Unit 7, Don Mills, Ont., Canada M3B 2M5 (416-449-1343; Canada 800-269-7839) ME, NY, VT, Canada Audio Equip.; Test & Measurement Equip.; AM-FM-TV Transmitters; Tape; Service & Repair

Sigmacom Systems Inc., 111 Industrial Dr., Whitby, Ont., Canada L1N 5Z9 (416-666-1661) Canada Audio Equip.; Transmitters, Antennas & Transmission Systems; Service & Repair; System Design

SonoTechnique, 2585 Bates Rd., Room 304, Montreal, Que., Canada H3S 1A9 (514-739-3368) Canada Audio & Video Equip.; Test & Measurement Equip.; Antennas; System Design

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Tele-Tech Electronics Ltd., 920 Denison St., Unit 11, Markham, Ont., Canada L3R 3K5 (416-499-3242) Canada Audio & Video Equip.; Test & Measurement Equip.; Tape; Used Equip.

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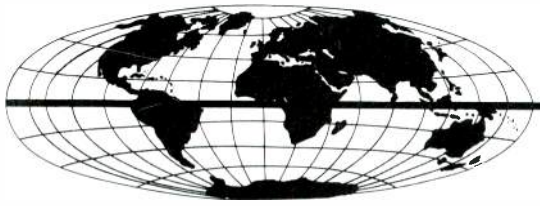

By John Williamson, editor, *Communications Engineering*

CATV's year of action

If 1983 was the year of promise for CATV in the United Kingdom, 1984 should be the year of action. Barring accidents, a cable bill will follow the liberalizing telecommunications bill through Parliament and become law; a national cable authority will be formed; and some holders of pre-legislative franchises will be ready to transmit programs. By year's end, the United Kingdom will have a thriving cable industry.

In this context, the timing of the July Cable '84 exhibition and conference at London's Wembley Conference Centre was excellent. The second annual event attracted more than 70 major exhibitors, with the display area increased by 50% to meet demand.

In addition to terrestrial cable, the Wembley exhibition covered aspects of *cables in the sky* satellite communication. Although DBS on an individual-subscriber basis is seen as directly competitive with cable, industry opinion questions the economic viability of such a service. Also, satellite television is regarded complementary to cable by many.

Conference Proceedings

One of the attractions of Cable '84 was a satellite dish display area. Visitors saw a number of TV channels broadcast live, relayed by three geostationary satellites. Included were two channels from the Soviet Union, via the Gorizont satellite; the Music Channel, Sky Channel, TVS and a German/Dutch channel, via the European Communications Satellite; and the TEN, TEG and Screensport, via Intelsat V.

The conference at Cable '84 featured about 100 experts from Britain, mainland Europe and North America. The scene was set by an opening session in which government and industry spokesmen presented their views. The proceedings then focused on international developments and technology, day-to-day aspects of implementation and operation and the external political, regulatory and financial forces that make an impact on the industry and which will ultimately determine its success.

Switched-star system

Of 11 preliminary CATV franchises awarded in the United Kingdom last year, the national telecommunications administration—British Telecom—is to play a major role, as a shareholder and cable provider, in five of the projects. Mercury, the competitive telecommunications network service provider, was also featured in one of the awards. Both underline the govern-

Stereo TV is the one to watch.

Flash. *Stereo TV is the hot topic at the 1984 Consumer Electronics Show in Chicago.*

Flash. *Every major TV set manufacturer plans to put multichannel units on the street by 1985.*

Flash. *NBC announces The Tonight Show and Friday Night Videos will soon be recorded in stereo.*

Flash. *ABC tests bilingual broadcasts of The Fall Guy in Spanish markets; ratings soar.*

Flash. *NEC introduces VHF and UHF transmitters with full stereo sound.*

In 1977.

We signed on seven years ago.

Stereo TV may be hot, but it's nothing new at NEC.

You see, we prototyped it way back in 1969. And signed on with our first multichannel transmitter in 1977.

And since then, we've installed more than 100 stereo TV transmitters in Japan and Australia. With the same proven technology found in more than 1,400 NEC transmitters around the world.

So now, as America moves into stereo, NEC stands ready to offer you this exciting new technology.

Tested. Tenured. And fine-tuned.

Stereo TV Transmitters. Right now. From NEC.

Stereo TV is just a matter of when. So what can you do now?

Well, you could buy unproven technology. And pray that you don't pay for trial and error. Sooner and later.

Or, you can call NEC toll-free at 1-800-323-6656. We have a full line of multichannel transmitters, with single output powers up to 35 kW, that we'd love to show you.

You see, we're the one to watch in stereo television. Because we already have been for seven years.

NEC

IMAGINE WHAT WE'LL DO FOR YOU

NEC America, Inc., Broadcast Equipment Division, 130 Martin Lane, Elk Grove Village, IL 60007, in Illinois 312-640-3792. 650-8416

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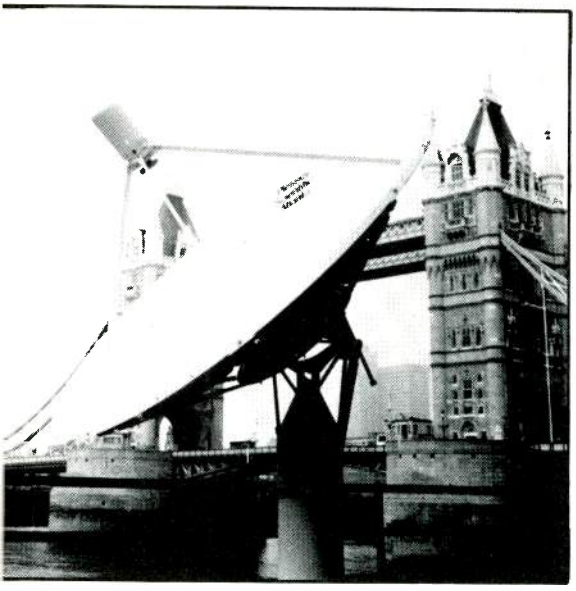

A satellite receiving antenna from Plessey/Scientific-Atlanta is only one of many CATV and satellite broadcast-related products shown at CABLE '84.

ment's commitment for cable to provide information services as well as entertainment.

Nine of the first franchises will use *switched-star* cable technology. A switched-star cable TV network is one in which services and programs are delivered to points located throughout the network, and each subscriber has a wideband link to the nearest switch point. The subscriber signals his individual requirements to the switch point and, provided he is authorized, is switched through. There is no requirement for a decoder in the subscriber's premises, and both broadcast and individual services can be provided over the same network.

Tree branch distribution

Another alternative for CATV is the tree/branch, in which a decoder is used in the home to select a channel or service. There are three distinct levels of sophistication with tree/branch arrangements.

In its most rudimentary form, the subscriber selects the required channel with a tuner. If optional subscription channels are included, a blocking filter prevents unauthorized viewing. This setup has the advantages of simplicity and low cost of capital equipment. Disadvantages include the comparative ease of program theft and inflexibility—each time a subscriber changes his service options, his particular filter must be altered. Also, the provision of periodic pay-per-view services is impossible.

In more elaborate tree systems, the cable operator controls subscriber access to channels by signal scrambling at the head end. A set-top descrambler is enabled or disabled via signal that permits customers to be individually addressed. A much wider range of programming options is possible with more security than the basic tree.

Program Options

The highest level of tree/branch sophistication involves the inclusion of a return signaling channel, allowing the subscriber to communicate his requirements to the CATV head end.

Most systems in North America and Europe are tree/branch. However, the switched-star systems can be more flexible. There is no impediment to the transmission of private data to specific locations without passing any other subscribers. British Telecom's switch-star systems will offer options such as:

- Programs on demand from a video disk library.
- Cable text, a video magazine service.
- Viewdata and photo viewdata.
- Tele-banking and shopping.

Coaxial cable is commonly used in tree/branch networks, while optical fiber is viewed as most suitable for switched-star setups. A hybrid system is also possible. Fiber-optic technology, with its broadband characteristics, could be used in trunk lines of a tree network, and coaxial, with its electronic compatability, could form feeder lines to individual receiver decoders.

PESA

High reliability.

PESA'S current products are basically the Mobile Color TV Units, Character and Title Generators and TV Transmitters and Transposers.

But a true representation of PESA would not be complete without also mentioning the other products that PESA designs, manufactures and markets.

- Complete Television Networks.
- News service center.
- Production and Post-Production studios.
- Switching and Control centers.
- Professional equipment for the monitoring, synchronising and distribution of video and audio signals.
- TV Transmission. Transmitters and Transposers.
- We are clearly well experienced in the field of Professional TV.

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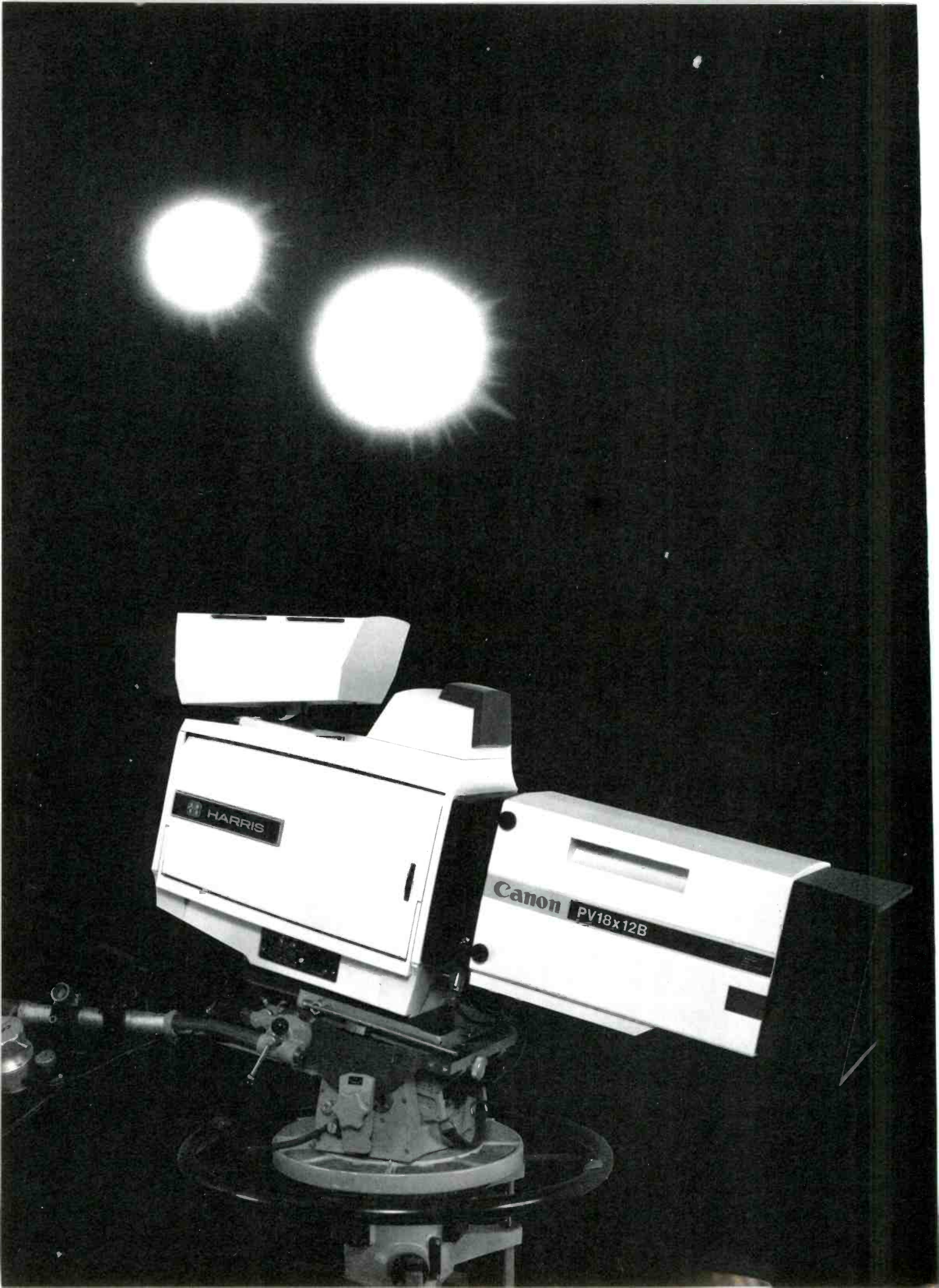
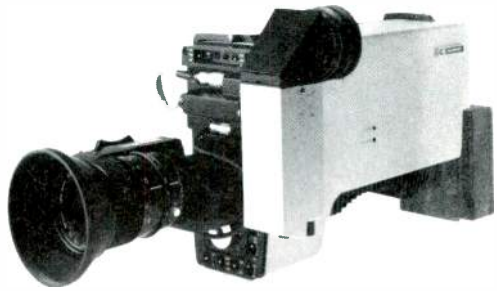
Electronics and Data Systems Division of INI.


HARRIS
Canon
PV18x12B

Which camera company offers a unique new process that sharpens your image without dulling the colors?



Now there's a special circuit in all Harris cameras that sharply defines the reds, *without darkening them.* Other cameras offer contouring on only one color at a time...Harris cameras provide contouring out of red and green simultaneously! This enhances picture clarity over a wide color spectrum, *with no loss of color fidelity.*

It's exclusive, and just one of the many advancements that make Harris cameras superb performers in the field and in the studio.

TC-90 ENG/EFP Cameras... Built for the Way You Use Them

Weighing about 8 pounds, the TC-90 is one of the smallest. But we deliberately made it a little bit bigger than it had to be to add balance and stability. A little longer to let the cameraperson grasp the lens in a natural, comfortable, controlled way. And we carefully shifted extra weight to the tail, so that the weight of the lens is counterbalanced.

Most cameras blind-side you to the right. Not the TC-90. Its low profile lets you see right over the top for total right-side visibility. And that low-profile body is constructed of a rugged graphite composite that is unaffected by the inevitable rough treatment in the field.

The TC-90 gives you auto white balance and auto black balance at the flick of a switch. With the addition of the exclusive Smart Package™, you also get computerized diagnostics, auto centering and encoder balance—plus microprocessor time code generation that lets you record SMPTE and VITC time codes as you shoot.

C Series Studio Cameras ...Picture Perfect

You expect top performance from a studio camera, and with Harris C Series models you get it! Color fidelity and picture integrity are the best in the industry. High resolution with low lag, high sensitivity, low noise, highlight handling and variable contrast control give you color as you really see it, and clean, sharp video even under the most severe lighting conditions.

If you want a full computer-controlled automatic setup camera, choose the TC-85C. Or, if you're on a tight budget now, the TC-80C is a manual setup camera with automatics that can be upgraded in the field later to full computer setup capability. Both feature a new viewfinder with electronic-generated safe title and safe action areas, and a variable rectangular window. It's tiltable and rotatable, too.

An impressive 48 operator functions are controlled by the computer in the TC-85C, and adjusted according to preset parameters. Each camera has a built-in independent computer so that all cameras can be set up at the same time. Even by an inexperienced cameraperson. With just the touch of a button.

With the addition of a CRT and/or printer, which plug right into the TC-85C computer control unit, complete information on camera status becomes available on a hard-copy printout or on the CRT screen.

Manned 24-Hour Service

One of the real pleasures of owning a Harris camera is the secure feeling of knowing that it's backed by *manned,* 24-hours-a-day, 365-days-a-year emergency service. And by the best parts availability system in the industry.

Call or write for more information. Or, better yet, ask for a demonstration of the Harris camera of your choice. Harris Corporation, Studio Division, P.O. Box 4290, Quincy, IL 62305. 217/222-8200.

HARRIS

For your information, our name is Harris.

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EECO's corporate headquart(

EECO, Inc. - A corporate profile

By Carl Bentz, television editor

The EECO corporate headquarters are situated on a company-owned 19-acre site in Santa Ana, CA. With manufacturing facilities in Arizona, Minnesota, South Dakota and England, EECO designs and manufactures a diversified line of electronic products. Founded in 1947, the company became public during the 1950s.

The company products fall into two major categories: electronic components and computer technology-related products and systems. Actually, there are four product lines, including switch products and avionic systems, which form the Component Products Division; computer systems for hotels, represented by the wholly-owned subsidiary EECO Computer; and time code and editing products,

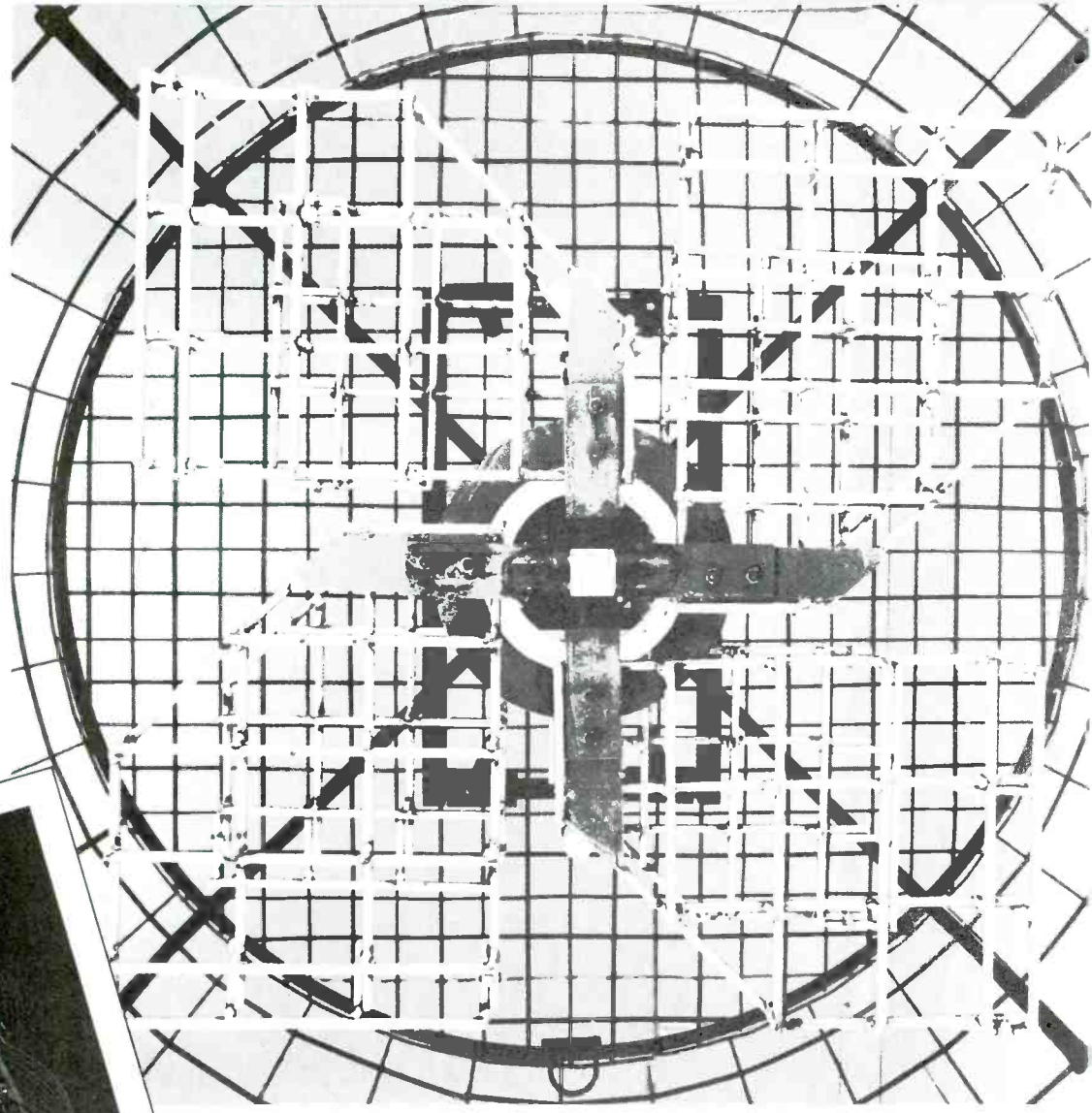
EECO's Computer-Aided Design (CAD) facility.

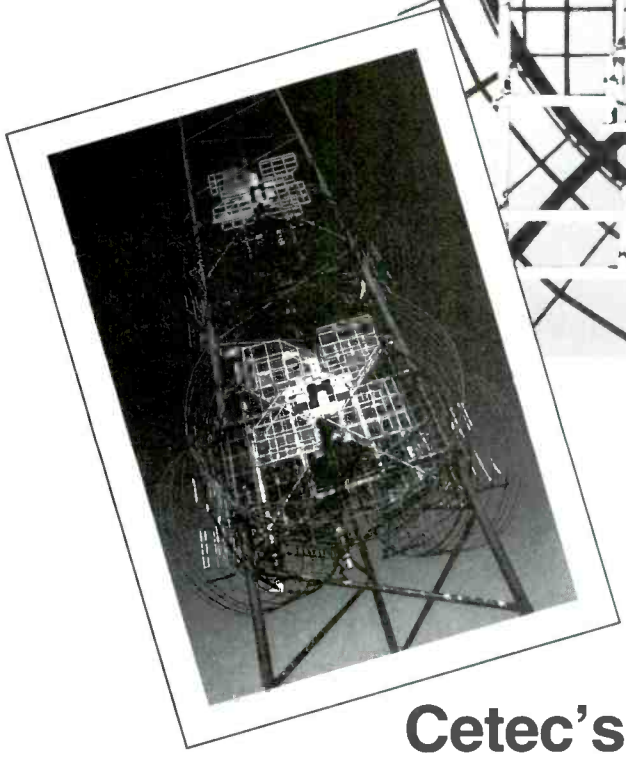
Quality assurance testing of EECO's in-flight entertainment product line.

The wraps are off, and the newest Community Antenna system is now available for multi-station use. It's a thoroughly engineered panel antenna. Wider than the entire FM band. In fact, wider than CH-7 through CH-13, so it's made for TV also.

More and more FM stations faced with the FCC Docket 80-90 requirements are considering a community antenna system as the ideal solution to the problems. It only takes:

- One good site
- One tall tower
- One group of four or more forward looking stations
- One **Cetec BROADcaster** antenna





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Circle (89) on Reply Card

Printed circuit board production facility.

from the Video Products Division.

Component products

EECO's largest product line is switches, including electromechanical and membrane devices for front panel and printed circuit board use. Various part numbers include thumbwheel, DIP rotary or rocker, and touch-type membrane units. The recent acquisition of Maxi-Switch Company, Minneapolis, adds micro and personal computer keyboard products to the line.

Also familiar to many are products for avionics. Passenger seat arm controls to select movie and stereo audio channels, adjust sound volumes, actuate reading lights and call the flight attendant are systems provided by EECO. More recently, some aircraft cockpits include an instrument display with a computer-controlled radio management system designed for both commercial and military use.

EECO Computer

The computer division supplies turnkey hotel property management systems worldwide. Many of these systems involve the Sheraton chain and include automation for front office operations—reservations, registration, night audit and cashier functions. Front office operation is linked to back office automation accounting and interfacing to energy management, telephone uses and food/beverage services. EECO provides installation, training and maintenance for the customer.

Video products division

To broadcasters, EECO stands for computer-based editing, time code systems and, most recently, videodisc equipment. The products are distributed through a network of OEM contracts and authorized distributors, targeting TV and professional video communications markets.

The first commitment to video post-production came in 1967 with the "On Time" time code editing system. Pioneering efforts in time code products have had a major impact on video techniques. Close coordination with SMPTE resulted in the establishment of recommended practices for both longitudinal (LTC) and vertical interval (VITC) time code standards.

The 1970s were active years as

EECO's video product engineering lab.

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Circle (90) on Reply Card

IVES system production line.

EECO's EMME computer-assisted editing system (independent creative workstation with optional monitors and optional ASCII keyboard shown).

EECO grew in technology and expertise with the development of several synchronizer products, a CMOS time code generator IC and editing control products designed jointly with RCA (RE-600 and RE-800) and Ampex (Mantis and the STC-100 accessory). The developmental work earned an Emmy award for outstanding achievement in engineering of time code equipment, as well as an Academy Award citation for the application of code and control systems to interlock non-sprocketed film and tape media for motion picture production.

Video product growth has continued into 1984 with the standard EECO IVES desktop editing system, sporting options for PAL standards use and A/B roll functions. The A/B roll enhancement may be added to existing systems, providing three VTRs with effects capability through a bridge and accessory package. In addition, interfacing is available for IVES to support Panasonic's AU-300 M-format equipment.

Time code peripherals remain an important part of the product line. The TCP-250 time code processor, the tenth model of the peripheral series, includes functions of reading, display and insertion of LTC and VITC code with user bits.

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FOR-A's Digital Time Base Corrector (FA-410) now offers Dynamic Tracking[1] compatibility for both the SONY Broadcast U-Matic[1] (BVU-820) and the PANASONIC VHS (NV-8950)[2] VTRs. All of the FA-410 features from extraordinary transparency in operation to good human engineering (not to mention price!) are now enhanced with the ability to fully utilize Dynamic Tracking modes for fast and slow motion and still frame. For broadcast, cable and editing, the FA-410 is dynamically better than ever.

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Call or write today for your copy of the new FOR-A Digital TBC brochure which covers all performance and engineering specifications including details on the new Dynamic Tracking options.

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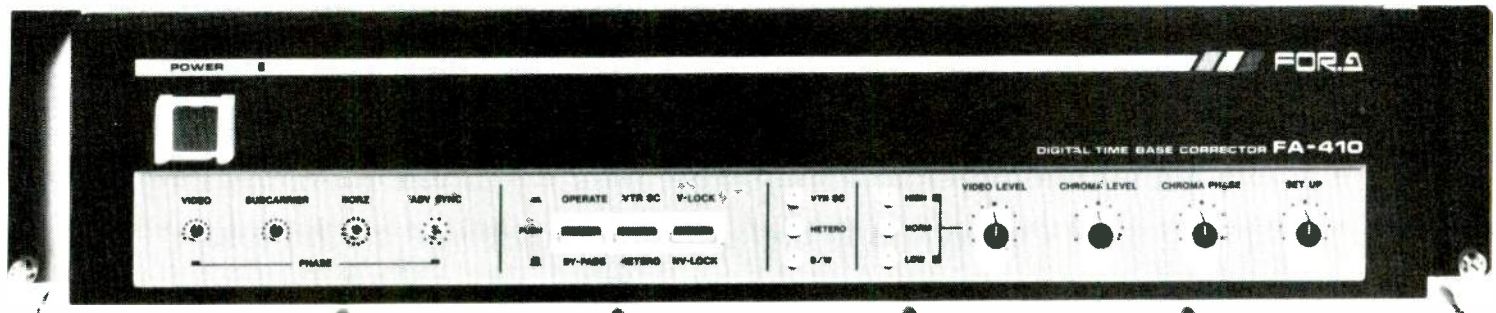

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[1]Dynamic Tracking and U-Matic are trade names of Sony Corporation.
[2]The Panasonic VHS NV-8950 is V-locked with modification by FOR-A Corporation. Contact FOR-A Sales Department for complete information.

Circle (91) on Reply Card

Typical applications for EECO's EECODER system include training of medical personnel.

A recent collaboration with the engineering team at Swiderski Electronics, Elk Grove Village, IL, has resulted in the EECO multimachine editing system—EMME for short. The background of the design group includes over 100 years of experience in post-production, as well as hardware, software and system design of several well-known products from Bosch, CMX and Datatron. EMME is designed to handle multiple video and audio systems for such applications as video post-production and video sweetening.

Another recent project of the video products group culminated in the EECODER Still-Frame Audio system. Using videodisc technology for storage, EECO allows the equivalent of 225 80-slide carousels, each with an associated 20-second audio message, to be stored on one 54,000-frame capacity disc. Primarily for interactive video use in training programs and simulation applications, the system also suggests use for large-scale storage of commercial messages for a radio station or slide/message ID/commercial presentations for television. Random access to any item on the videodisc system, to be marked for EECO by the 3M company, is possible.

Predictions

The entire product base of EECO involves microprocessors, computer control devices and related products. The company's financial situation allowed 11.4% of 1983 sales, approximately $4 million, to be committed back to research and development across the company's range of interests. During the first half of 1984, the video product division accounted for about 10% of the corporate sales. Approximately 14% of the profits were returned to the continuing search for computer-based applications that will spell out EECO's bright future.

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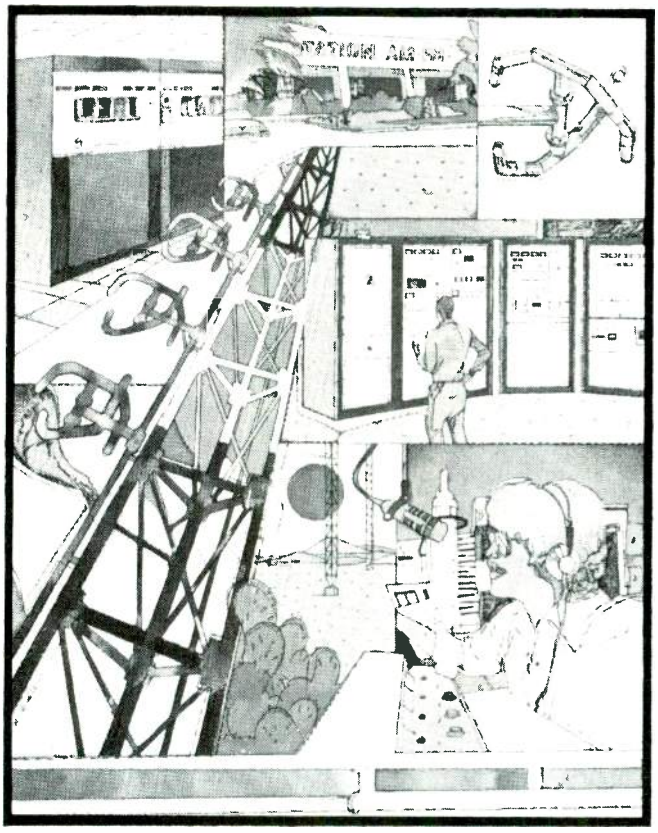

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50 kW

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10 kW
20 kW
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Circle (92) on Reply Card

Reaching for the sky

By Warren Small

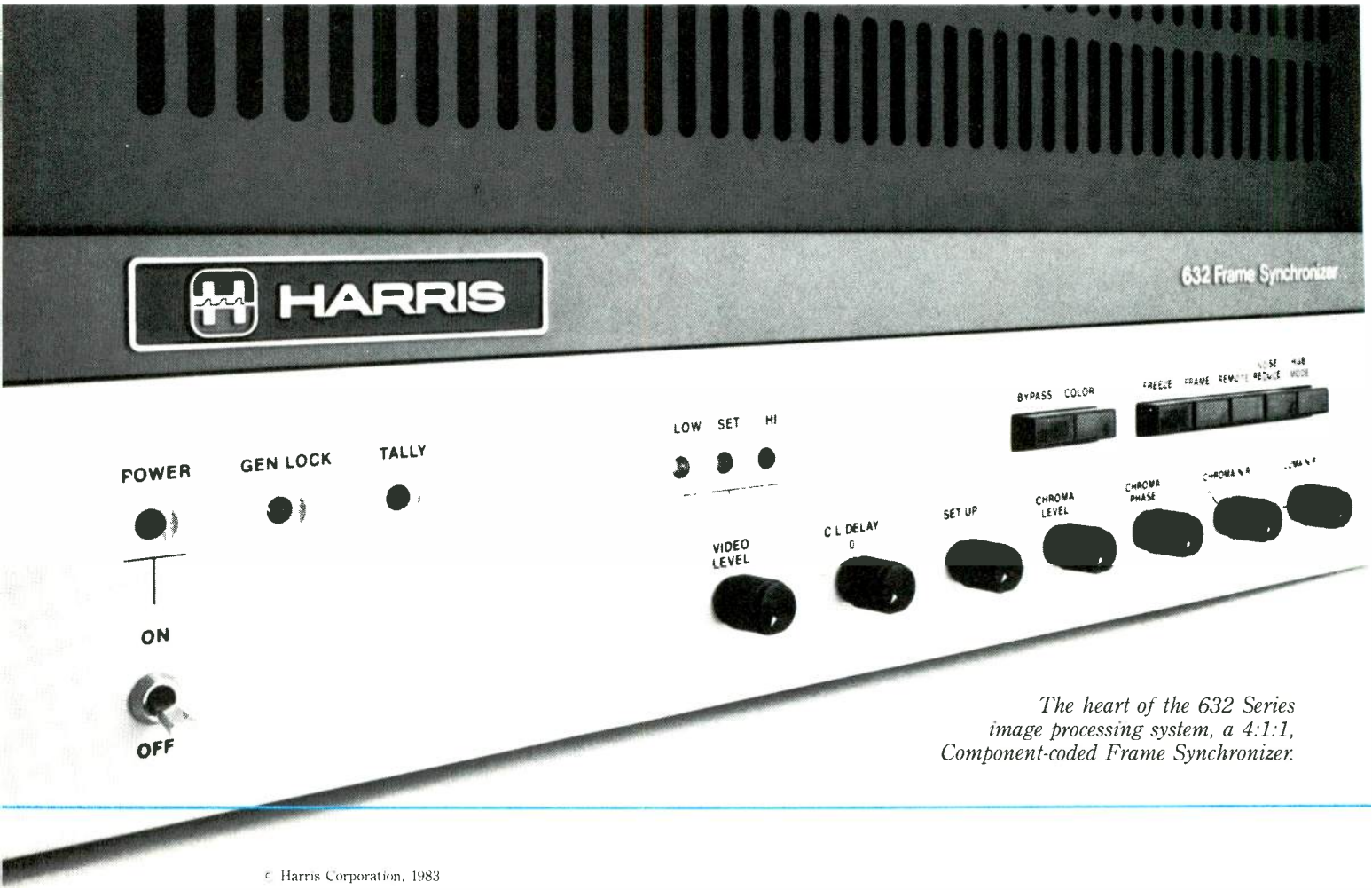
In 1981, WGIR (Knight Radio) entered the satellite age when we installed our first earth station to pick up the United Press International wire service. We knew it would only be a matter of time before our radio network, NBC, would also be coming from the sky. We didn't know, however, what we would have to do to accomplish the rather routine task of installing a dish and pointing it in the right direction.

When the announcement came that all three major radio networks were going to be using transponders on Satcom 1-R, we began to plan our installation. At first, there was some question as to whether NBC would really be prepared to cut the phone lines by December 1983. All doubts were removed, though, when the network gave us an ultimatum in April 1983 to install a dish or cease affiliation by the end of the year.

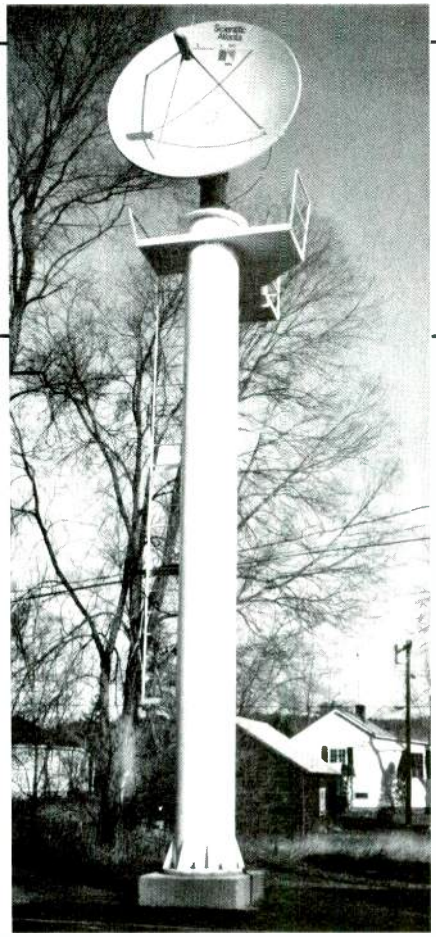
Because of the local terrain and the low look angle to Satcom 1-R from our position, we hired the John T. Hills Engineering consulting firm, Manchester, NH, to survey our site and determine the bird's exact position in the sky. The consultant's measurements showed the satellite look angle at nearly 12 feet *below* the top of some trees on a nearby ridge. This was not exactly good news and so—with the network's ultimatum in hand—we contracted with a local engineering firm experienced in satellite installations (Goldberg-Jacobsen Engineering, Inc.) to design a structure that would hold the dish high enough to "see" over the trees.

Our criteria for the dish mount not only included functionality, but appearance and ease of maintenance as well. Based on the surveyor's data, in order for the dish to receive Satcom 1-R and allow for tree growth over the projected life of the antenna, our designer told us the structure would have to hold the dish 29 feet above the ground. This was more than twice what we had originally estimated, and we began to worry about what type of ungainly structure might begin to rise next to our parking lot.

The consulting firm (Goldberg-Jacobsen) was ahead of us, though, and proposed using a 30-inch water pipe as the main support for a platform that would hold the dish at the required height and provide work space to orient the antenna and ser-



The heart of the 632 Series image processing system, a 4:1:1, Component-coded Frame Synchronizer.



The Receive-Only Satellite (ROSAT) installation at WGIR, Manchester, NH. Because of local terrain problems, the 2.8m Scientific Atlanta dish was mounted on a 29-foot steel platform. The structure is designed to withstand 100 mph winds.

vice the Low Noise Amplifier (LNA). Not only did this design place our dish where it would work, but it also gave us a nice-looking structure that required only 16 square feet of space in the parking lot.

Constructing the platform

Like most construction projects, ours had its share of setbacks. Initially, there were some design modifications to strengthen the platform and provide for survival in winds of up to 100 mph. We do not see such severe winds in this area very often; however, the dish itself was designed to withstand 100 mph winds, and we didn't want a structure that would collapse in winds lower than the design maximum for the antenna.

The work platform at the top of the structure provided the greatest number of design problems. A full octagonal platform was first proposed, but this was deemed too costly. Goldberg-Jacobsen proposed an alternate plan that cost less but was inadequate in terms of serviceability of the dish. The final solution called for two small extensions to the north and south and a 7-foot platform to the east. This provided adequate space for moving the dish and servicing the LNA. The final design was submitted to the contractor (Pro-Con, Inc., Manchester) in early August 1983.

Construction of the tower itself was delayed while the fabricator waited for materials to arrive. This delay set the project back by almost a month. We were still optimistic, however, of meeting the Sept. 5 deadline we had

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4 ±.5 mm convergence within center circle—to prevent outlines from appearing around images.

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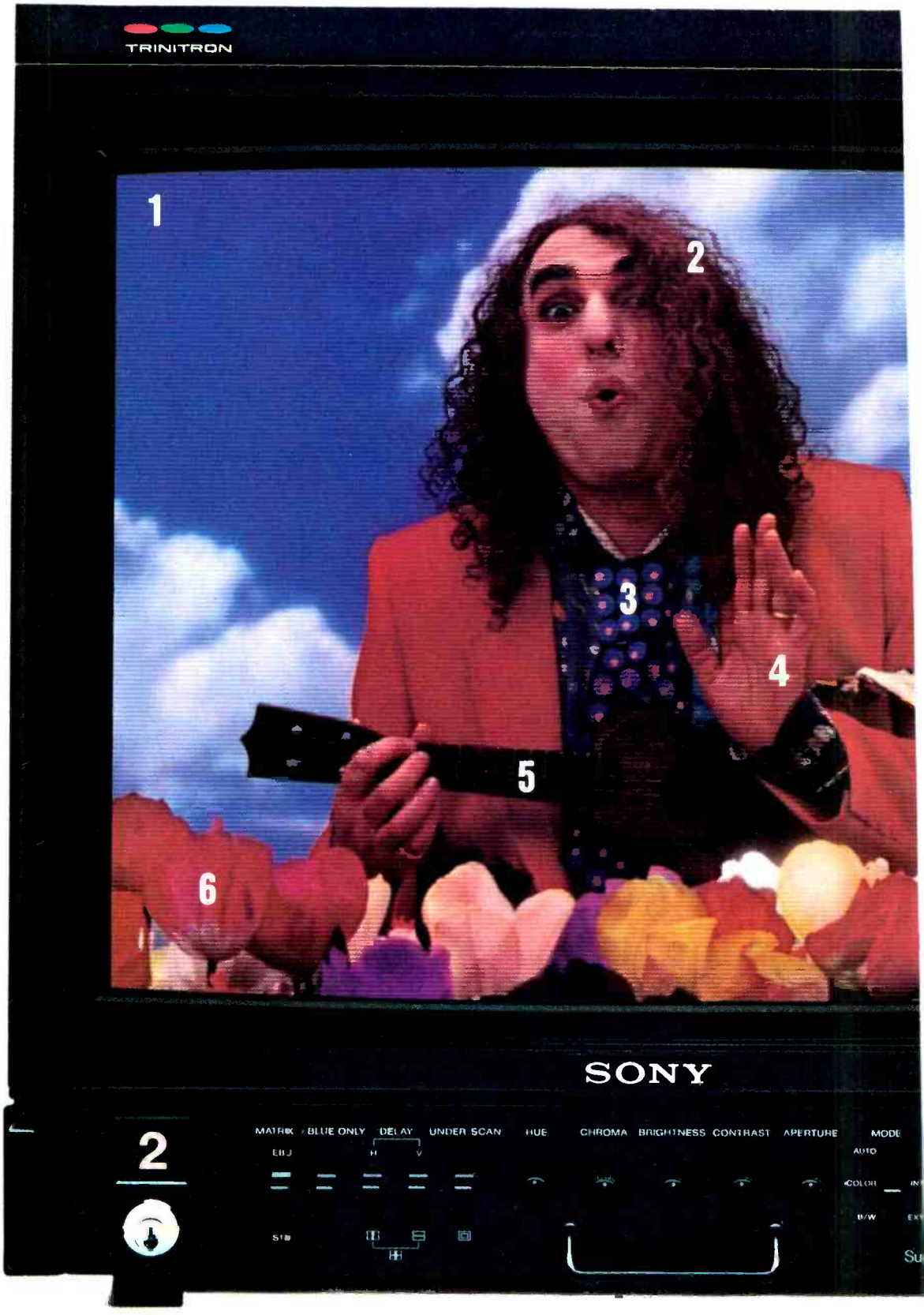

DRAMATICALLY IMPROVED SO THEIR ABSOLUTE WORST.

If this were live, and you were critically evaluating your video signal, you would be looking blissfully at one of the most revolting pictures you ever saw.

You would, that is, if you were viewing a new Sony BVM-1900 or BVM-1201 Broadcast Trinitron®.

The new BVM Master Control Monitors have been completely re-engineered to reproduce your signal precisely the way it was fed into them.

If Tiny Tim's hair was covered with snow, or his ukulele was making too much noise, you'd know it. Because these Trinitrons offer the highest resolution available—900 TV lines.

This degree of resolution has been made possible through Sony's extensive research and development in high-definition TV.

However, the real reason they're the state of the art in broadcast CRTs is that they give you the highest resolution without ever compromising color purity or brightness.

That's because instead of using a shadow mask, which suffers from the disadvantage of being spherical (therefore causing it to warp from heat), Sony uses an exclusive Aperture Grille. It's cylindrical, and is rigidly held straight at the top and bottom, enabling it to resist thermal or mechanical bending and ensuring white uniformity.

And thanks to another exclusive Sony feature, Automatic Beam Control, when Mr. Tim goes tiptoeing through the tulips, they won't turn into pansies right before your eyes. Because the monitor reads its own signal and instantly corrects for color drift.

Plus, all phosphors used in BVM Broadcast Trinitrons now match the industry's U.S. standards.

For more information on the one piece of test equipment you shouldn't be without, the one with mixed video capability, that's ready to accept computer graphics, and you don't have to be Tiny Tim to afford, contact Sony Broadcast today.

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SONY® Broadcast

The WGIR radio ROSAT antenna is moved into place by a crane. The top platform on the supporting structure was designed to provide adequate room for adjustments and maintenance.

set for the project. That optimism was short-lived, though, as other delays prevented further work on the structure and base.

The concrete for the base was finally poured during the week of Sept. 19. First the 10-foot square, 16-inch thick, steel-reinforced footing was poured six feet below the ground. Then, the nearly 5-foot tall, 4-foot square base was poured around a web of reinforcing bars. Eight 2-foot long anchor bolts were provided to fasten the tower to the base. When completed, the base weighed about 18 tons and, with the dish and tower together weighing only two tons, this gave us an extremely bottom-heavy structure to satisfy the wind loading requirements.

The steel tower was constructed by Novel Iron Works, Portsmouth, NH, and was shipped ready-to-install on Sept. 29. After a crane lifted the structure into place, it was leveled and bolted into position. The dish had been assembled on the ground and the crane was used again to lift the entire antenna to the top of the structure. The coax line to the indoor Scientific-Atlanta equipment was then connected, and the antenna positioned.

The whole process took just five hours and the results were impressive. We were nearly a month past our original deadline, but the greatly improved audio quality of the satellite-delivered network programming made the money and effort spent very worthwhile.

Deciphering FCC antenna proof requirements

By Dane E. Ericksen, P.E., Systems Design

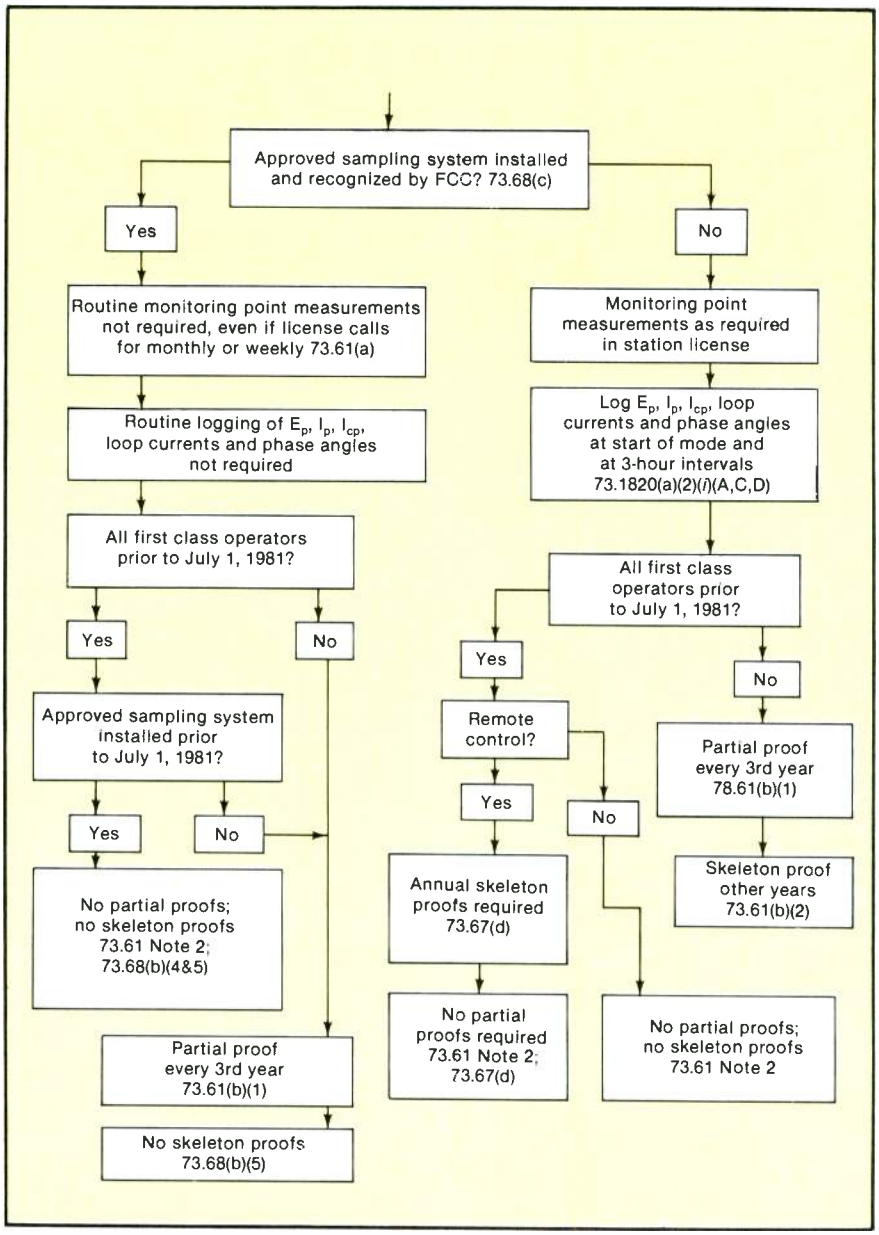


Figure 1. This flow chart simplifies a determination of the type of proof, if any, that is required on the directional array. Reference numbers are given to rules in Volume III, Part 73, of the FCC Rules and Regulations.

FCC rules require that most AM broadcast stations using a directional antenna conduct some form of field-strength measurements. The FCC requires these measurements to insure that the directional antenna radiation does not exceed the authorized standard pattern; the station wants the measurements to insure proper coverage *and* because the FCC requires them; and the chief engineer wants the measurements for early detection of problems in the directional array.

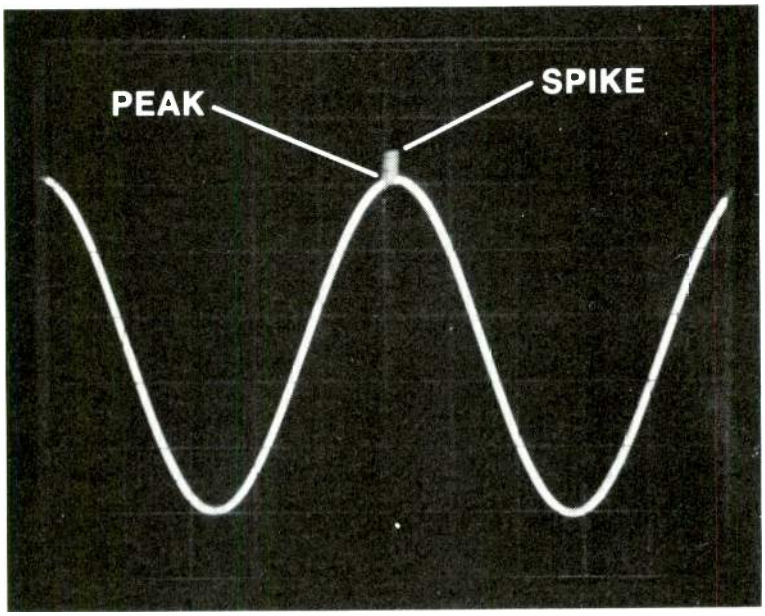
There are four categories of field-strength measurements:

1. The complete RF proof
   - 30 points per radial
   - required at initial construction
2. The partial RF proof
   - 10 points per radial
   - required every third year under certain conditions (see chart)
3. The skeleton RF proof
   - three points per radial
   - required under certain conditions in those years when partial proofs are not due (see chart)
4. Monitoring point measurements
   - at each monitoring point specified in the station authorization
   - required at least monthly, if an approved sampling system is not installed
   - not required at any routine interval, if an approved sampling system is installed (even if the station license specifies weekly or monthly intervals).

Who and when

The FCC rules governing partial proofs, skeleton proofs and monitoring point measurements are contained in Vol. III, Sections 73.61, 73.67, 73.68

Can Your FM Modulation Monitor Tell a Peak from a Spike?



TFT's new FM/Stereo and SCA monitors make modulation uncertainty a thing of the past. Based on more than 14 years of experience with over 5,000 monitors, these new instruments have an exclusive (pat. pending) Peak Differentiator that separates true modulation peaks from the spikes generated by noise, overshoot and multipath distortion.

With the Model 844 FM/Stereo monitor and the Model 845 SCA monitor, you can modulate your transmitter at the absolute legal limit, with absolute confidence, to achieve maximum coverage.

Both new monitors have a built-in frequency-synthesized FM modulation calibrator—another TFT first. Merely push a button on the front panel to get a modulation accuracy better than 1 percent—year after year—without any additional instruments.

Other important features include automatic bandwidth selection when you change between remote and on-site monitoring, and a multipath detector to minimize distortion in off-the-air applications.

In addition, the Model 845 SCA monitor allows you to select up to three SCA frequencies. And, using the digitally programmable preselector in the Model 844, you can monitor your competition off-air to get a fast, precise fix on how your loudness measures up.

So, to take the guesswork out of modulation and get all the coverage you're entitled to, get your monitor from TFT. For detailed specifications, and a demonstration, call or write.

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Circle (98) on Reply Card

September 1984 *Broadcast Engineering* 187

FCC update
Continued from page 6

over AM, FM and TV stations.

Studies conducted by the FCC during the 1960s and 1970s concluded that it was possible to measure and control loudness. However, the commission said its experience in this area had led it to the conclusion that *loudness* was a subjective term. This fact, combined with advances in technology that permit both broadcasters and TV viewers to modulate loudness levels in commercials, led the commission to conclude that regulations in this area were not necessary.

Expanded use of AM carrier signal

In line with similar deregulatory actions for FM and TV stations, the commission has amended its rules for AM broadcast stations to permit them to expand the uses of their carrier signals.

Under the revised rules, AM stations will be able to use their carrier signals for any broadcast or non-broadcast function that does not interfere with their main channel operations or the signals of other stations. Under previous rules, AM carrier non-broadcast uses were restricted to remote control telemetry and utility load management.

Possible new uses include paging and subscription services. If common carrier uses are planned, however, authorizations would have to be sought from the FCC's Common Carrier Bureau, as well as from state public service commissions.

FCC affirms cable system exemption from local rate regulation

The FCC has affirmed its November 1983 decision exempting non-basic CATV services from rate regulation.

Such non-basic or *tiered* services include pay programming, commonly provided in tiers, offered to subscribers at a single package rate distinct from the rate charged for regular subscriber services. Under the commission's decision, local authorities may prescribe rate regulations only with respect to a cable system's basic service package, which consists primarily of off-the-air broadcast signals.

Continued on page 190

High Definition Audio

For the complete picture

The new 300 Series Audio Production Console has been specifically designed to complement the latest audio and video technology. It's the only console in its class, offering mono or stereo inputs each available with or without equalization, output submastering, audio-follow-video capability, a comprehensive user-programmable logic system, and a wide range of accessories for custom tailoring to your specific requirements. Available now. Call us collect for further information.

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Circle (106) on Reply Card

FCC update

Digitized terrain data

The FCC has proposed rules that would standardize the acceptance of computer-generated antenna heights above average terrain (HAAT). Also, the commission issued a Public Notice specifying interim procedures to be followed for the use of such data pending adoption of the new rules.

The proposal involves specification of a particular data format, but no single data source. The agency said it believed the 30-second file, which typically contains 16 discrete elevation points in an 8-mile segment, was adequate for HAAT calculations when making interpolations to produce 50 points. In this connection, the FCC noted that the 30-second point format appeared to be the most available and convenient due to variations among sources. Use of digitized data in generating HAAT will be an option only, and the manual method, using topographic maps, will continue to be the standard in cases of dispute.

In the interim, before new rules are adopted, applicants will be allowed to use any data file with equivalent or greater accuracy than the 30-second point file of the National Geophysical Data Center. In submitting applications under the interim standards, applicants must identify the file being used. Also, the commission specified that applicants must use the FCC's linear interpolation techniques, contained in a commission program, for calculating HAAT.

Class I-A clear channel application freeze lifted

Effective July 17, the FCC lifted its freeze on the filing of applications on the 25 Class I-A clear channels.

The freeze, announced in early 1982, was imposed to resolve incompatibilities between assignments proposed on the U.S. I-As by the United States and Canada.

Lifting the freeze on applications on the I-A clears does not affect the freeze separately imposed on June 5, 1984, on the filing of applications on the Canadian clear channels (690, 740, 860, 990, 1010 and 1580kHz).

Cable registration of added signals deleted

The FCC has also eliminated the requirement that cable systems file registration statements when they add a TV signal to their systems.

The commission determined that this requirement was unnecessary, because cable systems were required to file FCC Form 325 annually. Schedule 2 of that form requires a listing of the entire carriage complement of the filing cable system. |:-)))|

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In its various configurations, the Harris 9100 provides intelligent remote control; automatic transmitter control; automatic logging; plant protection through intrusion and fire alarms; and automatic control of tower lights and building temperature. It can even exercise your standby equipment...and operate up to three remote sites from a single location!

The Harris 9100 watches over your transmission system and physical plant. It makes decisions automatically, based on pre-programmed limits...with a minimum of operator intervention. Quite simply, it is the most intelligent remote control system on the market.

Improve your manpower allocation. Increase plant protection. Maximize equipment life. The Harris 9100's automatic features are unmatched.

Whether you're AM, FM, TV or Satellite (or any combination), the Harris 9100 Intelligent Remote Control System is designed for you—for your security, efficiency *and* savings. For more information, contact Harris Corporation, Studio Division, P.O. Box 4290, Quincy, Illinois 62305-4290. 217-222-8200.

HARRIS

Circle (108) on Reply Card

Advances in AM radio design

By Martin Giles,
applications manager,
National Semiconductor Corporation

New developments in integrated circuit technology have made possible significant advances in the design of AM receivers. Although the marketability of higher-performance, and higher-cost, AM radios has yet to be tested on a large scale, the promise of hi-fi AM is welcome news to station managers and engineers alike. On the leading edge of receiver technology are the integrated circuit manufacturers.

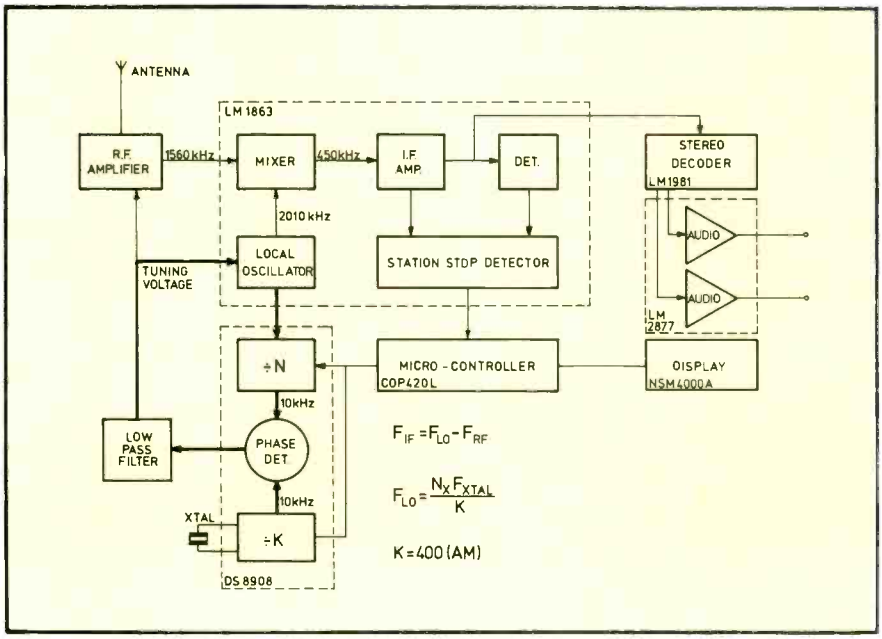

Figure 1. The basic PLL synthesized tuning system for an AM radio using an advanced microcontroller IC for circuit management.

Although AM radio has been around for many years—or perhaps *because* it has been around for so long—not much attention has been paid to receivers, other than efforts to make the electronics smaller and less expensive. Extensive use of transistors in the '60s certainly made smaller size and lower cost practicable, but it wasn't until the introduction of dedicated integrated circuits (ICs) in the '70s that performance improvements could be made without increasing the price significantly. Even then, the thrust of design was primarily to keep the cost down, usually by combining AM and FM circuits in a single IC, sometimes to the extent of sharing the same IF amplifier for both radio services. In fact, many people attribute the general low quality of AM radios to this continuous drive for lower cost. Today, with the introduction of AM stereo and sophisticated phase-locked-loop (PLL) tuning systems, the AM radio may be due for a change. Nevertheless, the receiver designer faces several significant problems other than cost in attempting to produce higher quality AM radios.

The AM receiver

Because of the greater range advantage that AM broadcasting has over FM broadcasting, AM long has been a popular service in automotive radios, and it is in this area that many advances are being made. This is particularly true of IC designs for the signal processing and tuning stages. Push-button tuning in an automobile is not so much a luxury as an important safety factor. Once the driver has programmed his favorite stations, he can keep his eyes on the road, instead of watching the radio dial as he adjusts the tuning knob. New ICs have been developed recently that make the programming task both simple and convenient.

A typical PLL synthesized frequency tuning system is shown in Figure 1. Essentially, the crystal oscillator provides a reference frequency, which is divided down to give one input to a phase detector. This input frequency is chosen to be either the exact radio frequency (RF) channel spacing—10kHz in the United States or 9kHz in Europe—or a sub-multiple of the channel spacing, such as 1kHz or 500Hz. This input frequency is compared with a similar input from a programmable divider driven by the radio's local oscillator (LO). If the two frequencies match, the phase detector control voltage will be fixed. However, if the frequencies do not match,

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Paul Stone, General Manager, Georgia Radio News Service

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But lower costs and superior performance aren't the only advantages of a Microdyne radio network. Our system is frequency agile and has an optional bandwidth selection feature that lets you change formats when you change channels.

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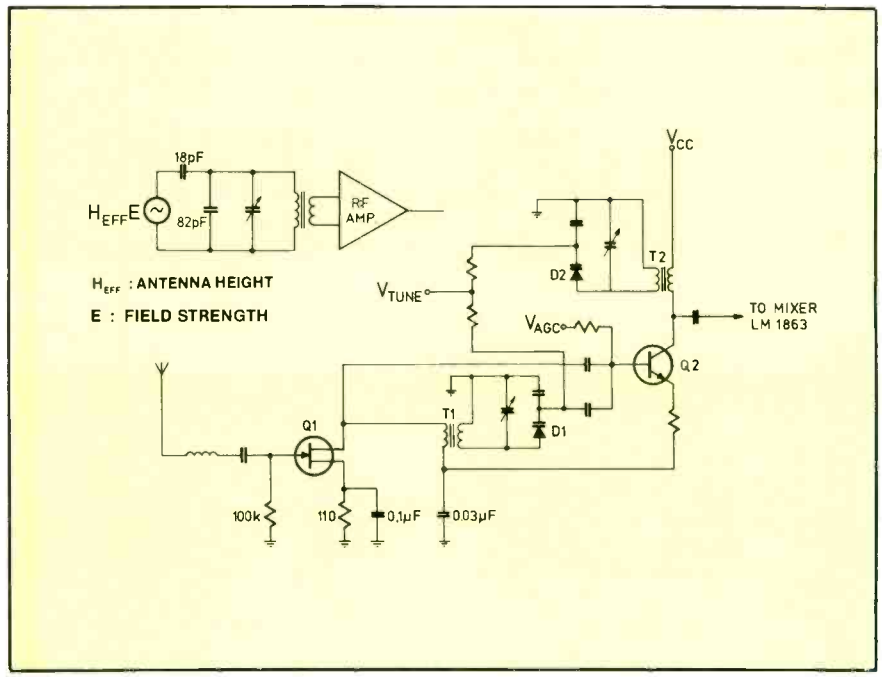

Figure 2. A conventional AM radio antenna input stage (top) compared with an improved active RF input stage (below). Use of an active RF input stage and advanced IC circuits enables the design of an AM receiver with wider audio bandwidth, lower distortion and improved S/N performance.

the phase detector will generate a change in the control voltage that will retune the LO until the two signals agree.

For example, with a reference oscillator frequency of 4MHz, a fixed divider (K) of 400 will provide a 10kHz input to the phase detector. Similarly, when the LO frequency needs to be 2010kHz (in order to mix a 1560kHz RF signal down to a 450kHz IF), a divide by N of 201 will also produce 10kHz at the phase detector input. Should the LO attempt to drift, the detector will produce a control voltage proportional to the instantaneous phase difference between the two divider frequencies, and thus pull the LO back on the correct frequency. Simply incrementing or decrementing the programmable counter N by 1 will retune the LO to the next lower or higher station frequency.

In the example we have chosen, each integer change in N will move the LO by 10kHz, thus ensuring that all the AM station frequencies can be addressed. To accommodate the medium wave band in Europe, a 9kHz shift is needed. Changing the reference oscillator frequency to 3.96MHz will allow both 10kHz and 9kHz shifts to be programmed, or alternatively lower phase detector inputs such as 1kHz or 500Hz can be used. Now, the factor N is changed by 10 or 20 to increment the station tuning frequency. Even so, it is desirable to keep the input frequencies to the phase detector as high as possible, because this will affect the amount of filtering needed at the phase detector output.

The lowpass filter at the detector output serves to help determine the dynamic characteristics of the loop and remove the input frequency components from the control signal. Too much filtering because of relatively low input frequencies will necessarily cause the loop to be slow, extending the time required to lock the LO onto a given station frequency. On the other hand, insufficient filtering of the unwanted phase detector products will degrade the LO phase S/N ratio. This is an obvious problem in FM, but also applies in AM for the AM stereo formats that use angle modulation of the RF carrier. The low peak deviation of the AM stereo carrier (typically less than 1 radian) means that particular attention must be paid to future AM LO designs.

To avoid the user having to remember the N number for a particular station frequency, a micro-controller IC can be used, such as the National Semiconductor COP420L-HSB. This device can store pre-selected stations in memory and provide a serial data output to the frequency synthesizer for station scanning. At the same time, another serial output from the microcontroller drives a display device giving the selected station frequency. Introduction of the micro-controller allows several features to be added to the radio, including a real-time clock with an output to the same display.

One further input to the micro-controller becomes important. In the station *search mode*, it is necessary to be able to identify when a valid station frequency has been reached and that a modulated RF carrier is present. This is called a *stop indication* and is pro-

vided by the radio signal processing circuits. A stop indication causes the micro-controller to begin an algorithm to determine whether to actually stop scanning. Typically, the micro-controller waits 10ms after incrementing the station stop frequency (10kHz in the United States) and then samples the signal stop output 10 times within the next 40ms. If none of these samples indicates that a stop signal is present, the synthesizer is incremented to the next station frequency. However, if at least one of the samples shows that a stop signal is present, the micro-controller waits another 200ms and then resamples the stop output. This procedure allows the radio RF/IF/AGC circuits to stabilize at the new tuning frequency before the scanning process is interrupted. Even so, to provide a stop output within 50ms while maintaining low THD in the detected audio output puts severe constraints on the radio AGC circuits.

The receiver environment

Despite the capability of most AM broadcast transmitters to generate an RF bandwidth in excess of ± 15kHz, the typical AM receiver today exhibits an audio bandwidth (– 3dB) of between 1.5kHz and 2.5kHz. In part, this is attributable to cost-conscious design efforts, but even so, the receiver manufacturer is restrained from building radios with a full 15kHz audio bandwidth for a number of other reasons. To see why this is the case, we must examine each stage of a modern AM radio.

The limitation to wide audio bandwidth can start right at the antenna. Depending on the radio type, automotive or home model, two kinds of antennas are used extensively: the capacitative whip antenna, for automotive; and the ferrite rod antenna, for home use. Ferrite rod antennas are popular in home and portable radios because of their relatively high sensitivity, coupled with compact size. Unfortunately, to get this sensitivity and provide adequate RF selectivity, the antenna matching circuit Q is usually high—from 80 to 100. (The RF/antenna circuit must be able to reject unwanted RF carriers spaced 455kHz above the LO frequency, which can generate a mirror or *image signal* in the IF amplifier and cause interference with the desired RF carrier located 455kHz below the LO frequency.) This simply means that the bandwidth is no more than ± 8kHz at the upper end of the band, falling to less than ± 3kHz at the lower end. Therefore, at best, the audio bandwidth is 8kHz, and at worst, only 3kHz.

The IF amplifier filter is the next stage that limits the effective audio bandwidth. Although there has been widespread introductin of ceramic ladder filters for this function, typical filter – 3dB bandwidths range from ± 2kHz to ± 5kHz. Even at this point, it appears we will be lucky to get a 2.5kHz audio bandwidth at the detector. The reason for such a relatively narrow filter bandwidth is the need for an exceptionally fast roll-off in response (steep filter slopes) in order for the radio to give satisfactory reception under a wide variety of conditions. One of the biggest reception problems is adjacent channel rejection, and the IF filter is usually the only protection against adjacent channel interference in the receiver.

Adjacent channel problems are caused by the close frequency spacing of U.S. AM broadcast transmitters. Allocations are made at 10kHz intervals and the wide propagation range of AM carrier frequencies means there is always a chance for interference. At night, sky-wave propagation multiplies the range and, therefore, the number of potentially interfering stations. The modulation components produce a background noise effect called *monkey chatter*, and an adjacent channel transmitter carrier can produce a 10kHz beat with the desired transmitter carrier. To minimize monkey chatter and

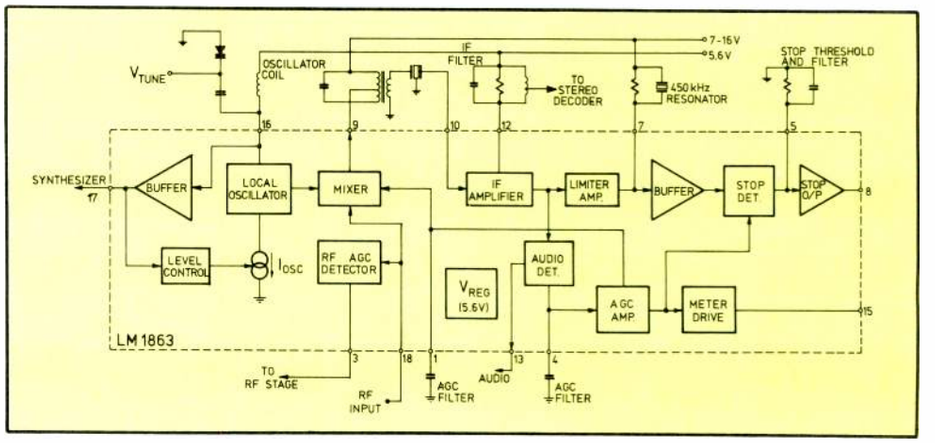

Figure 3. A design example (using the National Semiconductor LM1863) of an AM radio based on current integrated circuit technology.

avoid using a 10kHz high Q notch filter at the detector output, radio manufacturers have traditionally used narrow-band, steep-slope filters, which also help with the reception of weak, distant stations in the presence of strong, local stations.

With a ferrite rod antenna in close proximity to the rest of the radio circuits, a third limitation on audio bandwidth can occur. If products of the IF appearing at the detector output, along with the desired modulation envelope, are radiated back to the antenna, they can beat with the RF carrier to produce an audible phenomenon known as *tweet*. To prevent this, the detector stage has filters to reduce the level of IF harmonics, often starting to roll off the detector response at 3kHz.

Fortunately, circuits following the detector are not likely to be a problem. For many years, semiconductor manufacturers have been supplying monolithic audio amplifiers with bandwidths in excess of 20kHz and power output ranges from milliwatts to tens of watts.

New receiver designs

Having discussed some of the present radio design problems, we can now appreciate how a modern AM radio IC design can overcome (or at least mitigate) these limitations.

As mentioned earlier, one area in which AM has always remained a popular service is in the automobile. This is because AM has a greater satisfactory reception range and is not subject to the multipath problems of FM stereo. Because AM can offer a comparable or better service than FM in the automobile environment, it is in the automobile radio that the AM section is getting a lot of attention. This is not to say that problems do not exist—they do. In fact, an automobile radio raises problems of its own.

Similar to the ferrite rod antenna, the automotive whip antenna matching circuit often has high Q for good

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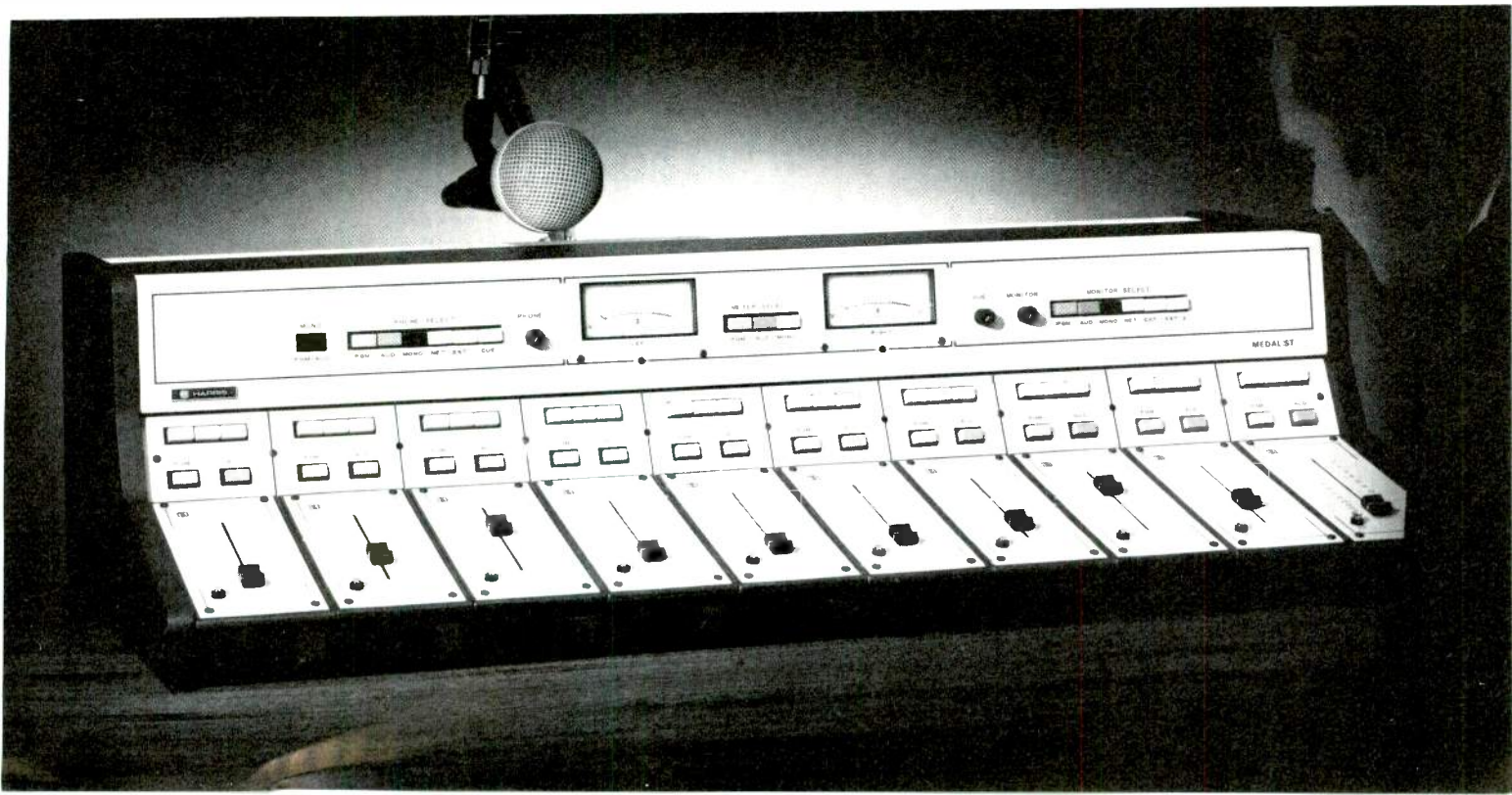
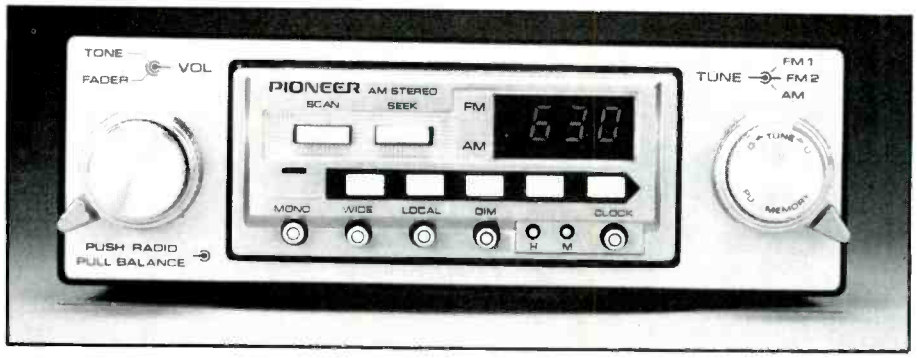
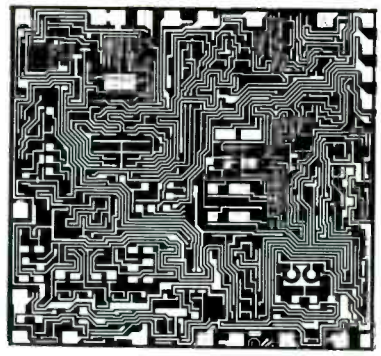




This Pioneer AM-stereo FM receiver uses the LM1981 AM stereo decoder integrated circuit manufactured by National Semiconductor.



A micro-photograph of the LM1981 AM stereo decoder chip.

sensitivity and image rejection. Unlike the ferrite rod, the whip antena with an associated coupling cable is highly capacitive and, thus, tuning the matching circuit with a varactor is impractical. Also, the signal field strength at the antenna can vary widely (or wildly) as the automobile moves around, with very strong unwanted signals simultaneously present while the radio is tuned to weaker, more distant stations. Because a tuned circuit cannot be used between the antenna and the RF input, the RF amplifier stage must be resistant to overload by strong signals.

A discrete FET RF stage is generally preferred to a bipolar integrated RF amplifier, which has a poorer overload capability, for the RF gain stage. Because this discrete stage will isolate the antenna capacitance, tuned circuits can be used to couple the signal to the mixer. (See Figure 2.)

A design example

Figure 3 shows an example of a modern IC AM receiver circuit, the LM1863. The signal level at the mixer input is detected, and above a certain threshold level the device supplies an AGC voltage to reduce the gain of the RF stage in the presence of strong signals. This is done via transistor stage Q2 (see Figure 2), which also forces FET Q1 into its resistive operating region, attenuating the antenna signal and preventing excessive modulation on varactor tuning diodes D_1 and D_2. Using two tuned circuits with an RF gain stage to compensate for insertion loss provides excellent sensitivity (2.2uV), along with better than −70dB image rejection and exceptional bandwidth (± 14kHz).

The local oscillator of the LM1863 is unusual in two respects. First, there is a feedback loop around the oscillator to control its amplitude. This is done because the tuned L/C circuit that sets the operating frequency maintains a relatively constant Q across the AM band. Because the operating frequency changes by a factor of 2:1, the load

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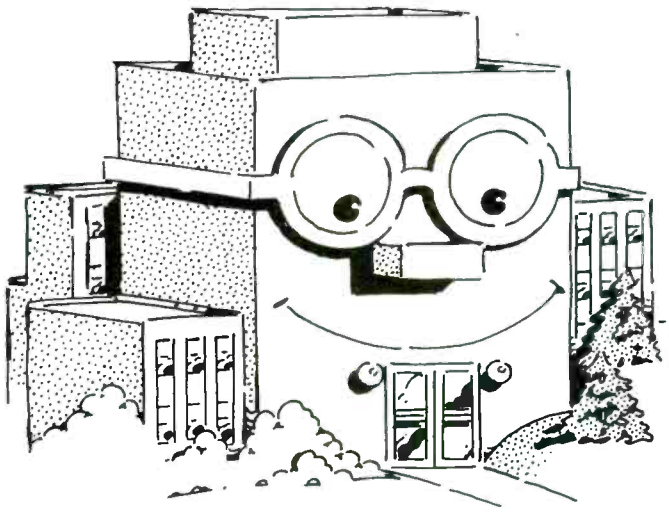

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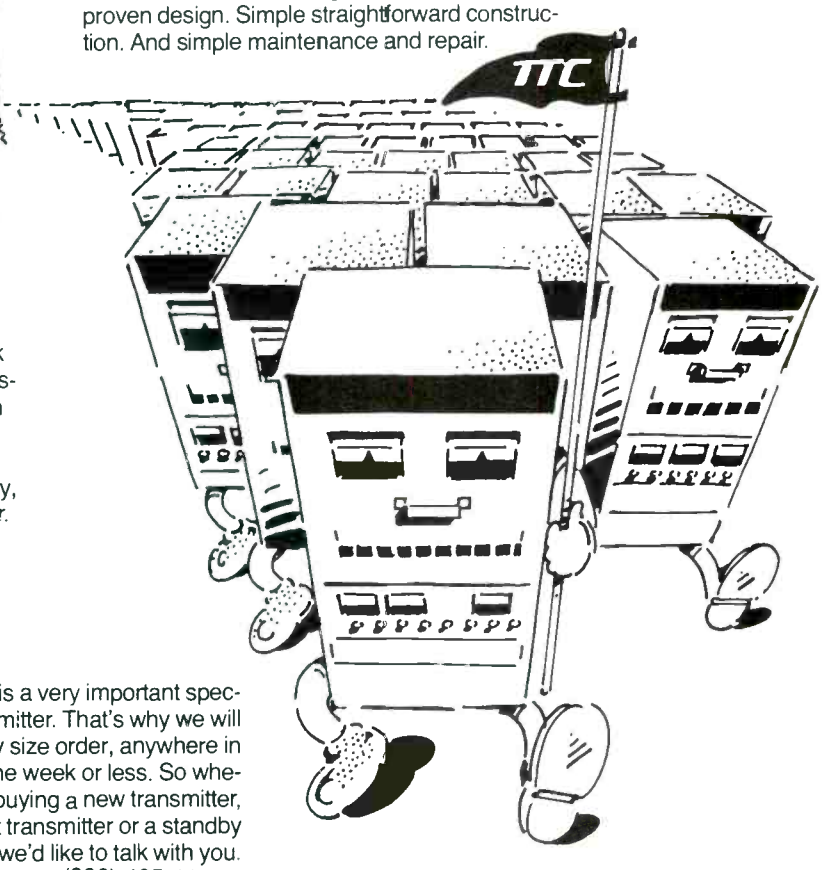

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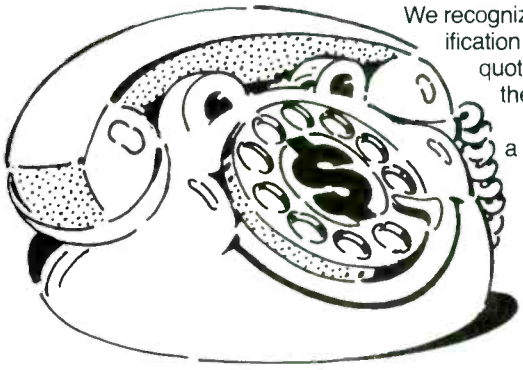

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impedance presented by this tuned circuit also changes by 2:1, with a corresponding 2:1 change in the oscillator waveform amplitude across the circuit. This amplitude change is enough to modulate the varactor diode, which is controlling the operating frequency, and would normally require a slight compensating shift in the varactor control voltage. The same control voltage is supplied to the RF tuned circuit varactors, and they would, therefore, become mistuned as the operating frequency shifted across the band. By using an amplitude-controlling feedback loop, this tracking problem is avoided.

The second, and not so obvious, difference in the LM1863 LO is that it has been designed for low phase noise operation in anticipation of the angle-modulated RF carriers for AM stereo broadcasting. The phase noise of this oscillator is better than −60dB, referenced to 1 radian peak deviation of the RF carrier, which compares favorably with the phase noise level of crystal-controlled oscillators. Unfortunately, this noise performance will be impaired by noise modulation from the varactor tuning control voltage source, putting emphasis again on good filtering in the PLL system. Finally, the LM1863 LO has a buffered output suitable for driving the PLL programmable divider chain.

Between the mixer and IF amplifier is the main IF selectivity element—a ceramic filter. A single filter is shown in the Figure 3 circuit. It is likely that the majority of radios will continue to be built with a single, relatively narrow bandwidth filter for the previously mentioned reason of interference rejection. For a high-quality receiver, a switched-filter IF amplifier can be used. A relatively narrow filter is used for nighttime reception and for listener preference on some heavily processed signals, with a wider bandwidth filter being switched in for hi-fi reception. Ceramic filter manufacturers are working on wider bandwidth filters with low passband ripple and steep filter skirts, yet these are still in the ± 6 to ± 8kHz region. Systems with bandwidths beyond this will probably be limited to a few home receivers with good antenna systems.

In a stereo receiver, the IF signal is tapped from the IF amplifier output and directed to the stereo decoder, which needs this signal in order to extract the stereo difference information. The decoder IC (LM1981, for example) has an envelope detector built in, so the on-board detector of the LM1863 can be used to generate the AGC control voltage and signal strength meter drive. The IC has up to 20dB AGC range on the mixer and IF amplifiers before gain reduction is transferred to the RF stage. This helps maintain the RF stage noise figure while the signal is weak and dominated by antenna noise. The dual AGC scheme permits an excellent 54dB overall S/N ratio with a 30% modulated carrier.

Another function provided by the LM1863 is *stop detection* for the PLL frequency synthesizer system. In order to recognize a valid station, two criteria must be met. First, a signal must actually be present on the station frequency. This is determined by feeding the IF amplifier output through a limiter stage, followed by a 450kHz tuned circuit. An inexpensive ceramic filter that can be damped with an external resistor is used to set the *window* of frequencies that are allowed through to the stop detector, thus ensuring that the proper IF signal is present. Interestingly, this can also be done by monitoring the excess phase detector output on the stereo decoder IC (LM1981), which allows scanning for stereo-only channels. The second criterion is that the signal must be strong enough to obtain a satisfactory S/N ratio. This is done by measuring the AGC voltage. The threshold level is set by an external resistor. When both criteria are met, the stop detector is activated, signaling the PLL microcontroller to stop scanning.

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One difficulty encountered with detecting signal presence is the AGC response time. If the scanning process causes the radio to tune from a very strong station to a weaker one, the AGC system must be able to increase the radio gain rapidly enough for a valid stop indication. However, if the AGC is too fast, it will begin to track the modulation envelope and cause distortion in the detected audio. To prevent this, the LM1863 uses a 2-pole AGC filter system to give fast response with low distortion—in fact, a 10X improvement in audio THD, compared to that of a conventional single-pole AGC system.

The LM1863 provides a high quality AM signal processing circuit that is designed to complement the electronic tuning systems that are becoming popular.

What next?

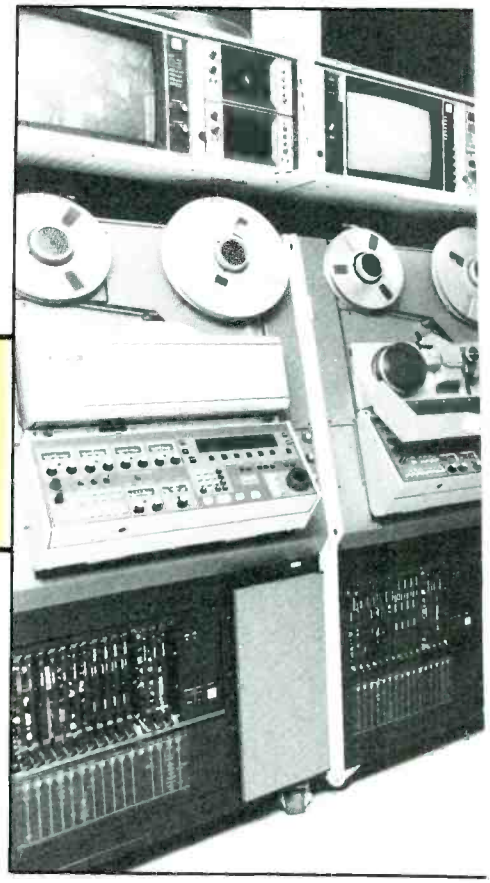
Already we have suggested that designs for increased audio bandwidth to best use the proposed AM stereo formats may not go as far as a hi-fi buff would expect. This doesn't mean improvements are unfeasible, however. Techniques to cancel interfering signals that can appear as the bandwidth is increased already exist, especially when synchronous or product AM detectors are used. These are, of course, more expensive than the common envelope detector and will undoubtedly introduce some problems of their own. However, the extensive use of product detectors in FM shows that this can be done. A more likely barrier to widespread use of such systems is the consumer's perceived value, and how much he is prepared to pay. As implied in this article, the major developments are currently related to auto radio, rather than home radio, and this will be the area to watch.

There is one problem the receiver manufacturer cannot solve alone, and that is compatibility. Any effort to produce a high-quality, wide audio bandwidth AM receiver will result in a certain amount of customer dissatisfaction, because on some stations it will sound strident or *screechy*. This is because many broadcasters are employing signal processing to enhance the sound of their stations, usually involving a lot of compression and emphasis of the mid to high frequencies.

It is hard to explain why a customer should pay more for a radio that, to him, doesn't sound as good. There is equally little incentive for the broadcaster to reduce his signal processing, because then his station will sound "dull" and "lifeless" on the many millions of receivers already in the marketplace. High-quality AM won't happen overnight. |:-)))|

Field report:

Ampex VPR-3



By Joseph Mahedy, chief engineer, Modern Telecommunications, New York

My first exposure to 1-inch helical VTRs came at a small UHF station about 12 years ago. Having worked on quad machines, I was very pessimistic, as were other engineers, of this mechanical toy they called a *broadcast VTR*. Many hours were spent in front of the VR-7900, tweeking its servos and TBC, hoping they would stay locked as it played back on the air. If someone had told me that one day I would see *1-inch* as a broadcast standard, with full-color pictures from −1x play to +3x play speed, I would have laughed. In the 12 years since then, however, many advancements have been made in 1-inch technology and time base correctors.

Type-A format had many drawbacks, including non-compatability with other manufacturers of 1-inch VTRs. Type B, which gives superior recordings, never caught on in the United States, probably because of its segmented helical format. Finally, SMPTE Type C was adopted, and all manufacturers designed their VTRs according to that standard, creating compatability. In the last four years, we have seen several generations of Type C, leading up to the VPR-3.

Looking deceptively like a videotape machine, the VPR-3 is actually a computer, disguised as a tape machine. The machine does not replace the VPR-2B, or the VPR-80; it does much more.

Unique features

The single most impressive feature of the VPR-3 is superior tape handling. We all know of problems in using spot reels on most 1-inch transports and the inability of most VTRs to handle 2- and 3-hour reels or not doing frame-by-frame editing for fear of tape stretch or shredding. These problems are eliminated with the VPR-3.

Search-to-cue offers the operator the ability to store 100 cue points on a tape. This is especially useful in live sports, where you need multiple cue points. At MTI we have used this feature in lieu of a still store device, which stores 100 different still frames. Although it is not random access, the search-to-cue is fast, accurate and useful for a number of different needs.

The VTR features an SC/HI meter that even inexperienced operators can

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Bandwidth	Flat to 4.2 MHz ± 0.5 dB −3 dB at 5.0 MHz	Flat to 5.0 MHz ± 0.5 dB −3 dB at 6.0 MHz
S/N (Rhode & Schwarz unweighted with bandpass filter) using TBC-3	−46 dB peak-to-peak video to RMS noise on interchange basis	−43 dB peak-to-peak video to RMS noise on interchange basis
LF Linearity	2% blanking to white (maximum)	2% blanking to white (maximum)
Differential Gain	4% blanking to white (maximum)	4% blanking to white (maximum)
Differential Phase (40 IEEE units of subcarrier through TBC-3)	4° at 3.58 MHz off-tape (max)	4° at 4.43 MHz off-tape (max)
Chrominance/Luminance Delay	20 n sec (maximum)	25 n sec (maximum)
2T $\sin^2$ Pulse & Bar	1% K-factor maximum	1% K-factor maximum
Moire	−40 dB color bars 75% amplitude 3.58 MHz subcarrier	−36 dB color bars 75% amplitude 4.43 MHz subcarrier
GENERAL		
Record Time	190 minutes nominal, 9200 feet of tape on 14" reel	
Shuttle Time	less than 72 seconds for 60 minute tape, 3.6 minutes for a 3 hour tape	
Tape-Timer Accuracy (Control track updated)	±0.1 Field with continuous control track	
Tape Speed	244 ± 0.5 mm/sec 9.606 ± 0.02 in/sec	239.8 ± 0.5 mm/sec 9.44 ± 0.02 in/sec
Video Writing Speed	1009 in/sec nominal	842 in/sec nominal
FM Carrier Frequencies	7.9 MHz blanking 10.0 MHz peak white	7.68 MHz blanking 8.9 MHz peak white
Audio Equalization	15 microseconds 3180 microseconds	15 microseconds
Lock-up time from Ready Mode	20 milliseconds	Lock-up time from Scanner Off 3 seconds

Selected manufacturer's specifications.

Author Mahedy demonstrates the VPR-3 tape-handling system to Phil Mancino, vice president of engineering, MT.

A close-up view (right) of the menu display, soft keys and primary transport controls.

Along with this console configuration (right), the VPR-3 is available in a table-top format.

use. By centering the needle on the SC/HI meter, virtually all H-shifts will be eliminated.

The audio system is designed specifically with the operator in mind. I/O ports for output processing make interfacing a noise-reduction or time-compression/expansion system as easy as plugging the external equipment into the ports. Also, full-stereo monitoring, an audio confidence head in record and the capability of mixing channels 1 and 2 at the output are included.

One engineering feature, *auto set-up*, will automatically optimize three different tape stocks and store the data in memory. There is an auto tach phase and the capability to put artificial sync pulses on a non-sync recording. The operator may change almost any parameter via a menu. Diagnostics are planted to troubleshoot problems down to a component level.

Technical evaluation

Often when a newly purchased machine arrives, it is not working up to specifications, or not working at all. Having recently received our fourth VPR-3, I can honestly say that all four worked out of the box. No repairs were made, nor any adjustments performed before the VTRs went on-line within hours after they had arrived.

On inspecting the machines, I found I could gain access quickly to virtually any area. I found high-quality parts throughout the machine on well-laid out printed circuit boards. Having several of the first production machines after ABC, I found the documentation, although preliminary, to be 95% complete, with only some parts lists incomplete.

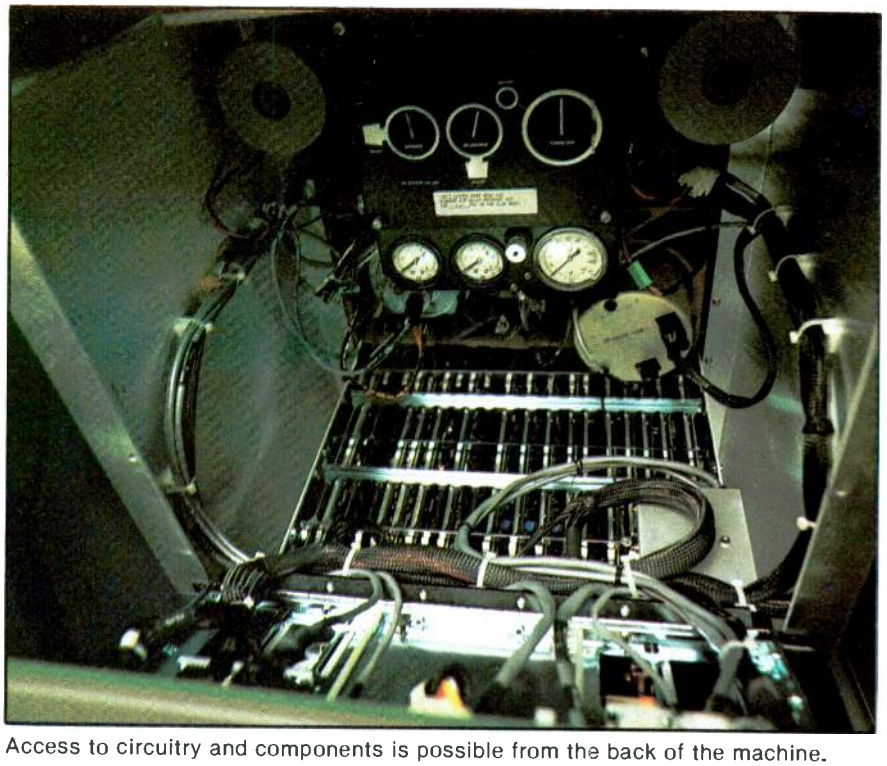
Elimination of most of the mechanical assemblies makes the transport less prone to failure and should drastically reduce preventative maintenance costs.

The video input stages have clamping, a selectable low-pass filter (for users with RF problems) and an input cable equalizer to peak up input signals that suffer from high-frequency roll-off. This is handy for any facility. Also included is a calibration pulse to aid proper adjustment of input and demod levels.

The most significant evaluation performed was trying to fool the tape handling system into destroying a tape. The battle was lost. Any reel size can be loaded and the transport will handle it without fear of tape stretch or run-off. Several air guides on the transport eliminate friction, which causes the tape to stretch. A vacuum capstan replaces pinch rollers to give accurate control of the tape in any mode of operation. The continuous use of the capstan permits a coupling servo to monitor both tension-arm positions and adjust the capstan acceleration in conjunction with the reel servos.

The heart of the VPR-3 is the control system. There are two Z-80 microprocessors; one for system control, the second for I/O functions. A third Z-80 is used on an optional time code reader/generator card. We have experienced no problems with the micros.

The auto set-up is remarkable and saves much engineering time by allowing the operator to set up bias



Access to circuitry and components is possible from the back of the machine.

levels easily. By selecting auto set-up mode on the menu, the VTR automatically goes into a sequence to optimize record currents, bias currents, equalization and predistortion for all three audio channels. It then adjusts video record bias for peak RF. You can see what is happening during the optimization mode by looking at a bar graph on the menu display. I had my audio engineer check all the levels that the computer had set. He found that all parameters were correct and accurate. Memory in the computer allows storing and recalling any one of three different tape stock parameters, so the optimization procedure does not have to occur. Of course, at any time you can manually optimize the machine as well.

The auto-scan tracking (AST) system on the VPR-3 is practically the same as the one on the VPR-28 at first glance, but some improvements have been made. A high-frequency tach on the vacuum capstan sends a reference to the AST servo to give faster lock up than on the older machine. Additionally, electronics in the TBC will give locked pictures in shuttle mode (50x play speed). The AST system and TBC work very well from – 1x to + 3x play speed.

I am disappointed in what Ampex decided to use as the TBC. The TBC works very well, but with the most sophisticated 1-inch VTR in existence today, they did little in the way of the TBC. I think Ampex should have offered somewhat better than an 8-bit, 3x subcarrier unit. The TBC-3 seems to be an updated TBC-28 with some extra features.

The signal system, as a whole, is

LEADERSHIP IN VIDEO EDITING

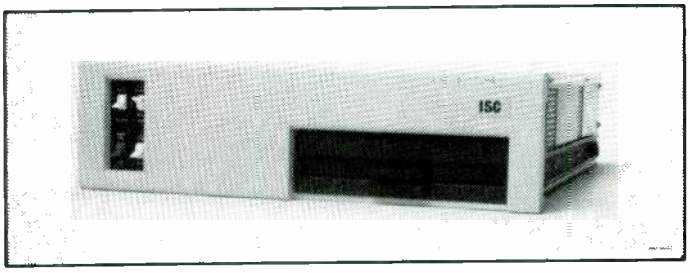
ISC

51

The top of the line System 51 is without reservations, an editing system unmatched in features, performance and reliability. This system was specifically designed to perform flawlessly for the profession's best in their most demanding applications. The interfacing possibilities with the industry's most complex equipment is virtually limitless. The system features huge memory capacity, 16 ports for unrestricted control, and the most powerful software features in the industry.

41

The System 41, a high performance on-line editing system, is designed for the most demanding applications. This system has a faster CPU than Systems 21 or 31. It also has features which make variable-speed VTR control and editing precise and easy. System 41 software and hardware features permit full exploration of the professional's creativity.



31

An editing system designed to serve both on-line and off-line applications. The System 31 is an editing system of unusual functional dimension. With eight I/O ports, and exceptional features such as Super-Slave and Cue Ahead, the System 31 provides exceptional performance at an outstanding performance/cost ratio.

21

The System 21 is especially efficient as an off-line editing system using cassette VTRs. Compact construction helps minimize installation costs and accessory equipment requirements. Yet the System 21 has superior edit list display, storage and management capabilities.

SYSTEM 51 FEATURES

- Fast DEC 11/23 CPU
- Memory Management
- 256 K Bytes of Memory
- 10 M Byte Hard Disk Drive
- 0.5 M Byte Floppy Disk Drive
- Distributed Processing Control
- 16 Control Ports for VTRs and Switchers
- 4 Accessory Ports
- 132 Column Wide Form Printer
- Jogger Motion Control
- DEC RT/11 Operating System
- Exclusive Super Edit
- Assignable VTRs, Video, Audio
- Video, Dual Audio Editing
- Edit List Display, Input-Output
- Multiple Edit List Disk Files
- Color-Lock Sync Interface
- Single-Keystroke Dissolve
- Multiple-Record, Synchronous Replay
- Super-Slave
  - Slave 1 to 6 VTRs
  - Easy Slave Setup
  - Positive Offset Lock
  - Easy Offset Change
  - Slaves in Edit List
- Help File
- Auto-Track Dissolve Setup, Anywhere in Edit List
- Match Any Edit, Both Sides of Dissolves
- Remote Terminal Emulator
- Auto-Clean Removes Overlaps
- Preview, Edit Functions
- Print Spooling
- Sequential, Checkerboard, and Cue-Ahead Auto-Assembly
- Replay Any Edits, with Auto-Scroll
- Six-Character Alpha-Numeric Reel ID
- Notes in the Edit List, with Individual Add, Delete
- Event Number to 9999
- Powerful Edit List Management With/Without Ripple
  - Insert
  - Delete Groups
  - Recall
  - Replace
  - Move Groups
  - Shift Groups
- User-Bit Time Reference
- Real-Time Edit Mode
- 10 Macro Functions, with Nesting
- Three Freeze Modes
- Film Package
  - Direct Film Entry
  - Slate Calculation
  - 35/16 mm
  - Centered Dissolve
- Match to Freeze, Variable-Speed
- VTR Speedometer
- Fill Mode Computes VTR Speed
- Unique Timed-Action Modes
  - XGPI
  - Expanded Switcher Control
  - Log in Edit List
  - Precise Programmed Motion

ISC—the strong, quiet company setting the pace.

INTERACTIVE SYSTEMS COMPANY
5601 N. Broadway, Mesa Reservoir Rd.
Boulder, CO USA 80302 (303) 447-2013
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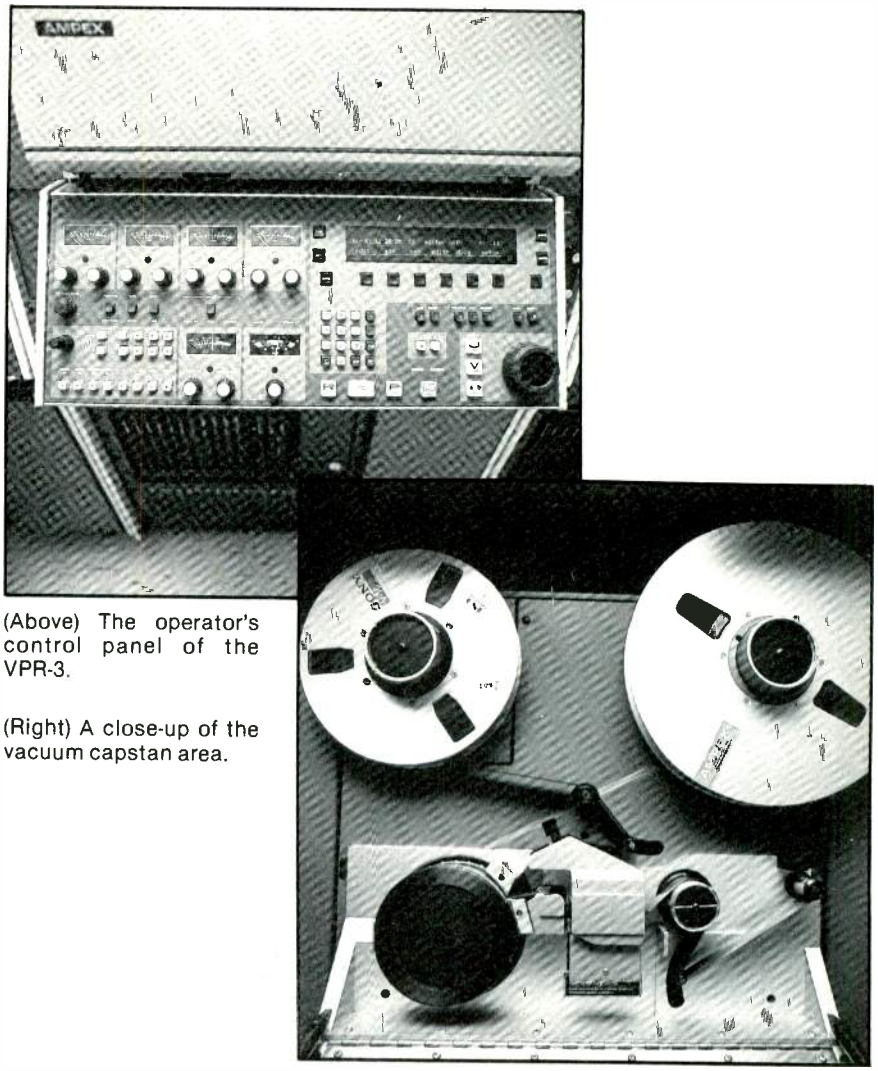


(Above) The operator's control panel of the VPR-3.

(Right) A close-up of the vacuum capstan area.

very similar to earlier VPR designs, so your engineers should feel right at home, although there will be data buses almost anywhere you look.

The software is the brains of the machine. Ampex has recently released version 2.0 software to eliminate some minor bugs in version 1.1. Also changed was a software command for audio muting. In the earlier software, in all modes except normal play speed, audio would be muted, making it impossible to use a time compression/expansion system. This has been corrected in version 2.0, which seems to be trouble free.

Operational evaluation

Most of the operator's interface is done through a menu and six *soft keys*. The soft keys are used to create dialogue with the computer in the VPR-3 in order to do a number of varied operations. From the menu, you can select sub-menus, depending on your choice of edit, varispeed, search-to-cue, diagnostics or set up. It is very difficult at first to remember where all the software switches are, but the more it's used, the simpler it becomes. The menu gives the operator all pertinent information needed to do a specific task, whether it is search-to-cue, tape time or time code, varispeed percentages of real time speed, selection of color frame, and so on. To be competent on the machine, you must *know* and *understand* the menu.

The operator's panel is well-laid out and can be conveniently positioned at an angle or practically flat. On it, the audio system controls are planned for the operator. Separate record and playback audio levels include a unit/variable switch. Audio has full stereo capabilities and any combination of monitoring methods can be accomplished.

There are separate video input and demod level controls on the front panel, along with a *calibration pulse enable* to set the levels. Also located on the panel is an SC/H meter, which aids in setting VTR for proper SC/H phase.

A numeric key pad is used to enter edit numbers into the menu and may also be used for time code calculations. Below the menu display are standard edit and preview switches, and below that are normal machine controls.

CHRISTIE ELECTRIC'S COMPREHENSIVE INDUSTRY BUYER'S GUIDE FOR REFLEX® -20 PORTABLE POWER

EQUIPMENT		REFLEX-20 BATTERY PACKS & POWER SUPPLY										REFLEX-20 CHARGERS & SEQUENCER							
		CAMERA PACK			MULTI-PURPOSE HIP PACK		BATTERY-TO-EQUIP CABLE		INTERNAL PACK	APPROX. RUN TIME	DC POWER SUPPLY	SINGLE CHANNEL	SMT CHARGER* CABLE	DUAL CHANNEL			DM CHARGE CABLE	RS1A SEQUENCER	SLOW CHARGER*
		Battery	Christie Mount	Battery for Key Slot Mount	Battery	Belt	One Battery	Two Battery	Battery	Minutes	Battery Eliminator*	115/230V 50/60HZ		115V 50/60Hz	230V 50/60Hz	115/230V 50/60Hz		115/230V 50/60Hz	115/230V 50/60Hz
AMPEX	BCC-14	—	—	—	HR1	B-	BE18	BBE18	—	100	—	SMT	CSB8	DMBZ1	DMBZ2	DMCZ	CBB8	RS1A	TC1
	BCC-20	KR2	KA23	KS12	—	—	—	—	—	105	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	VPR-20	—	—	—	—	—	—	—	11BB40A3†	60	—	—	—	"	"	"	CB9	"	—
ARRI	16BL	—	—	—	HR1	B-	BE21	—	—	—	—	SMT	CSB8	"	"	"	CBB8	"	TC1
	16SR	—	—	—	HR1	B-	BE20	BBE20	—	—	—	SMT	CSB8	"	"	"	CBB8	"	TC1
	16ST	—	—	—	HR1	B-	BE20	BBE20	—	—	—	SMT	CSB8	"	"	"	CBB8	"	TC1
	35BL	—	—	—	HR1	B-	BE20	BBE20	—	—	—	SMT	CSB8	"	"	"	CBB8	"	TC1
BOSCH	KCA90	—	—	—	HR2	B-	BE16	BBE16	—	—	—	—	—	"	"	"	CB5	"	TC1
HITACHI	FP1020	—	—	—	HR1	B-	BE26	—	—	110	—	SMT	CSB8	"	"	"	CBB8	"	TC1
	FP10	KR2	KA28	KS12	—	—	—	—	—	150	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	FP21	KR2	KA30	KS12	—	—	—	—	—	110	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	FP22	KR2	KA30	KS12	—	—	—	—	—	100	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	SK81	KR2	KA28	KS12	—	—	—	—	—	115	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	—
	SK90	—	—	—	HR1	B-	BE26	—	—	75	—	SMT	CSB8	"	"	"	CBB8	"	TC1
	SK91	KR2	KA26	KS12	—	—	—	—	—	110	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
IKEGAMI	HL-77	—	—	—	HR2	B-	BE8	BBE8	—	60	—	—	—	"	"	"	CB5	"	TC1
	HL-79(D)	KR2	KA24	KS12	—	—	—	—	—	100	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	HL-83	KR2	KA26	KS12	—	—	—	—	—	—	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	ITC-350	KR2	KA25	KS12	—	—	—	—	—	105	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	ITC-730	KR2	KA24	KS12	—	—	—	—	—	—	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
JVC	CR4400U	—	—	—	—	—	—	—	ER5	90	—	—	—	"	"	"	CBB1	"	—
	KY2700	KR1	KA15	KS11	—	—	—	—	—	135	KS1	—	—	"	"	"	CBB14/24*	"	TC1
PANASONIC	9400	—	—	—	—	—	—	—	ER5	90	—	—	—	"	"	"	CBB1	"	—
PHILIPS	LDK-14	—	—	—	HR1	B-	BE18	BBE18	—	100	—	SMT	CSB8	"	"	"	CBB8	"	TC1
	Video-80	—	—	—	2 of HR3	B-	—	BE22*	—	100	—	—	—	"	"	"	CBB12	"	TC1
RCA	TK-76(B&C)	KR2	KA20	KS12	—	—	—	—	—	60	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	TK-76(A,B,C)	—	—	—	HR1	B-	BE3	BBE3	—	60	—	SMT	CSB8	"	"	"	CBB8	"	TC1
	TK-86	KR2	KA21	KS12	—	—	—	—	—	75	KS1	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	HR1020	—	—	—	—	—	—	—	ER5	90	—	—	—	"	"	"	CBB1	"	—
	TH-50	—	—	—	—	—	—	—	2 of ER6	90	—	—	—	"	"	"	CBB11	"	TC1
SHARP	XC-700	KR2	KA27	KS12	—	—	—	—	—	100	KS	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	XC-800	KR2	KA27	KS12	—	—	—	—	—	—	KS	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
SONY	BVH-500	—	—	—	—	—	—	—	2 of ER6	90	—	—	—	"	"	"	CBB11	"	TC1
	BVP-300	KR2	KA22	KS12	—	—	—	—	—	145	KS	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	BVP-330	KR2	KA22	KS12	—	—	—	—	—	145	KS	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	BVU-50	—	—	—	—	—	—	—	ER6	225	—	SMT	Included	"	"	"	CBB11	"	TC1
	BVU-110	—	—	—	—	—	—	—	ER6	215	—	SMT	Included	"	"	"	CBB11	"	TC1
	DXC-1800	—	—	—	—	—	—	—	ER8	120	—	—	—	"	"	"	CBB1	"	—
	DXC-6000	—	—	—	—	—	—	—	ER8	70	—	—	—	"	"	"	CBB1	"	—
	VO-4800	—	—	—	—	—	—	—	ER8	145	—	—	—	"	"	"	CBB1	"	—
THOMSON	MC-601	KR2	KA22	KS12	—	—	—	—	—	145	KS	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
	MC-602	—	—	—	HR1	B-	BE11	BBE11	—	100	—	SMT	CSB8	"	"	"	CBB8	"	TC1
	MC-301	KR1	KA15	KS11	—	—	—	—	—	—	KS	—	—	"	"	"	CBB14/24*	"	TC1
TOSHIBA	PK60	KR2	KA26	KS12	—	—	—	—	—	145	KS	SMT	(CSB12)*	"	"	"	CBB16/26*	"	TC1
30V, 250W Lights		—	—	—	2 of HR1	B-	—	BE7**	—	20	—	—	—	"	"	"	CBB8	"	TC1

Battery Packs
Two Christie "HR" packs can be operated in parallel on one belt using dual battery-to equipment cable, giving approx. 2.2 times usual run time.

Belts
B0-31"-39"
B1-35"-43"
B2-39"-47"
B3-43"-51"

*Connects 2 batteries for ± 12.5V
**Connects 2 15V batteries in series

KS1 fits Christie battery pack mount.

*(For KS12 only) KR2 included.

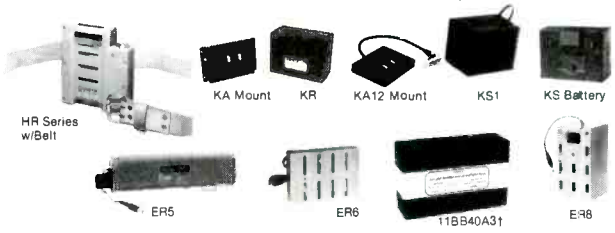
*CBB14 & CBB16 are for KR batteries. CBB24 & CBB26 are for KS batteries.

Note: CB- are straight cables; CBB- are "Y" cables.

†Available through Ampex Corp.

Specifications:

Model:	Nom Voltage:	Approx. Weight:	Approx. Dimensions:
ER5	12	2 lbs. 8 oz.	2-5/8 x 10 x 2-3/8"
ER6	12.5	3 lbs. 8 oz.	6-5/8 x 4-3/4 x 1-5/16"
ER8	12	2 lbs. 7 oz.	2-3/4 x 5 x 2-3/4"
HR1	15	5 lbs. 8 oz.	7-1/4 x 8 x 2"
HR2	±7.5	5 lbs. 8 oz.	7-1/4 x 8 x 2"
HR3	12.5	4 lbs. 8 oz.	7-1/4 x 8 x 2"
KR1	13.75	4 lbs. 3 oz.	5-1/2 x 4-1/2 x 2-3/4"
KR2	15	4 lbs. 5 oz.	5-1/2 x 4-1/2 x 2-3/4"
KS11	13.75	4 lbs. 1 oz.	5-1/2 x 4-1/2 x 2-3/4"
KS12	15	4 lbs. 3 oz.	5-1/2 x 4-1/2 x 2-3/4"
11BB40A3	13.7	7 lbs. 14 oz.	8-1/4 x 5-3/8 x 2-7/8"
KS1	N/A	3 lbs.	4-1/4 x 5-1/2 x 4-1/2"




"SMT" Charger


"D" Charger

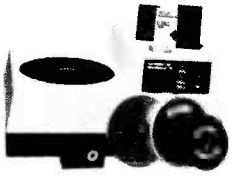
"SMT" - Single Channel
Will recharge one ER6, KR2, HR1***, or KS12*** battery packs in less than 20 minutes (unless battery is too hot at start of charge).
15 lbs.
9⅜ x 8½ x 11⅛"
***Requires CSB8 for HR1. CSB12 for KS12 batteries.

"DM" - Dual Channel, Multi-Purpose
Will charge any two similar ReFLEX-20 batteries above (switching for operation with different Christie batteries is automatic). This is also the only Christie ReFLEX-20 charger series that can be used with RS1A sequencer.
21-25 lbs.
9⅜ x 8½ x 11⅛"

TC1 Timed Slow Charger
Will recharge ER6, HR1, HR2, KR1, KR2, KS11, KS12. Charge in 14-16 hours. 115/230V, 50/60Hz.
20 oz.
4½ x 2½ x 1¼"
excluding wall-mount transformer.

RS1A Sequencer
The Sequencer model RS1A will charge up to 8 intermixed ReFLEX-20 batteries automatically in sequence in less than 4 hours. The Sequencer must be used together with DMB (115V, 60Hz), DMBZ1 (115V, 50/60Hz), or DMBZ2 (230V, 50/60Hz) only.
11 lbs. 8 oz.
10¼ x 5¼ x 9⅜"

MAXERASE-16
BULK VIDEO/AUDIO TAPE DEGAUSSER
A 30-second one pass total erasure of all high coercivity video tape formats and sizes.



The MaxErase-16 (Model ME-16) with its advanced design is the most powerful professional degaussing machine on the market today. It makes use of a patented high-power (equivalent flux of over 16 kilowatts) assembly composed of magnetically coupled upper and lower cores, assuring totall erasure of any video tape.

There are no other degaussing machines currently available which: (1) come even close to the magnetic flux levels generated; (2) direct almost all of the degaussing flux through the tape; (3) simultaneously rotate the tape reel or cassette while passing it linearly through the magnetic field preventing the "spoking" associated with machines which do not rotate the tapes; (4) move through the magnetic field while rotating in one direction on the way in and again through the magnetic field on the way out while rotating in the opposite direction; and (5) do all this in one pass, automatically, in about 30 seconds.

HANDLES ALL FORMATS/SIZES
The MaxErase-16 is the only automatic degausser capable of being quickly adjusted to accommodate maximum degaussing fields for all widths of audio, computer, video, and instrumentation tape from one-fourth inch up to 2.6 inches and any tape reel size up to 16 inches in diameter. It automat cally handles all magnetic tape formats — reels, cassettes, cartridges and discs. For even faster degaussing, on smaller formats and sizes, several tapes can be erased at once by the MaxErase-16.

For Equipment not listed, contact:

SINCE 1929
CHRISTIE
ELECTRIC CORP.
20665 Manhattan Place, Torrance, California 90501 U.S.A.
(213) 320-0808, TWX 910-349-6260, **(800) 421-2955**

Circle (124) on Reply Card

The VPR-3 has two serial remote ports to communicate to external controllers. In MTI's configuration, port 1 interfaces to an ISC editing system, while port 2 is used to control another VPR-3, in an editec mode. It is useful to have the control panel of the record machine controlling the playback machine as well.

Having worked with all types of C-format machines, I find the VPR-3 is the easiest to thread. The first few times it was difficult, because there is no threading diagram on the machine. The take-up reel can be either A-wind or B-wind, depending on the polarity of a jumper, located near the lower right of the take-up reel.

On the TBC, the video, black and chroma phase adjustments use control knobs, but the H phase and subcarrier phase are still screwdriver adjustments. Control knobs for the two functions would save a good deal of time.

A problem I have with the VPR-3 is not being able to see E/E easily. For E/E mode through the machine, you must shut down the scanner. I find this to be a hindrance, and it is a condition I hope they correct in the future.

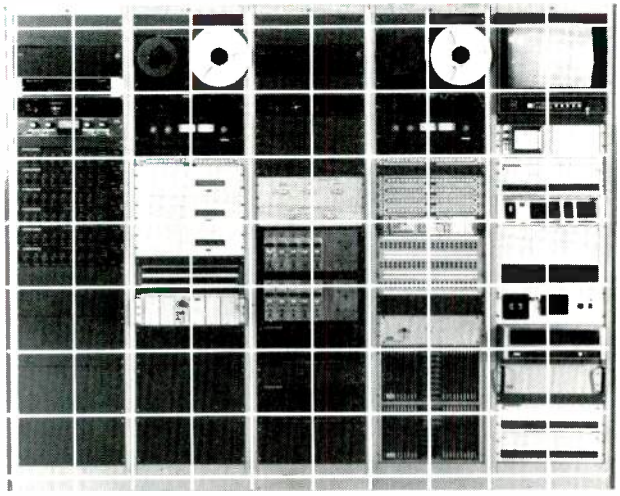
Edit interfacing and RS-422 serial remote

Although ABC had several ISC editing systems married to the VPR-3s for the '84 winter Olympics, MTI was the first teleproduction house with a VPR-3 editing system. Chuck Heuer, director of engineering at MTI, did the actual interfacing.

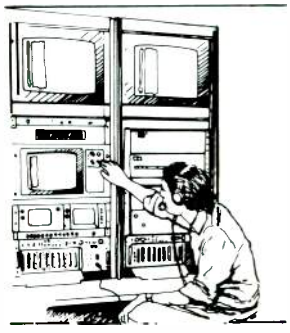
"At a physical level, interfacing is simple (RS-422)," Heuer said. "At a language level, there were a few hitches. Ampex's continuing evolution of software, a later revision than ABC's, had become slightly incompatible with the ISC editing software. ISC quickly modified its program to run with the new revision of VPR-3 software so there would be good communication."

Another hitch Heuer found was a definite time delay between when the command was given by the external controller to when it was actually completed. For example, using an external editor, the machine cannot make an edit of less than four frames. This is because of the time it takes for the command to pass through the two Z-80s to actually complete the command. Heuer explained, "The editor in the VPR-3, in fact, can do single field editing, but this cannot be done by the ISC editor at this time. While it is possible to avoid this 4-frame problem by sending the machine an out time as a deferred event, this is a trade-off introducing other operational problems

To Totally Appreciate A Video, Audio/Visual or Teleconferencing Communications System Created By Avtec, You Have To Take It Apart.



Whether it's a conference room, a training center, a video studio or an audio/visual center, to fully appreciate the thought and care that went into a total communications system created by Avtec, you have to take it apart. And when you do, you'll begin to appreciate why Avtec has been acknowledged as a worldwide leader in total communications systems.



Design

Avtec designers begin a system at the very beginning. They will work with you, your architect and/or your communications consultant during initial planning. They'll study your requirements and provide all of those little details that ultimately lead to a system's successful operation.

Engineering

Avtec's engineering department is comprised of dedicated, talented professionals. Together, they control every facet of every system designed by Avtec. They'll consider the designer's concepts and translate those concepts into the technology a system specifically calls for.

Procurement

Avtec considers every communications system individually. We realize each has a specific purpose. We keep in mind the client's specific requirements, so we select and procure all system components on the basis of the best available technology and technical compatability.

Fabrication

Avtec procured equipment is tested individually as well as a total system and retested to make certain it meets our client's requirements and Avtec's demanding standards. Enclosures, consoles and alike are fabricated and finished and the system's components are assembled and shipped to the installation site.

Once the system is on site, Avtec personnel test every function. When we're absolutely certain the system is performing as it should, only then will we approve it for operation.

Documentation And Training

We don't consider our job to be over until our clients fully understand how to operate their systems. So we document every piece of hardware and software. Avtec engineers will remain at the installation as long as necessary to train all client personnel and we'll return to the site to repeat training sessions on an as needed basis.

Maintenance

If you appreciate the fact that during the life of any communications system problems sometimes arise, you'll appreciate Avtec service. Avtec's service group is available virtually anytime, anywhere in the world to solve problems quickly, efficiently and professionally.

AVTEC In Total

Each individual part of any Avtec communications system can be considered a specialty. The fact that Avtec can and does have proven expertise in each of these specialties, has established Avtec as a premier company in video, audio/visual and teleconferencing communications systems.

So if you are considering creating parts of a communications system or a total system, consider Avtec—the total company for total communications systems.

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Circle (127) on Reply Card

to the editorial operation." According to Heuer, the parallel port on the VPR-3 is limited and provides only the basic machine controls. Otherwise, the RS-422 ports on the machine do work well communicating serially.

It should be noted that LEDs on the control board indicate whether serial data is present.

Pros and cons

A list of various features shows how the engineering and operational staff at MTI votes for the VPR-3.

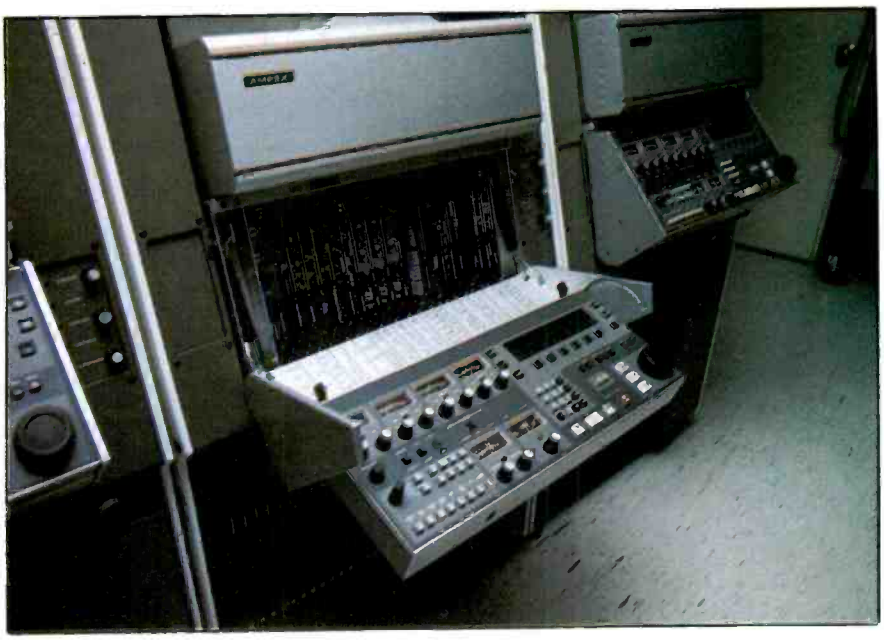
Engineering Pros

- Very few mechanical parts, reducing replacement part costs and preventive maintenance costs.
- Diagnostics make troubleshooting easier and faster.
- Software can be easily upgraded.

Operational Pros

- Tape handling is best.
- Ability to control the variables in the machine, via the menu.
- Very fast search-to-cue.
- Improved monitoring.
- Excellent audio system.
- Under external computer control with the ISC system, the ability to use job and slo-mo eliminate the need for VITC.

From the ISC editing controller, MTI's Bob Lefcovich handles four VPR-3 machines.



The control panel folds down for easy access to circuitry.

Engineering Cons
- Engineers will need digital background to troubleshoot some of the circuitry.
- Limited parallel interface.
- TBC shortcomings.

Operational Cons
- Very difficult to learn at first.
- Several functions not easy to access.
- Shuttle speed is inhumanly fast.
- E/E is not easily accomplished.
- Machine should have separate unity/variable switches instead of one master.
- When the VPR is in shuttle, operators wearing a tie or scarf have the real danger that it can get caught in the reel.

Conclusion

I have just touched the surface of the VPR-3. There are many subtle improvements in the design of the machine that you will have to see for yourself. The Ampex VPR-3 passes its published specifications with flying colors. We at MTI feel the VPR-3 outperforms any 1-inch videotape recorder on the market today. The designers should be very proud of the product for its unique engineering and operational designs.

Editor's note:

The field report is an exclusive **BE** feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting firm. The intent is for equipment to be tested on-site. The author is at liberty to discuss his research with industry leaders and to visit other broadcasters and/or the manufacturer to track down pertinent facts.

In each field report, the author is free to discuss the full applicability of the equipment to broadcasting, including personal opinions on good features and serious limitations, if any.

In essence, these field reports are prepared *by* the industry *for* the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author, if support is requested in some area.

It is the responsibility of **Broadcast Engineering** to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement by **Broadcast Engineering** for or against a product.

For more information on the Ampex VPR-3, contact Ampex Corporation, 401 Broadway, Redwood City, CA 94063.

Field report:

TASCAM 122-B cassette recorder

By Brad Dick, director of engineering, KANU/KFKU Radio, Lawrence, KS

The addition of a new cassette recorder to a broadcast station is usually nothing to shout about. With more than 150 cassette recorders on the market now, the differences between them can't be all that great—right? Wrong!

Figure 1. (Left) A close-up of the 122-B front panel is shown. Note the front-panel bias adjustments below the level-control knobs and the operating-mode switches on the right side of the panel.

Figure 2. (Below) The front panel controls of the TASCAM 122-B studio cassette recorder/reproducer.

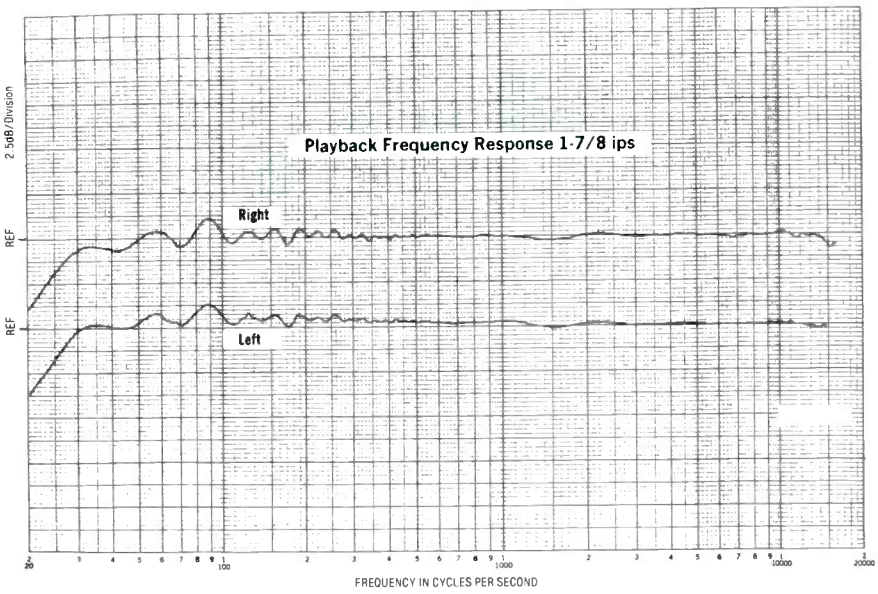


Figure 3. Playback frequency response of the tape deck at 1⅞ ips.

KANU recently had the opportunity to evaluate the new TASCAM 122-B cassette recorder. This particular unit should not be confused with the TASCAM 122, which is the consumer version. The 122-B is a professional-grade cassette recorder with full XLR connector and broadcast-level compatibility.

At first glance, one doesn't notice much difference between the 122 and the 122-B. In fact, some vendors apparently have not heard about the 122-B. One set of bids issued for three TASCAM 122-Bs showed eight vendors agreeing to supply the 122, yet not one bid for the 122-B. Some bidders noted that an XLR-type cassette recorder was not available. Through the cooperation of David Oren, marketing representative of TASCAM, we were able to obtain one of the new units for evaluation.

This station had been using two of the most expensive cassette machines for several years. One persistent problem with these machines had been the capstan pressure roller tension. Despite constant adjustment, cassettes regularly were being damaged by the machine.

One significant difference between the machines we had and the TASCAM 122-B is the single-capstan drive mechanism. The TASCAM uses the more common single-capstan system. This type of drive has proved over time not only to be more reliable than dual-drive systems, but with new motors the wow and flutter is not appreciably higher (typically 0.06% vs. 0.04%, NAB weighted).

Pro features

The 122-B has two main features that are directly applicable to profes-

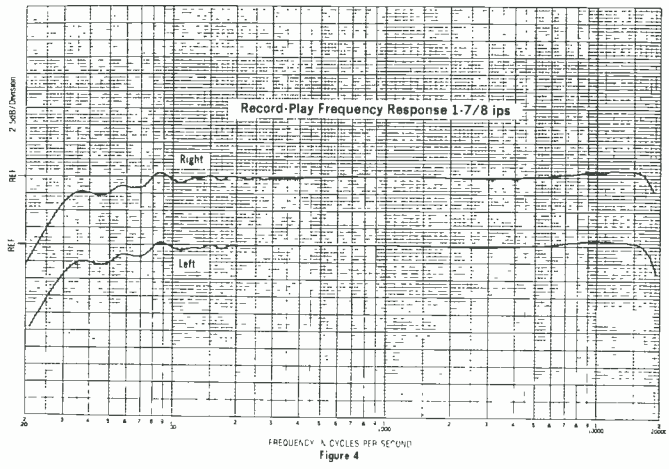


Figure 4

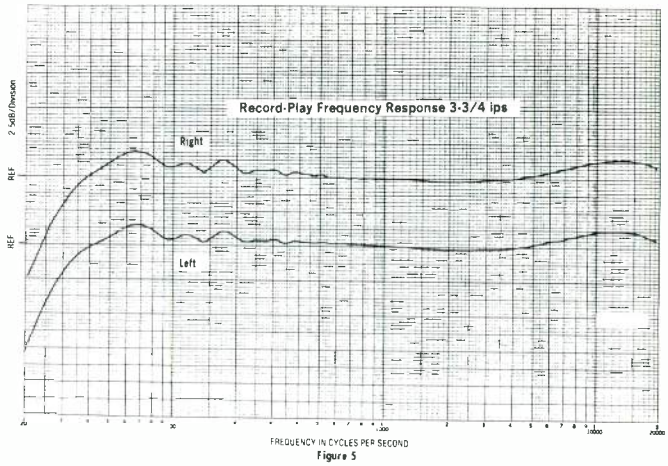


Figure 5

Figure 4. (Left) The record-playback frequency response of the unit at 1⅞ ips.

Figure 5. (Above) The record-playback frequency response at 3¾ ips.

sional use. The first is the machine's capability of recording at 3¾ ips. The high-speed feature provides reel-to-reel quality in almost every respect. Granted, the maximum time for recording is only about 22 minutes per side on a C90 cassette, but at this speed the production possibilities are greatly expanded.

The second professional feature is the full XLR input and output capability. The ease with which the machine can be interfaced with professional equipment is refreshing. The XLR provision is not just a connector difference. The outputs and inputs are active-balanced circuits. The outputs are capable of +6.5dBm before clipping. The inputs are high-impedance and fully balanced. These inputs are designed to directly interface with nominal console output levels of +4dBm.

In some small production rooms, the cassette machine may need to be interconnected with auxiliary equipment that uses RCA PIN jacks. This is no problem for the 122-B. The front panel contains a pair of high-level RCA PIN jack inputs. For operator convenience, either the front-panel RCA PIN jacks or the rear XLR inputs can be selected with a front-panel switch. See Figures 1 and 2.

The rear panel also contains RCA PIN jacks for inputs and outputs. A rear-panel switch allows the user to select either of the two sets of rear-panel jacks (RCA or XLR). The RCA PIN jack inputs and outputs are identical to those on the standard 122 machine.

Front-panel access is provided to either the input or output signals for monitoring purposes. The front-panel output level controls affect only the output level, not the metering level.

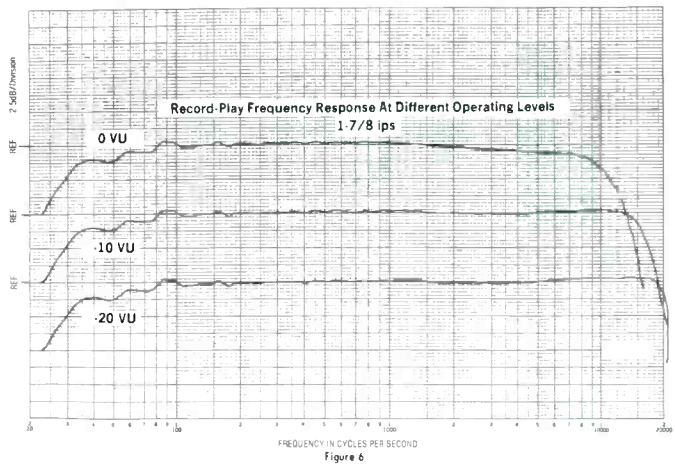


Figure 6

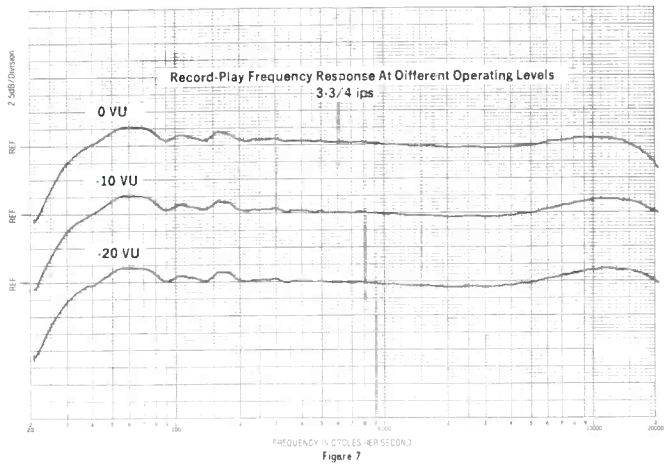


Figure 7

Figure 6. (Above) The effects of operating level on record-playback frequency response performance at 1⅞ ips.

Figure 7. (Right) effects of operating level on record-playback frequency response performance at 3¾ ips.

The operator can also select the equalization and bias for a particular type of tape—normal, cobalt (Co) or chromium dioxide (CrO_2). Also, the front panel provides access to record-bias calibration controls for a fourth set of parameters. A small push-button switch selects these controls for user optimization of performance. The equipment manual provides clear and concise instructions on how to set the controls for best recording performance.

Standard features

Other front-panel controls provide the standard types of features that are expected on such a machine—memory stop and play, headphone level adjust and motion controls. The machine is fully solenoid-controlled and a remote-control box, model RC-90, is available. For those engineers wanting to mount the remote controls for the cassette recorder in a console or custom cabinet, I suggest buying the RC-90. The unit comes apart easily, and the remote-control bezel can be used as a cover plate for a custom housing.

The recorder provides the necessary interface for an external RX-8 dbx noise-reduction system. The RX-8 encoder/decoder control and audio signal lines plug directly into jacks on the rear panel. Selecting the dbx noise-reduction system with the front-panel switch automatically interfaces the necessary circuits in the dbx noise-reduction unit to the audio circuits in the 122-B.

You might expect Dolby noise reduction also to be available. Although it is included, it is a new Dolby circuit. This noise-reduction system is referred to as Dolby System/NR + HX.

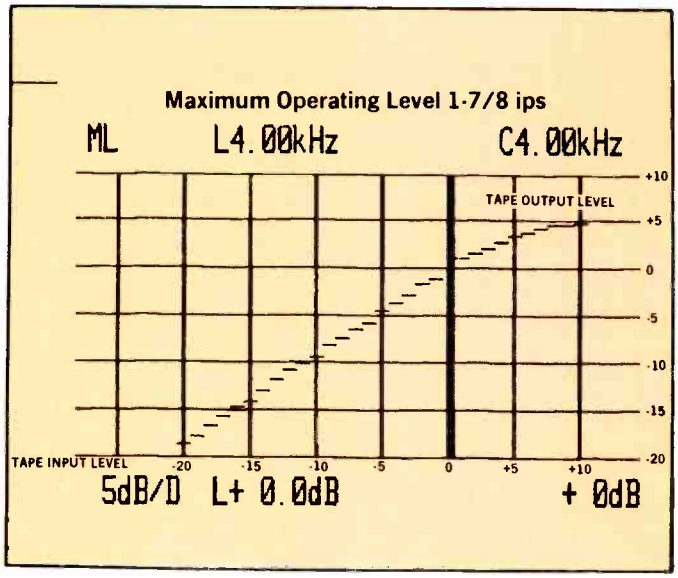


Figure 8. The charted results of the maximum operating level test at 1⅞ ips.

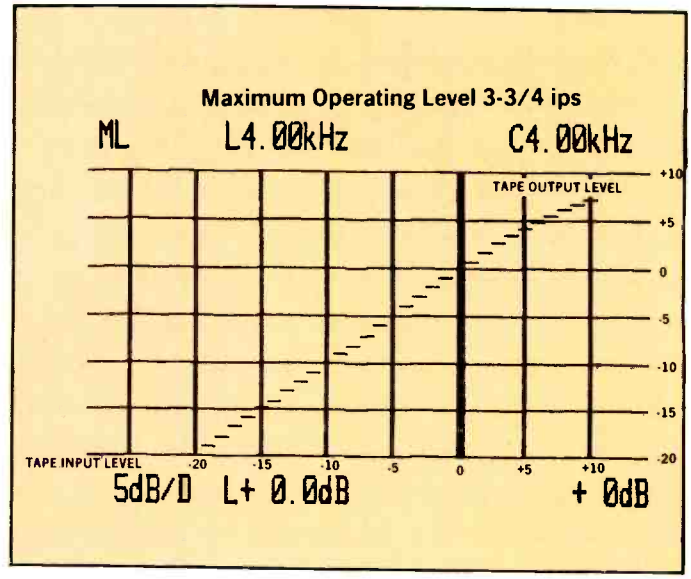


Figure 9. The charted results of the maximum operating level test at 3¾ ips.

The new Dolby circuit provides the standard Dolby noise reduction, plus greater headroom in recording. Tapes recorded with the switch in this position can be played back on normal Dolby machines, as well as those with the Dolby HX circuits. The operation of this circuit is explained later in this article. (See page 220.)

The switch you might not expect on a cassette deck is the speed switch. This machine runs at both 1⅞ ips and 3¾ ips. This feature is regularly used at KANU to provide clients with high-quality copies of their performances in one half the normal time.

Performance

So much for the features; now, does it really perform? The standard set of performance checks were run on the cassette machine, using the UREI 2010 plotter and the Sound Technology 1500A analyzer.

Figure 3 shows the playback fre-

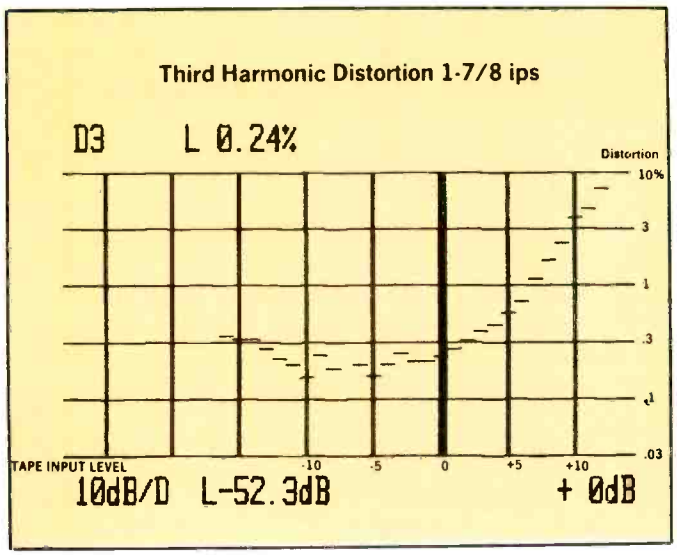


Figure 10. The charted third harmonic distortion results at 1⅞ ips vs. input level. Standard operating level is designated by the heavy 0dB vertical line. The test frequency is 1kHz.

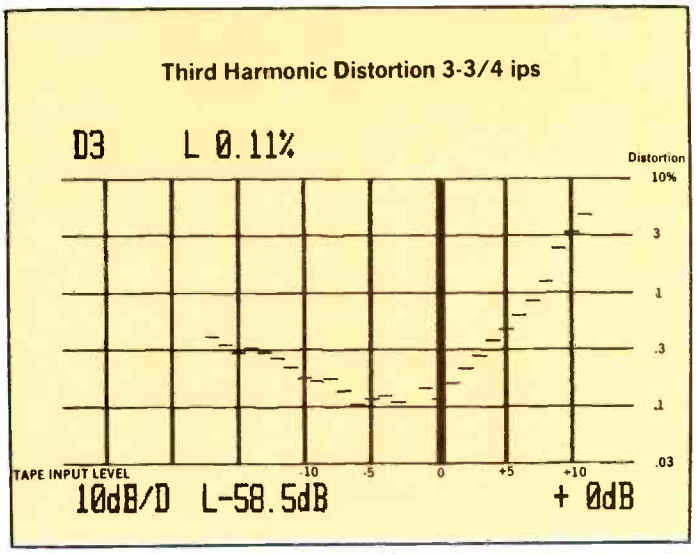


Figure 11. The charted third harmonic distortion results at 3¾ ips vs. input level. The heavy vertical line at 0dB represents the machine's standard operating level. The test frequency is 1kHz.

quency response for each channel. The upper graph represents the right channel, the lower graph the left channel. The uniform response is good and was measured only at 1⅞ ips. So far, no playback frequency test tapes are available for 3¾ ips. The graph only goes out to 15kHz, but that is because the test tape only goes to that frequency.

Figure 4 shows the record-playback frequency response measured at 1⅞ ips. The factory settings were used with a TDK C-60 cassette. The top-end −3dB point is about 19kHz for each channel.

The 3¾ ips record-playback frequency response is shown in Figure 5. At this higher speed, the −3dB point is completely off the graph. A normal-bias tape was also tested at this speed, and although the performance was not quite as good as the chrome tape, it exceeded the performance that

Dolby HX noise reduction

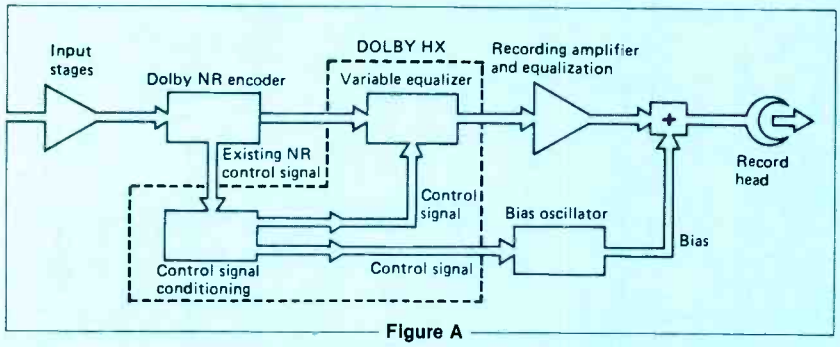


Figure A

Figure A. The basic block diagram of the Dolby HX noise-reduction system used in the TASCAM 122-B tape deck. New circuitry (shown within the dashed lines) takes a control signal from the Dolby B-type noise reduction encoder and, through control circuits, employs the signal to vary the power going to the bias oscillator and adjusts the record equalization as needed.

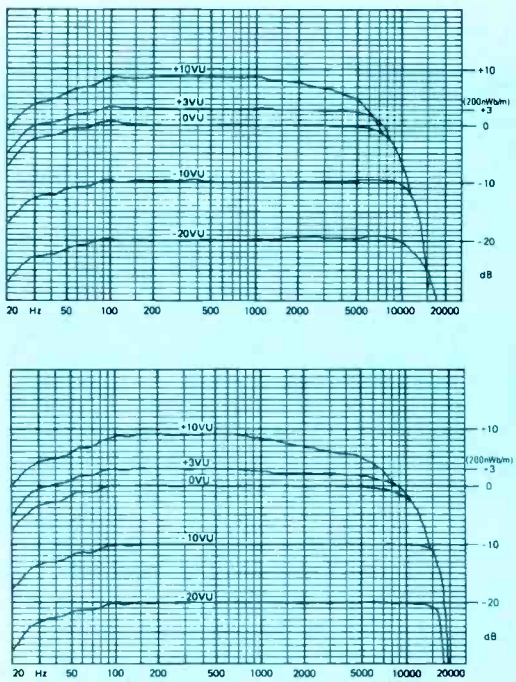


Figure B. The effects of Dolby HX noise reduction on frequency response. The top chart shows a high-quality cassette deck recording using conventional techniques. The bottom chart shows the same tape and the same deck, but with the Dolby HX noise-reduction circuit employed.

The TASCAM 122B tape machine has the standard Dolby noise-reduction processing as well as a Dolby HX (Headroom Expansion) feature. This new type of noise reduction provides greater headroom in recording. Tapes recorded in this mode can be played back on standard Dolby machines, even if they do not have the HX feature.

The basic Dolby HX process is shown in Figure A. The extender process works by constantly adjusting the bias level to increase the amount of energy that can be placed on the tape. To maintain a flat frequency response at these different bias levels, the record equalization is adjusted along with the bias. In the playback mode, the frequency response is flat, as though a constant amplitude bias had been applied when the tape was recorded.

The dramatic effect of this feature is shown in Figure B. The upper graph shows a high-quality cassette recording without the HX feature. Notice how the high frequencies are rolled off as the input level is increased. The lower graph shows the same recording tape with the HX feature in place. Notice the improvement in high-frequency performance with the HX circuit in operation.

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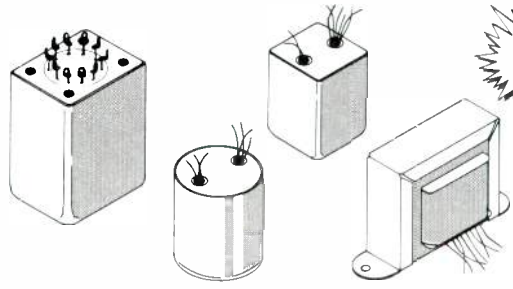

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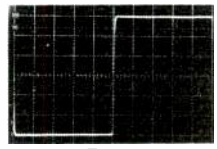

JE-16A
2 kHz Square Wave

INPUT TRANSFORMERS AND SPECIAL TYPES

	Model	Application	Impedance Ratio Pri-Sec	Turns Ratio Pri:Sec	20Hz Max Input Level[1]	Typical THD Below Saturation (%) 20 Hz / 1 kHz	Frequency Response (dB ref. 1 kHz) 20 Hz / 20 kHz	Band-Width[2] –3 dB @ (kHz)	20 kHz Phase Response (degrees)	Over-Shoot (%)	Noise Figure (dB)	Magnetic Shield[4] (dB)	Number of Faraday[4] Shields	Package[5]	PRICES 1-19	100-249	1000
MICROPHONE INPUT																	
†	JE-16-A JE-16-B	Mic in for 990 opamp	150-600	1:2	+8	0.036 / 0.003	−0.08, −0.05	200	−8	<1	1.7	−30	1	A = 1 B = 2	64.21 68.86	42.89 45.99	29.60 31.74
†	JE-13K7-A JE-13K7-B	Mic in for 990 or I.C.	150-3750	1:5	+8	0.036 / 0.003	−0.09, −0.21	85	−19	<2	2.3	−30	1	A = 1 B = 2	64.21 68.86	42.89 45.99	29.60 31.74
	JE-115K-E	Mic in for I.C. opamp	150-15 K	1:10	−6	0.170 / 0.010	−0.50, +0.10	115	−5	<7	1.5	−30	1	3	42.03	28.07	21.92
LINE INPUT																	
	JE-11P-9	Line in	15 K-15 K	1:1	+26	0.025 / 0.003	−0.03, −0.30	52	−28	<3		−30	1	1	103.47	69.13	47.69
	JE-11P-1	Line in	15 K-15 K	1:1	+17	0.045 / 0.003	−0.03, −0.25	85	−23	<1		−30	1	3	40.05	26.76	20.90
†	JE-6110K-B JE-6110K-BB	Line in bridging	36 K-2200 (10 K-600)	4:1	+24	0.005 / 0.002	−0.02, −0.09	125	−12	<1		−30	1	B = 1 BB = 2	62.86 71.52	42.01 47.79	30.83 32.97
*	JE-10KB-C	Line in bridging	30 K-1800 (10 K-600)	4:1	+19	0.033 / 0.003	−0.11, −0.08	160	−9	<2		−30	1	3	41.56	27.76	19.16
	JE-11SSP-8M	Line in / repeat coil	600 / 150-600 / 150	1:1 split	+22	0.035 / 0.003	−0.03, −0.00	120	−9	<3.5		−30	1	4	151.90	101.47	70.01
	JE-11SSP-6M	Line in / repeat coil	600 / 150-600 / 150	1:1 split	+17	0.035 / 0.003	−0.25 −0.00	160	−5	<3		−30	1	5	79.22	52.91	36.51
SPECIAL TYPES																	
†	JE-MB-C	2-way[3] mic split	150-150	1:1	+1	0.050 / 0.003	−0.16 −0.13	100	−12	<1		−30	2	3	34.60	23.13	18.06
†	JE-MB-D	3-way[3] mic split	150-150-150	1:1:1	+2	0.044 / 0.003	−0.14 −0.16	100	−12	<1		−30	3	3	60.09	40.15	31.35
	JE-MB-E	4-way[3] mic split	150-150-150-150	1:1:1:1	+10	0.050 / 0.002	−0.10 −1.00	40	−18	<1		−30	4	1	96.90	64.73	44.66
	JE-DB-E	Direct box for guitar	20 K-150	12:1	+19	0.096 / 0.005	−0.20 −0.20	80	−18	<1		−30	2	6	43.57	29.11	22.73

1. (dBu) Max input level = 1% THD; dBu = dBv ref. 0.775 V
2. With recommended secondary termination
3. Specifications shown are for max. number of secondaries terminated in 1000 ohm (typical mic preamp)
4. Separate lead supplied for case and for each faraday shield
5. Except as noted, above transformers are cased in 80% nickel mu-metal cans with wire leads.

PACKAGE DIMENSIONS:

	W	L	H
1 =	1 5/16" Diam.	×	1 9/16"
2 =	1 3/16"	× 1 3/16" ×	1 5/8"
3 =	1 1/8" Diam.	×	1 1/16"
4 =	1 1/2"	× 1 3/4"	2 1/2" w / solder terminals
5 =	1 5/8" Diam.	×	1 3/4"
6 =	1 1/8" Diam.	×	15/16"

NICKEL CORE OUTPUT TRANSFORMERS[6]

	Model	Construction	Nominal Impedance Ratio Pri-Sec	Turns Ratio Pri:Sec	20 Hz Max Output Level[7] (dBu)	across (n) windings	600 Ω Load Loss (dB)	DC Resistance per Winding	Typical THD Below Saturation (%) 20 Hz / 1 kHz	Frequency Response (dB ref. 1 kHz) 20 Hz / 20 kHz	Band-Width –3 dB @ (kHz)	20 kHz Phase Response (degrees)	Over-Shoot[8] (%)	Package[9]	PRICES 1-19	100-249	1000
*	JE-123-BMCF	Quadfilar 80% nickel	600-600 150-600	1:1 1:2	+28	2	−1.1	20 Ω	0.002 / 0.002	−0.02 / −0.02	>450 160	−2.1 −4.1	<1	7	87.41	44.17	30.47
*	JE-123-DMCF	Quadfilar 80% nickel	600-600 150-600	1:1 1:2	+21	2	−1.0	19 Ω	0.004 / 0.002	−0.02 / −0.00	>450 230	−1.2 −2.5	<1	8	50.71	33.88	23.38
	JE-123-BLCF	Quadfilar	600-600 150-600	1:1 1:2	+32	2	−1.1	20 Ω	0.041 / 0.003	−0.02 / −0.01	>450 170	−1.9 −4.0	<1	7	61.30	35.79	24.70
*	JE-123-DLCF	Quadfilar	600-600 150-600	1:1 1:2	+27	2	−1.0	19 Ω	0.065 / 0.003	−0.02 / −0.01	>450 245	−1.2 −2.5	<1	8	39.61	26.45	19.42
	JE-123-SLCF	Quadfilar	600-600 150-600	1:1 1:2	+23.5	2	−1.1	20 Ω	0.088 / 0.003	−0.03 / −0.01	>450 245	−1.2 −2.8	<1	9	33.48	22.35	15.43
	JE-112-LCF	Quadfilar	600-600 150-600	1:1 1:2	+20.4	2	−1.6	29 Ω	0.114 / 0.003	−0.03 / −0.01	>450 205	−1.2 −3.2	<1	10	25.48	17.01	12.49
	JE-123-ALCF	Quadfilar	66.7-600	1:3	+26.5	3	−1.3	8 Ω	0.125 / 0.003	−0.04 / +0.06	190	−4.6	<6	8	42.14	28.15	19.42
	JE-11S-LCF	Bifilar w / split pri.	600-600 150-600	1:1 1:2	+30	1 (sec)	−1.7	63 Ω	0.058 / 0.002	−0.02 / +0.01 −0.02 / −0.05	>10MHz 155	+1.1 −4.1	<1	8	42.14	28.15	19.42

6. Multifilar construction has no faraday shield; cannot be used as input transformer. All specifications are for 0 Ω source, 600 Ω load.
7. Max output level = 1% THD; dBu = dBv ref. 0.775 V
8. Source amplifier –3 dB @ 100 kHz
9. Output transformers are horizontal channel frame type with wire leads, vertical channel frames available.

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PACKAGE DIMENSIONS:

	W	L	H	Mounting Centers
7 =	1 1/2" ×	2 5/16" ×	1 15/16"	2 13/16"
8 =	1 5/16" ×	1 15/16" ×	1 5/8"	2 3/8"
9 =	1 1/8" ×	1 11/16" ×	1 3/8"	2"
10 =	1 1/16" ×	1 7/16" ×	1 3/16"	1 3/4"

Prices shown are effective 6 / 1 / 84 and are subject to change without notice. Packing, shipping, and applicable sales taxes additional.

These charts include the most popular types which are usually available from stock. Many other types are available from stock or custom designs for OEM orders of 100 pieces or more can be made to order. Certified computer testing is available for OEM orders. Call or write for applications assistance and / or detailed data sheets on individual models.

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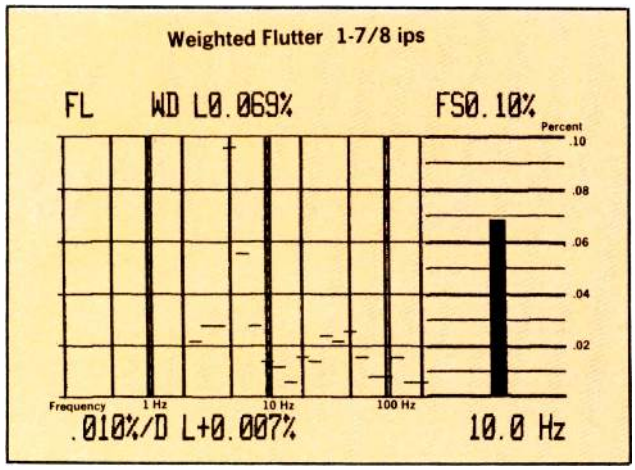


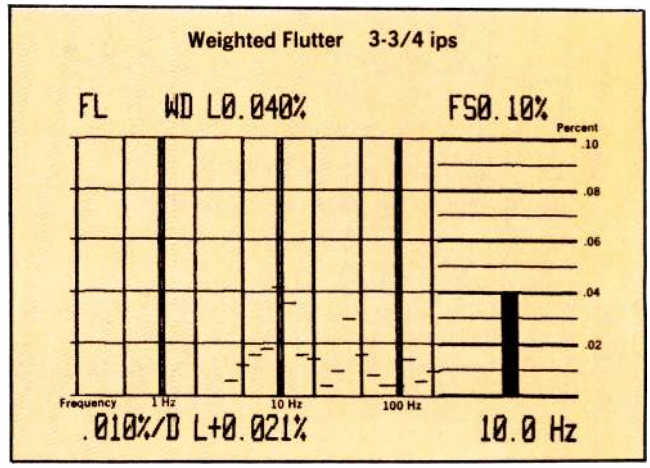


Figure 12. (Left) The measured weighted flutter performance of the tape deck at 1⅞ips.

Figure 13. (Above) The measured weighted flutter performance of the tape deck at 3¾ips.

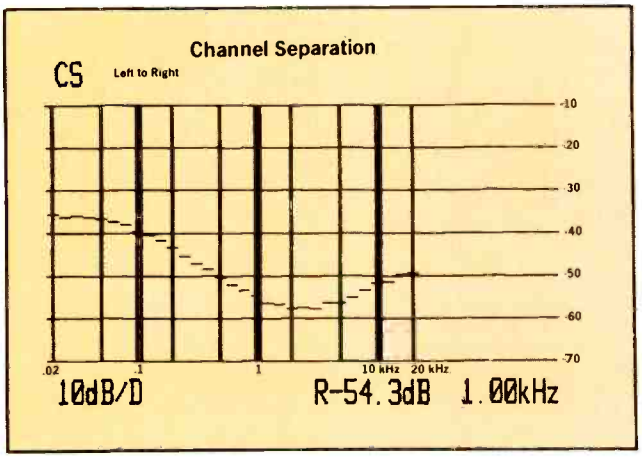
could be expected from many reel-to-reel recorders.

One of the problems with using a cassette machine for *serious* recording is the poor signal-to-noise ratios usually encountered. Cassette machines notoriously have been unable to handle the necessary levels to obtain high-quality recordings. Usually, some form of noise reduction system is added just to get the noise down to an acceptable level. However, with the advantage of the higher speed, a whole new world of possibilities is created.

Figure 6 shows the respective frequency-response curves from a chrome cassette tape running at 1⅞ips, measured at three different levels; 0 VU, −10 VU and −20 VU. These traces clearly show the loss of top-end performance at the higher record levels. This phenomena usually forces the user to lower the input levels to avoid the loss in high frequencies with a corresponding loss of signal to noise.

One way to get more audio on the tape is to simply pass more tape across the heads in the same amount of time, ie. higher tape speed. The TASCAM 122-B, running at 3¾ips, exhibits little high-frequency roll off, even at 20kHz. Figure 7 shows the record-playback frequency response as measured on a chrome tape at 3¾ips. Again, the −3dB point is not even on the graph.

Another example of the recorder's capability of putting more audio on the tape is shown on the printed output of a Sound Technology 1500A. Figure 8 shows an automated test of maximum record level for the recorder. The test set inputs a high-level fixed frequency tone and then de-



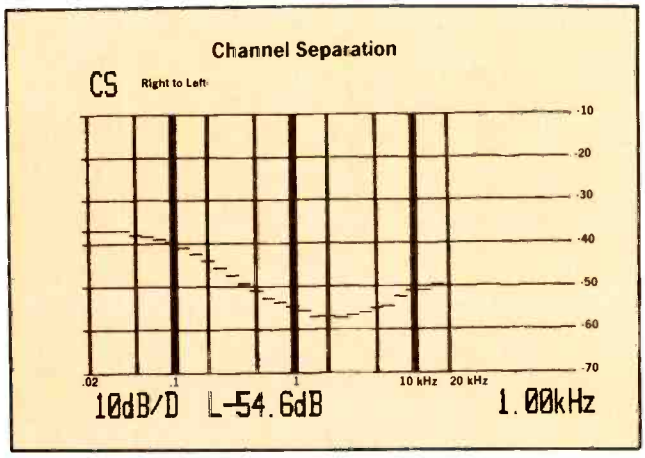


Figure 14. (Above) The channel separation (left-to-right) vs. frequency of the TASCAM 122-B.

Figure 15. (Right) The channel separation (right-to-left) vs. frequency for the cassette deck.

creases the input level while measuring the output level. The output level vs. the input level is plotted on the CRT screen of the 1500A. This test was run at 1⅞ips. Notice the slight roll off in output level as the tape reaches saturation. This saturation will show in the loss of high frequencies. Figure 6 also shows this loss of high-frequency response as a result of tape saturation.

The advantage of higher tape speed is shown in Figure 9. Here, the recorder was running at high speed, 3¾ips. The plot from the 1500A shows much less tape saturation at the higher input levels. Figure 7 shows how this higher speed affects frequency response. Compared to the lower speed, the frequency response is much better.

The distortion characteristics of the 122-B are good. Figures 10 and 11 show how the machine performed at 1⅞ips and 3¾ips, respectively. The low-speed distortion was 0.24%, and the high-speed distortion was 0.11%. Keep in mind that these figures were obtained with a full 0 VU input level. The actual measured noise level is shown on the same graphs. Unprocessed signal-to-noise ratios were measured at 52.3dB and 58.5dB.

An interesting display of the flutter performance of the recorder is shown in Figures 12 and 13. The graph shows not only the weighted flutter measurement, but also the flutter components at specific frequencies. Figure 12 indicates a weighted flutter level of 0.069% at 1⅞ips. However, an inspection of the graph shows most flutter components to be quite low. The only high-flutter component is at 5Hz. Most of the flutter components were well below 0.030%.

Figure 13 shows the same parameters for 3¾ips operation. In this case, most of the flutter components are below 0.020%. The vertical bar in both graphs indicates the instantaneous flutter value. The top digital figure is the 2Σ weighted value.

Figures 14 and 15 show the slow-speed audio separation between channels. Figure 14 shows the actual signal leakage from the left channel to the right channel, and Figure 15 shows the same parameters for leakage from the right channel into the left. A nice feature of the Sound Technology 1500A is that you can read these values at any frequency simply by positioning the cursor at that frequency. For comparative purposes, we used 1.00kHz. The digital values on the graphs show the specific crosstalk value at that frequency.

Construction

The unit is well-constructed. High-quality components are used throughout, and a general concern for the service aspect is evident. That's not to say that the unit is a snap to work on. But for what is usually referred to as typically Japanese construction techniques, this machine rates an A+.

The machine comes with an excellent user's manual, which provides both the novice and experienced user sufficient information to effectively use all of the 122-B's features. The clearly written language and accompanying photos and drawings make the adjustment of the bias controls easily understood by even the newest of users.

For the technician, TASCAM has provided an excellent technical manual, which gives a complete step-by-step alignment procedure, and carefully explains **how** the circuits are supposed to work. The manual provides simplified circuit drawings where necessary to help the user understand the machine's circuits.

Editor's note:

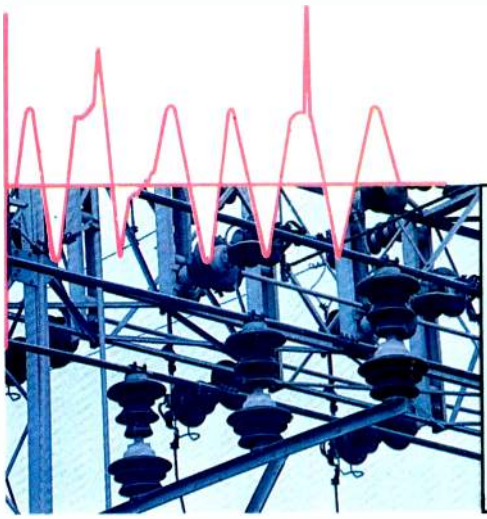
The field report is an exclusive **BE** feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting firm. The intent is for equipment to be tested on-site. The author is at liberty to discuss his research with industry leaders and to visit other broadcasters and/or the manufacturer to track down pertinent facts.

In each field report, the author is free to discuss the full applicability of the equipment to broadcasting, including personal opinions on good features and serious limitations, if any.

In essence, these field reports are prepared *by* the industry and *for* the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author, if support is requested in some area.

It is the responsibility of **Broadcast Engineering** to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement by **Broadcast Engineering** for or against a product.

For more information on the TASCAM 122-B cassette recorder, readers may contact Teac Corporation of America, 7733 Telegraph Road, Montebello, CA 90640.



The effects of ac line disturbances

Every electronic installation requires a steady supply of clean power in order to function properly. Recent advances in technology have made the question of ac power quality even more important, as microcomputers are integrated into a wide variety of broadcast products. The high-speed logic systems prevalent today can garble or lose data because of power supply disturbances or interruptions.

With this article, **Broadcast Engineering** begins an in-depth look at the effects of ac disturbances on broadcast equipment.

By Jerry Whitaker, radio editor

The ac power line into a broadcast plant is the lifeblood of any operation. It is also, however, a frequent source of equipment malfunctions and component failures. The utility company ac feed contains not only the 60Hz power needed to run the facility, but also a variety of voltage sags, surges and transients. These abnormalities cause different problems for different types of equipment.

An ac voltage sag is generally defined as a decrease of 10% to 35% below the normal line voltage for a period of 16ms to 30 seconds. A surge, on the other hand, is a voltage increase of 10% to 35% above normal, lasting 16ms to 30 seconds. (See Figure 1.) Sags and surges may occasionally result in operational problems for the equipment on line, but generally automatic protection or correction circuits will take appropriate actions to ensure that there is no equipment damage. Transients, however, are not so easily identified or eliminated. Many devices commonly used to correct for sag and surge conditions, such as ferro-resonant transformers or motor-driven auto transformers, are of limited value in protecting a load from high-energy, fast rise-time spikes on the ac line.

The scope of the problem

Transient suppression is important to broadcasters because the sensitive, high-speed, solid-state equipment in use today can be disrupted, or even destroyed by random short-duration spikes riding on the ac waveform. If not attenuated, these brief pulses, which are sometimes only a few microseconds in duration, can destroy semiconductors, disturb logic operations or latch up microcomputer routines.

Experience in the computer industry has shown that the vast majority of unexplained problems resulting in disallowed states of operation are actually caused by transient overvoltages on the utility feed. With the increased use of microcomputers in broadcasting, this warning cannot be ignored. The threat to broadcast facilities is compounded by the fact that microcomputers are being used at critical stages in the transmission chain, including program automation equipment and transmitter control systems.

The subject of transient over-

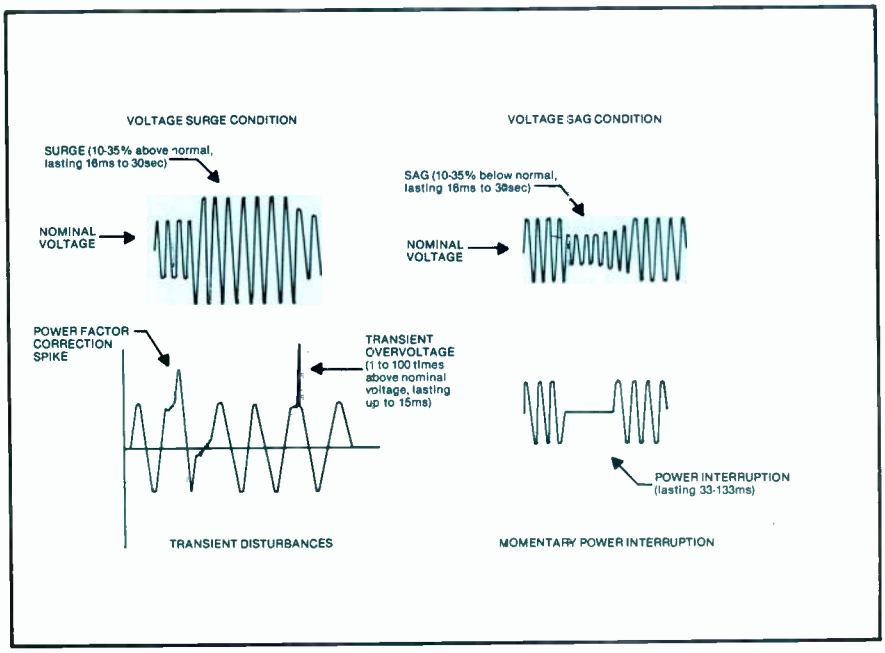


Figure 1. Various classifications of power-line disturbances. Voltage sags and surges can garble data and stress hardware components. Momentary power interruptions can cause a complete loss of volatile memory and severly stress hardware components, especially if the ac supply is allowed to surge back automatically. Transient disturbances can cause a wide variety of operational problems, from logic errors to complete system failure.

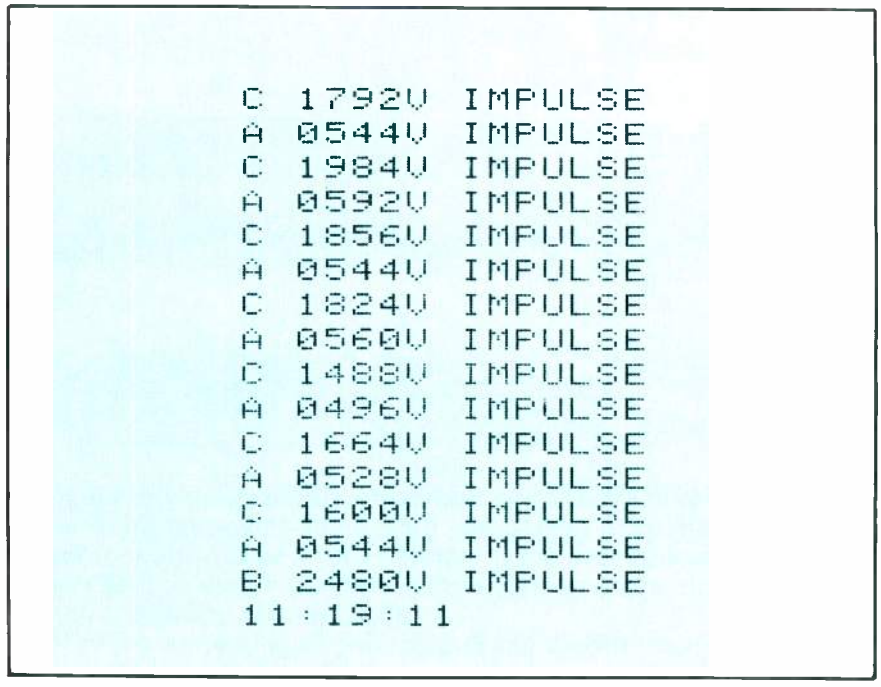


Figure 2. A portion of the ac monitor readout from the San Francisco area power-quality study. The first column indicates on which phase (A, B or C) the spike occurred. The second column is an actual readout of the transient (impulse) magnitude in volts.

voltages has been extensively studied in the computer industry. A pioneering effort by the IBM Systems Development Division in 1974, conducted by George Allen and Donald Segall, showed that voltage spikes lasting between 10 and 100μs in a frequency range of 10kHz to 100kHz can occur more than 50 times per month in a typical commercial environment.

Other more recent studies have shown that power line transients caused by utility company switching, distribution system faults, large loads going on- and off-line and lightning, can occur as often as 900 times per month. These spikes can reach 2kV (or more) and last up to 30ms.

Assessing the threat

Someone once jokingly said that the best transient eliminator was a transient monitor. Anyone who has monitored primary power service lines with an oscilloscope for any length of time would surely agree with that statement. Recent developments in digital technology, however, have changed the business of assessing the threat posed by unprocessed ac from an educated guess to a fine science.

Sophisticated monitoring equipment can give the user a complete, detailed look at what is coming in from the power company. Such monitoring devices can provide a wealth of information on the problems that can be expected when operating data processing, transmitting or other sensitive electronic equipment from an unprotected ac line. Typically, the power at a facility to be protected is monitored for a week or more. Then, an assessment is made as to whether ac processing equipment is needed at the installation.

As a case in point, a recently completed study for a San Francisco Bay area company planning to install a new data processing center graphically demonstrates the scope of the transient problem.

The firm wanted to determine the extent of transient activity that could be expected at the new site so that an informed decision could be made on the type of power conditioning needed. A Dranetz Engineering Laboratories model 606-3 ac line monitor was connected to the 480V dedicated drop at the new facility for a period of six days. During this time, the monitor recorded *thousands* of spikes, many exceeding 2kV, on one or more of the three phase inputs. The transient recording threshold was 460V *above* the nominal ac voltage level of 480V, phase-to-phase.

An expert from the report summary states that, on one particular day, the facility was plagued by many high-level transient periods, stretching from 8:30 a.m. until 3 p.m. In fact, the transient counters overflowed on the monitor's daily summary printout. The highest voltage recorded during this period was 4.08kV. (This transient activity occurred during periods of

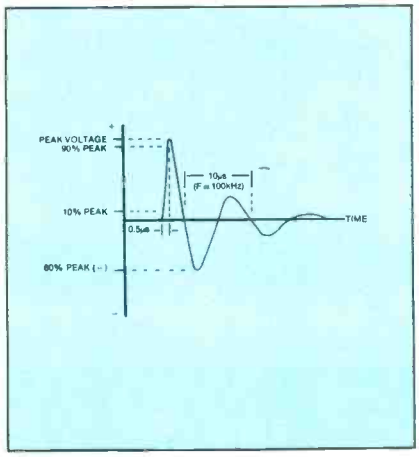


Figure 3. The suggested IEEE indoor-type transient overvoltage test waveform (0.5μs-100kHz ring wave, open-circuit voltage).

good weather.)

Figure 2 is part of the printout from this study. The data covers transients exceeding more than twice the normal line voltage that occurred within a period of just *30 seconds*. Even though these transients were brief in duration, any sensitive equipment connected to the power line would suffer damage in a short period of time.

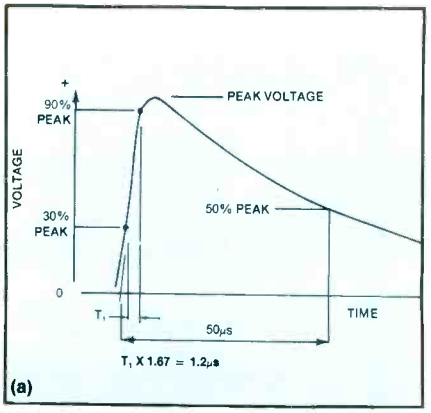
Although this is certainly a worst-case example of dirty ac, it points out the need for a minimal amount of spike protection on all incoming power lines. Studies such as the one detailed here should not be construed to be an indictment of utility company engineering standards. Few power drops are as bad as the one analyzed in this study. Further, most transient activity on ac lines is generated by power customers, not utility companies.

Standards of measurement

It is difficult to assess the threat posed by transient disturbances without a guideline on the nature of spikes in ac power systems. To this end, a working group of the Institute of Electrical and Electronic Engineers (IEEE) has suggested two waveforms, one unidirectional and the other oscillatory, for measuring and testing transient suppression components and systems in ac power circuits with rated voltages of up to 277V line-to-ground. The guidelines also recommend specific source impedance or short-circuit current values for transient analysis.

The voltage and current amplitudes, waveshapes and source impedance values suggested in the IEEE Guide (now ANSI/IEEE Standard C62.41-1980) are designed to approximate the vast majority of high-level transient disturbances, but are not intended to be worst-case conditions—a difficult parameter to predict. The timing of a transient overvoltage with respect to the power line wave is also an important parameter in the examination of ac disturbances. Certain types of semiconductors exhibit failure modes that are dependent on the position of a transient on the 60Hz ac system sine wave.

Figure 3 shows the ANSI/IEEE representative waveform for an indoor-type spike (for 120V to 240V ac systems). Field measurements, laboratory observations and theoretical calculations have shown that the majority of transient disturbances in low-voltage indoor ac power systems have oscillatory waveshapes, instead of the unidirectional wave most often thought to represent a transient overvoltage. The oscillatory nature of the indoor transient waveform is caused by the natural resonant frequencies of the ac distribution system. Studies by the IEEE show that the oscillatory frequency range of such disturbances extends from 30Hz to 100kHz, and that



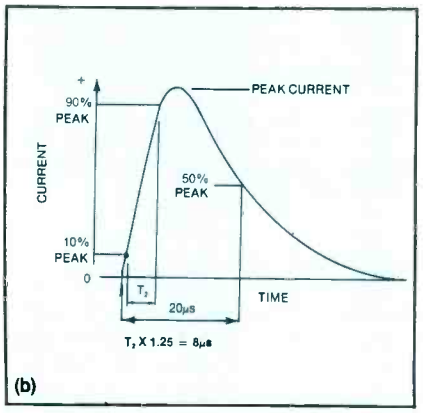


Figure 4. The unidirectional waveshape for outdoor-type transient overvoltage test analysis based on ANSI Standard C62.1. Figure (a) shows the open-circuit waveform, and Figure (b) shows the discharge current waveform.

the waveform changes depending upon where it is viewed in the power distribution system.

The waveform shown in Figure 3 is the result of extensive study by the IEEE and other independent organizations of various ac power circuits. The representative waveshape for 120V and 240V systems is described as a *0.5μs-100kHz ring wave*. This standard indoor spike has a rise time of 0.5μs and then decays while oscillating at 100kHz. The amplitude of each peak is approximately 60% of the preceeding peak.

Figure 4 shows the ANSI/IEEE representative waveform for an outdoor-type spike. The classic lightning overvoltage pulse has been established at a 1.2/50μs waveshape for a voltage wave and a 8/20μs waveshape for a current wave. Accordingly, the ANSI/IEEE standard waveshape is defined as *1.2/50μs for the open-circuit voltage (voltage applied to a high-impedance device), and 8/20μs for the discharge current (current in a low-impedance device).*

The outdoor waveshapes, while useful in the analysis of components and systems, are not meant to represent all transient patterns seen in low-voltage ac circuits. Lightning discharges can cause oscillations, reflections and

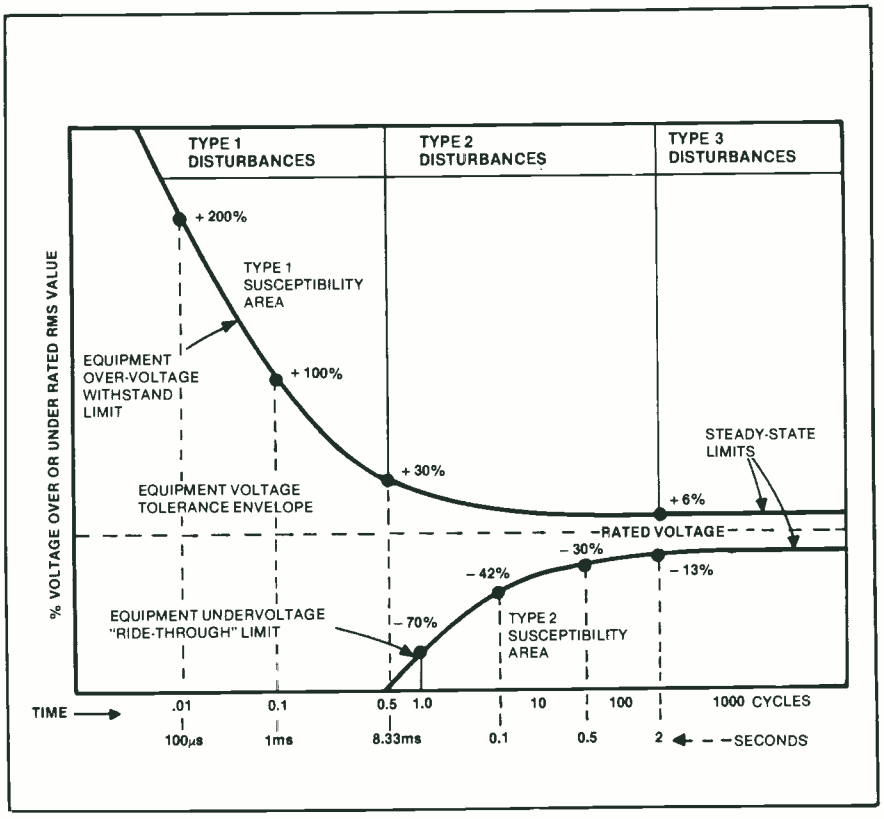


Figure 5. The recommended voltage tolerance envelope for computer equipment. This chart is based on pioneering work done by the Naval Facilities Engineering Command. The study identified how the magnitud *and* duration of a transient pulse must be considered in determining the damaging potential of a spike. The design goals illustrated in the chart are recommendations to computer manufacturers for implementation in new equipment.

other disturbances in the utility company power system that can appear at the service drop entrance as decaying oscillations.

Other considerations

Another fault condition associated with the utility company ac power supply is single-phasing. This is caused when one or more lines of a multiphase system is (are) open. Multiphase equipment, particularly motors, not protected against such occurrences will generally overheat, and sometimes fail.

Unfortunately, the power-quality problems affecting many areas of the country are becoming worse, not better. Broadcasters cannot depend upon power suppliers to solve the transient problems that exist. Utility companies are rarely interested in discussing ac disturbances that are measured in the microseconds or nanoseconds. The problem must be solved, instead, at the input point of sensitive loads.

Utilities have traditionally checked the quality of a customer's service drop by connecting a chart recorder to the line for a period of several days. The response time of such recorders, however, is far too slow to document any transient spike. Slow-speed analog recorders will only show long-term surge and sag conditions (as earlier defined), which can generally be dealt with by the regulated power supplies or high-voltage protection systems normally used in broadcast equipment.

The degree of protection afforded a radio or TV facility is generally a compromise between the line abnormalities, which will account for better than 90% of the expected problems, and the amount of money available to spend on that protection. Each installation is unique and requires an assessment of the importance of keeping the system up and running at all times and the threat of transient disturbances posed by the utility company feed to the plant.

Part 2

In an upcoming issue of **Broadcast Engineering**, *we will examine the sources of transient disturbances and how they are coupled into the broadcast plant.*

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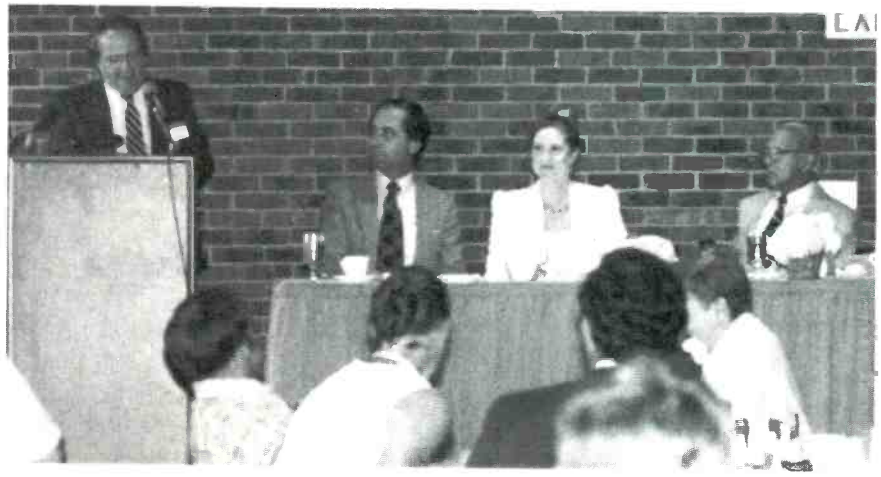
WOSU Conference replay

By Jerry Whitaker, radio editor



The highlight of the WOSU Broadcast Engineering Conference was the banquet address by Joe Flaherty, vice president, engineering and development, of the CBS Broadcast Group. He warned that failure to plan for the future could have serious consequences for the broadcast industry.

The fourth annual WOSU Broadcast Engineering Conference has concluded with another successful year. The conference, co-sponsored by the WOSU stations and **Broadcast Engineering** magazine in cooperation with the Office of Continuing Education at Ohio State University, was held July 17-19 in Columbus, OH. Nearly 300 engineers from across the country attended the WOSU conference to hear 27 separate engineering papers. The speakers list numbered more than 40, and included John Reiser and John Sadler of the FCC; Joseph Flaherty, vice president, engineering and development, CBS Broadcast Group; Wally Johnson, president of Moffett, Larson and Johnson, Consulting Engineers; Walter Jung, author, and audio consultant; Michael Rau of the National Association of Broadcasters; Don Markley, consulting engineer; John Kean, director of engineering for National Public Radio; Mark Durenberger, director of engineering for Hubbard Broadcasting; and Larry Cervon, president of Broadcast Electronics.

Banquet address

The highlight of the conference was the banquet address by Joe Flaherty of CBS, which dealt with the future of

the broadcast media. He told the capacity audience, "Broadcast technology is poised for a technical explosion...Technological advances will continue to accelerate, producing a bewildering array of equipment—both for the professional and the consumer; and the consumer will adopt many of these technologies more quickly than ever before."

Flaherty warned that, "The broadcaster's monopoly of video channels to the home is gone, and gone forever! The (new) *television of abundance* competes directly with the broadcaster for the attention of the viewer." He added that, "Complacency *now* would see us rumble on into 21st century oblivion."

Flaherty warned that by the year 2000, just 16 years from now, over-the-air television as we now know it may be relegated to the position of being a *secondary service* to other, more advanced delivery methods. He also stated that HDTV was "not as far away as many in our industry would like to think."

Flaherty urged those in attendance to make long-range goals and plans to both *identify* and *meet* the challenges of a changing marketplace for radio and TV broadcasting. He urged greater cooperation between the broadcast and consumer electronics industries as a means of ensuring orderly development of new transmission systems. Flaherty also urged broadcasters and broadcast industry manufacturers to cooperate on the development of new standards and technologies. He used the continuing battle over the AM stereo as an example of the results of in-fighting among manufacturers, which has hurt the industry. Flaherty reminded the audience that the concept of using a *marketplace solution* to AM stereo did not originate at the FCC, but instead came from the broadcast industry.

Flaherty went on to suggest that the National Association of Broadcasters increase its efforts in the technology field. He urged the Association to devote more effort toward meeting the challenges presented by the current

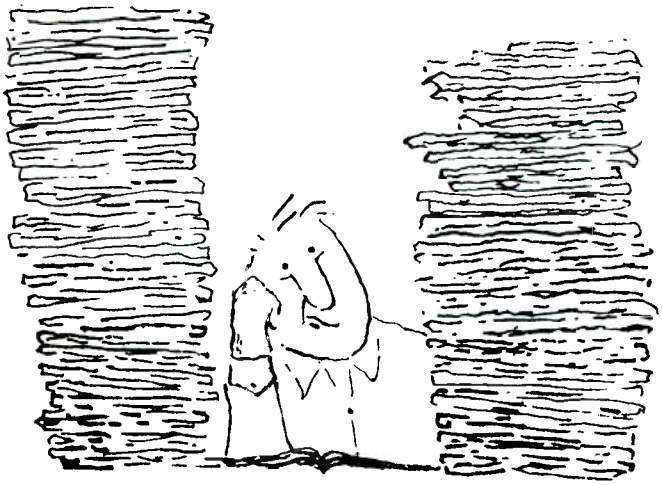
One of the most popular engineering sessions was the FCC Forum. Engineers in the audience were invited to question a panel of FCC representatives, shown here, about Commission rules and policies. The forum was moderated by Wally Johnson (standing).

The chairman and driving force behind the WOSU conference is John Battison, a long-time radio and TV broadcast engineer and author.

technological explosion, since these new developments will pose problems as important as the political ones the NAB faces today.

As in the past, one of the most popular sessions at the WOSU Conference was the FCC Forum, in which the audience was invited to fire questions at a panel of FCC representatives.

The FCC Forum panel consisted of Robert Greenberg, John Reiser and John Sadler of the FCC in Washington; Irby Tallant of the FCC in Detroit; and George Sklom of the FCC in Chicago. The panel was moderated by Wally Johnson. The session de-



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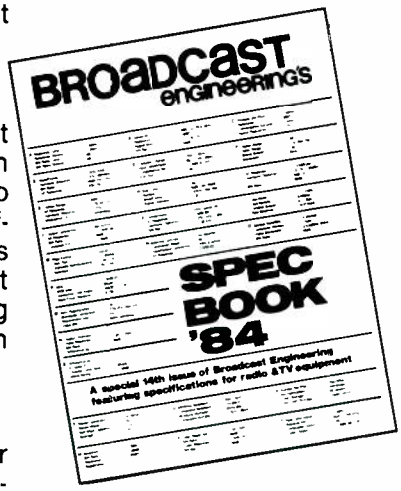

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termined that a major problem was keeping abreast of the commission's latest rules and policies. The panel suggested that each year engineers purchase a government publication that includes all updated rules and regulations of the FCC. The publication, titled *"The Code of Federal Regulations—Title 47, Parts 70 to 79,"* can be ordered from the government printing office at a cost of about $13.

Hot topics of discussion that the commission is currently studying are VHF drop-ins, AM broadcast band extension, LPTV, new remote control rules, AM station power allocation and operator licensing.

Sadler told the audience that the commission was taking a "hard line" on *City-of-License* and *Construction Permit* questions. He said that no program tests would be granted unless the facility in question had been built in accordance with the station's Construction Permit.

Reiser discussed planned changes in the remote control rules for transmission equipment. He said many of the existing Automatic Transmission System (ATS) provisions were likely to be incorporated into the revised remote-control rules.

In an engineering session paper delivered by Reiser, it was disclosed that a *Notice of Proposed Rule Making* would be forthcoming that will propose to modify the methods specified in the commission's rules for determining transmitter power output.

Technical sessions presented at the WOSU Broadcast Engineering Conference ranged from detailed discussion of data transmissions via FM subcarriers to a review of VHF and UHF propagation. The sessions provided engineers with a wide variety of topics that dealt with everyday maintenance and installation practices, as well as new technology. Special sessions were also presented on TV equipment, directional AM antenna systems and audio engineering developments.

Luncheon addresses were given by Wally Johnson; John Kraus, professor emeritus at Ohio State University; and Larry Cervon, president of Broadcast Electronics. In his presentation, Cervon incorporated taped interviews with about 15 industry pioneers and patent holders who have made significant contributions to broadcast technology. Included in the presentations were comments from:

- Parker Gates (now retired), founder and president of Gates Radio, which later became Harris' broadcast products division.
- Jim Weldon, founder and president of Continental Electronics, and the holder of several patents.
- Dr. George Brown, retired vice

president for engineering of RCA. Brown joined RCA in 1933 and was involved in many significant developments in broadcast technology during his long career at the company.

- Prose Walker (now retired), vice president for engineering of the National Association of Broadcasters during the 1950s, when the FCC was studying many landmark issues relating to broadcasting, including remote transmitter control and FM stereo.
- Carl Smith, the well-known directional AM antenna design engineer.
- Hilmer Swanson, senior scientist for advanced development at Harris. Swanson holds the patent for the Pulse Duration Modulation (PDM) technique.
- Jim Aurand of Varian, who developed the patented ½-wave folded-cavity power tube design while working at Broadcast Electronics.
- Bill Moulic, president and founder of SMC Corporation, who holds the patent on the 1kHz cue tone technique used in virtually all tape cartridge equipment.

Planning has already begun for next year's WOSU **Broadcast Engineering** Conference. The location will be the same—Fawcett Center for Tomorrow, Columbus, OH—and the scheduled date is July 23-25.

Associations

Continued from page 4

for future growth in the Broadcast Remote Pickup (RPU) service.

Radio broadcasters use RPU services for transmission of program material from remote locations back to the station's studios and for cues, orders and other related communications necessary to accomplish the broadcast. The commission proposes to split existing wideband channels into a uniform plan, consisting of 5kHz narrowband channels, which would allow the use of Amplitude Compandored Single Sideband (ACSB) narrowband technology on almost all of the currently assignable frequencies.

NAB said that it supported the use of ACSB or other narrowband technology in the broadcast RPU bands, provided such use was voluntary, not mandatory, and was administered by Local Frequency Coordinating Committees (LFCC's). While generally supporting the FCC's proposed channel-splitting plan, NAB suggested reservation of one or two nationwide wideband channels.

Howard Cosell to receive special RCPC award

Howard Cosell, whose broadcasting career began on ABC Radio in 1953, will receive a special award at the

1984 Radio Convention and Programming Conference (RCPC). Cosell will be honored for his long-term involvement and continuing contribution to the radio industry.

The presentation will be made at the RCPC luncheon Sept. 18, 1984, at which Cosell will be the featured speaker. RCPC is a joint venture of NAB and NRBA to be held Sept. 16-19, 1984, in Los Angeles.

SMPTE

Society of Motion Picture & Television Engineers
862 Scarsdale Ave.
Scarsdale, NY 10583
1-914-472-6606

Groups reach agreement on ¾-inch tape standard

At a meeting of the SMPTE users' subgroup on digital TV tape recording, a consensus was reached that the 19mm (¾-inch) tape width should be recommended as the basis for a worldwide standard. The working group concurred and began preparation of a detailed list of data-gathering experiments necessary to complete a 19mm format specification.

The SMPTE working group on digital TV tape recording met on May 4, 1984, at the Las Vegas Hilton Hotel. The meeting followed the NAB Conference, where experimental digital TV tape recorders were demonstrated by two equipment manufacturers.

The goal of the SMPTE working group is to agree on a standard in cooperation with the relevant EBU technical group (MAGNUM), for consideration by the appropriate CCIR study groups. These CCIR study groups are responsible for developing recommendations for the international exchange of digital TV programs on magnetic tape.

new products

Cable analyzer

An *MSE* Dirtcat analyzer allows quick location of cable shorts, tests stereo and mono headphones and checks loudspeakers for continuity, giving both visual and aural indications from the test.

Circle (226) on Reply Card

Motorized polar mount

Microdyne's motorized polar mount and programmable controller assist for CATV operators and broadcasters when switching between satellites along the geosynchronous arc. The motorized polar mount allows switching from one satellite to another in order to expand programming options. It designed primarily as an option for 5m and 7m parabolic antennas and joins their current line of motorized polar mounts for 10- and 12-foot antennas. The rack-mounted programmable position controller for the polar mount is simple to operate and has storage capacity for up to 16 satellite positions.

Circle (410) on Reply Card

Mic cables

Belden 8412 and 8413 microphone cables are available in red, yellow and blue thermoset jackets, making identification easier and enhancing appearance. 8412 uses two 20AWG stranded conductors with an 85% shield, while 8413 has two 24AWG conductors with 100% coverage conductive textile wrap and a 60% coverage copper braid shield.

Circle (232) on Reply Card

Portable uplink

Designed for remote ENG, the *Modulation Associates* SU-10 portable solid-state satellite uplink transmitter includes a 10W microwave amplifier. Applications include two independent SCPC channels or stereo transmissions.

Circle (233) on Reply Card

Synthesized signal generator

The *Hewlett-Packard* 8656B signal generator provides frequency coverage of 100kHz to 990MHz, an output range of + 13 to – 127dBm, with 0.1dB resolution: flexible AM and FM; 50W reverse-power protection and standard HP-IB programmability.

Circle (418) on Reply Card

Triode cavity

The *Eimac* CV-2252A cavity operates through the 170-228MHz range for high-band VHF TV, and combines with a *Varian/Eimac* 3CX12,000U7 high-mu triode to provide 15kW peak-of-sync video service with a typical gain of 14dB.

Circle (234) on Reply Card

Cassette tape

A high coercivity oxide formulation is used in *Ampex* 187 U-matic cassette tapes to provide low-noise picture reproduction with excellent color. The medium is enclosed in the same ABS anti-static plastic shells used with the Type 197 products.

Circle (235) on Reply Card

VCR care products

Improved head cleaning cassettes from *Nortronics* include a nozzle extension tube to allow wetting of the cleaning tape inside the cassette. The product cleans the full tape path of the VCR system.

Circle (236) on Reply Card

Updated editing controller

The *Sony* transportable post-production editing system is based on the BVE-5000P system with Version 2.22 software. It includes three flight cases for storing the equipment. New software features are user-programmable keys, edit listing, system file handling and more.

Circle (237) on Reply Card

Turntable

Russco models RT-700 and RT-710 phono turntables feature low rumble, crystal-locked speeds and quick starts. RT-700 operates at 33rpm and 45rpm only, while RT-710 allows adjustments of ± 9% from either 45rpm or 33rpm.

Circle (238) on Reply Card

3-channel scope

The *Leader* LBO-516 100MHz oscilloscope offers dual time base operation with alternate triggering for simultaneous display of two asynchronous signals, alternate time base and 8-trace capability.

Circle (239) on Reply Card

Special purpose cameras

The DX series (monochrome) and RX series (color) solid-state cameras by *AFP Imaging* are designed for many industrial purposes, including restricted space monitoring.

Circle (240) on Reply Card

Stereo delay compensator

The *Lexicon* model 1300 stereo digital audio delay synchronizer precisely compensates for video delays, when digital video processing or satellite transmission mandates recovery of lip sync.

Circle (241) on Reply Card

Group delay equalizer

GDE-73 and -143 adjustable IF group delay/amplitude equalizers from *LNR* are designed for use with satellite transmit/receive and terrestrial microwave terminals using analog (FM-FDM) or digital (QPSK, TDMA or 16QAM) transmission.

Circle (242) on Reply Card

Slide projector

Model 4320, a new dual drum 35mm slide projector from *Laird Telemedia*, uses microprocessor control for simple, versatile operation. It features lamp dissolve and slide superimposing.

Circle (243) on Reply Card

STL stereo demod

The *PowerPak* SCD-40 stereo composite demodulator uses phase lock loop technology to recover discreet left and right channels from a wideband, composite stereo STL signal. 15kHz low-pass filtering is used and dual LED bargraph peak modulation indicators are provided.

Circle (244) on Reply Card

Shrink tubing

Cole–Flex Corporation, offers a irradiated polyolefin shrinkable tubing with a shrink ratio of 4:1. Type ST-421 tubing is suitable for insulating irregular shapes, connector assemblies and for cable field repairs. ST-421 assists with difficult industrial, electronic, electrical and aerospace applications where shrinkable insulation must fit over large and small objects. The type ST-421 can be used as a boot over rectangular computer and telephone connectors to seal out moisture and prevent tampering.

Circle (401) on Reply Card

Mini-editing console

An ultra-compact editing console offered by *Winsted* is designed for flexibility and easy monitor viewing. Model R3802 console will accom-

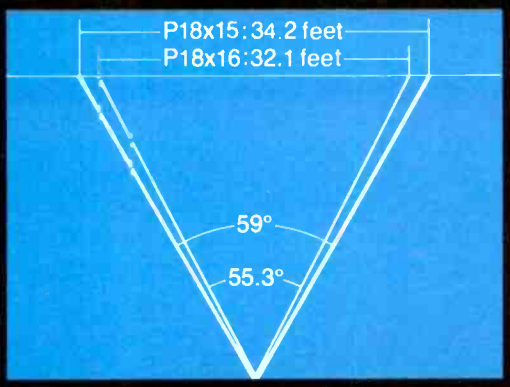
New Standards

The Widest Angle, The Highest Performance

Canon engineers have done it again, advancing the optical state-of-the-art so far forward that new standards must be considered.

The Canon P18 x 15 BIE offers the widest angle of any broadcast television zoom lens: 59°, plus incredible edge-to-edge sharpness, fidelity and sensitivity throughout its 18X range.

Every one of these superb lenses will be supplied with both 1.5X and 2X built-in extenders and a pattern projector. Options include manual, semi-servo or full servo operation.



The Canon F18 x 15 is the most versatile studio lens ever made, setting new standards for years to come.

P18 x 15 BIE F2.8 for 30mm Cameras* KEY SPECIFICATIONS

■ Focal length:	15-270mm
■ Max. Relative Aperture:	1:2.1 (15-218mm) 1:2.7 at 270mm
■ Angular Field of View:	59° x 45.8° at 15mm 3.6° x 2.7° at 270mm
■ Minimum Object Distance:	0.6 meter (2 feet)

*Also available: PV18 x 11 BIE F1.6 for 25mm Cameras

Canon Studio Standards

Canon®

Optics Division
Canon USA, Inc., Head Office: One Canon Plaza, Lake Success, N.Y. 11042 (516) 488-6700
Dallas Office: 2035 Royal Lane, Suite 290, Dallas, Texas 75229 (214) 620-2641 Chicago Office: 140 Industrial Drive, Elmhurst, Ill. 60126 (312) 833-3070
West Coast Office: 123 Paularino Avenue East, Costa Mesa, Ca. 92626 (714) 979-6000
Canon Canada, Inc., 3245 American Drive, Mississauga, Ontario L4V1B8, Canada (416) 678-2730

Circle (165) on Reply Card

modate ½-inch or front-loading ¾-inch editing equipment. This console features two shelves with full 13-inch extension for VCRs or storage. Slide-out shelf glides in and out, allowing editing controller to be out of the way when not in use. Monitor bridge tilts up to 5 degrees and adjusts to three comfortable heights. Locking front flip-up doors and rear access panel provides safe, secure storage of equipment.

Circle (407) on Reply Card

Power amplifier

RF Gain, Ltd., expanded its amplifier line into low-band, mid-band and 800MHz. The new frequency ranges are 35 to 50MHz, 66 to 88MHz and 806 to 890MHz, in addition to its present ranges of 136-174MHz and 420-475MHz. Amplifiers are also available in these frequency bands in a 100% duty cycle repeater configuration for 19-inch rack-mount.

Circle (408) on Reply Card

Adjustable TV table

Bretford Manufacturing announces a TV table with an adjustable top shelf and a lockable storage cabinet. The TVCA3654 has a (24" x 28") top shelf which adjusts to 10 heights: 36, 38, 40, 42, 44, 46, 48, 50, 52 and 54 inches. The table includes a lockable cabinet which provides a storage space 25" x 17" x 21". The table, adaptable to a variety of video applications, accepts an optional slant bar which, when attached to the top shelf, allows the television to set at an angle, thus eliminating overhead light glare. The electrical unit with two outlets, a 20-foot, 3-wire cord with a grounded plug and built-in cord winder can be mounted on the TVCA3654.

Circle (404) on Reply Card

Cable reels

Cable reels for video/audio/co-ax and power, from manual to power driven, are available from *Nalpak Video Sales*. Several models are suitable for many applications of cable handling.

Circle (405) on Reply Card

Portable uplink

Modulation Associates offers an all solid-state satellite uplink. This SU-10 portable is also suited for regional radio networks and corporate data networks, as well as for temporary telephone service and compressed video teleconference origination. It can be used for either two independent SCPC uplink channels or for stereo transmission. The design incorporates a 10W solid-state, microwave high power amplifier, and is available with audio or data processors, frequency agile modulators, dual-channel upconverters, dual HPAs and an audio monitor.

Circle (409) on Reply Card

Video microwave system

M/A-COM's MA-23CC system is a solid-state video FM microwave radio system that provides full bandwidth video and audio links in the 21.2 to 23.6GHz frequency band. The MA-23CC system applications include common carrier and broadcast ENG.

Circle (412) on Reply Card

Digital processor

Audio + Design offers a 16-bit digital processor, the PRO 701. This unit has XLR connectors and is fully balanced with operating levels up to +22dBm The PRO 701 also incorporates Coincident Time Correction (CTC), which gives the channels a coincident output in both the analog and digital domains. Input level controls are replaced with a 12-position input/output unity gain control that sets operating level in 2dB steps from +22dBm down to −2dBm. Additional features include switching for PAL/NTSC recording, record pre-emphasis and

copy prohibit, as well as digital input/output facilities, which enable direct digital-to-digital connection of machines and other processing equipment including 1610 and EBU formats.

Circle (415) on Reply Card

Data capture and processing system

CEC *Instruments Division of Transamerica Delaval* offers System 1298, a multichannel waveform acquisition, measurement and processing system centered on a 16-bit microcomputer. Under the control of MALPAK2, the system's supervisory program, a DL1200 programmable waveform recorder is combined with an HP9816S computer and HP9121D dual 3½-inch disk drive into an integrated workstation. System 1298 will replace or augment more traditional oscillographic or tape recorder installations with a computer-based system.

Circle (419) on Reply Card

Video editing disk system

The *Greco Systems* FDS-800 Minifile is an intelligent, high capacity data storage system used for processing editing decision lists and providing file and disk compatibility with CMX-based systems. The Minifile is self-contained in a metal enclosure with a 8-inch disk drive, power supply, microprocessor-based computer system, serial interfaces, operator keyboard and display. System functions include capabilities in support of video edit controls for storing, uploading and down-loading edit decision lists.

Circle (458) on Reply Card

Line-voltage meter

The *NLS* MA-2 is an ac digital voltmeter for fast, convenient measurement of ac line voltages of 110, 220 or 440Vac. Large, high-contrast LCD readouts require no interpolation of readings, no application of scale factors, and no variation in readings from person to person.

Circle (459) on Reply Card

Monitor speakers

Auratone multidriver sound monitors include five new models: the T5 Ultra-Compact 2-Way, T6 Sub-Compact 2-Way, T66 Compact 2-Way, QC66 Quality Control 3-Way and RC66 Road Cub 2-Way. The systems feature polypropylene low frequency drivers, wide dispersion dome midranges, tweeters and super tweeters.

Circle (460) on Reply Card

Illuminance meter

The *Minolta* illuminance meter is suitable for measuring illuminance instantaneously and continously. The meter features a sensitive silicon photo cell, combined with a sophisticated microprocessor and easy-to-read LCD. The illuminance meter also calculates integrated illuminance over a period of time, and measures illuminance deviation between sources.

Circle (461) on Reply Card

CRT tester

The *Leader Instruments* LVG-1601 programmable video generator features simplified push-button operation for testing high resolution CRT displays. The unit generates 11 standard patterns in RGB with sync signals for testing monochrome and color CRT displays.

Circle (463) on Reply Card

Multiplay compact disc player

The *Technics* SL-P15 multiplay disc player is a fully programmable compact disc changer system. It has two stereo channels and features state-of-the-art semiconductor circuitry with 12 new original LSIs and ICs designed specifically for compact disc reproduction. Major specifications in-

clude a frequency response of 4-20kHz ± 0.5dB; dynamic range of 96dB or more; S/N ratio of 96dB or more; THD of 0.003% or less and unmeasurable wow and flutter. The Technics SL-P15 is a front-loading unit with a motor-driven, slide-out compartment for disc-loading. It has a multifunction fluorescent digital display that provides a numerical readout of the track number, playing time and index number of the selections for the CD being played.

Circle (465) on Reply Card

Intelligent oscilloscope

Hitachi Denshi America introduces the V-1070, a low-cost version of the recently introduced V-1100 100MHz portable oscilloscope with built-in frequency counter/DVM, CRT readout, and ground level display.

Circle (464) on Reply Card

Test patterns

Accu-slides test patterns, distributed by Nalpak Video Sales, provide the same accuracy for use with telecine set-up and alignment as the standard Accu-chart system. Accu-slides are available in either a positive or negative image. They are mounted in a 2" x 2" glass protected format which is supplied with approved pin registered TV mounts and anti-Newton ring optical glass. The Accu-slide set consists of the color bar, gray scale, registration, linearity and resolution test patterns.

Circle (469) on Reply Card

Focus and test chart kit

Century Precision Optics test chart kit is designed for all types of lenses. The kit includes a 25" x 38" focus and test

chart using NBS-type resolution and seimens star patterns in strategic positions. Also included is an 8½" x 11" laminated 2-sided field chart, eight resolution patterns, and a complete set of instructions and tables for calculation of resolution.

Circle (470) on Reply Card

Digital memory Newsmatte available

Newsmatte, introduced by *Ultimatte Corporation*, offers the capability to composite smoke, fog, glass, shadows and fine hair detail and to eliminate edge crawl and cut-out looks. Once set up, the automated controls continually track to maintain a perfect composite. Newsmatte-2 is also available, and includes digital memory, which permits lock-in of the automated control set-ups.

Circle (454) on Reply Card

Audio level metering

Inovonics has introduced the TVU which connects the audio metering in-line with a video monitor. The TVU inserts a black box in the picture with a pair of vertical bars which represent stereo audio levels. Properly designated scales match the switchable VU (with peak flasher) and PPM response modes which conform to appropriate standards.

Circle (453) on Reply Card

Portable camera prompter

Tekskil Industries has introduced its 909 prompting system, the first prompter specifically designed for portable video cameras. The 909's cast-aluminum camera

mount supports the camera over the 9-inch imaging monitor, providing balance over the tripod camera head.

Circle (455) on Reply Card

Audience opinions tally

Measurements of telephoned audience responses to issues of public concern raised during programming are now available with CallCount from *JBI*. The CallCount system consists of two or more line concentrators, a digital recording device and a CallCount tabulation/transcription device. CallCount hooks into any basic phone system, up to 200 lines, and can handle 15 calls per telephone line per minute.

As a question is posed during a broadcast, two phone numbers are provided for callers to voice their opinions and cast their ballots. Through an RS-232 interface, tallies are immediately displayed and continuously updated on screen or can be read from the readouts on the CallCount unit.

Circle (466) on Reply Card

TV camera

The XC-800II professional video color camera from *Sharp Electronics Corporation* features resolution improved to 650 lines horizontal and S/N enhanced to 57dB. It is compatible with Sharp's XC-803TX Triax System and offers optimum video performance up to one mile from the base station.

Circle (456) on Reply Card

Instrument shuttle

The *Tektronix* K117 instrument shuttle, a rugged transport for delicate electronic test equipment, assists field service technicians by also serving as an on-site work station. The K117 is compact, lightweight and easily maneuverable. It provides shelves for extra tools, documentation and repair parts.

Circle (467) on Reply Card

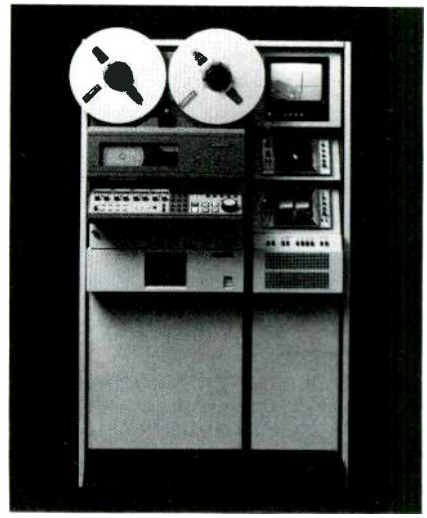
Digital reverberator

A new version of the *Ursa Major* digital reverberator, the 8X32-MkII, is available with increased flexibility. The 8X32-MkII features four additional user-modifiable reverb programs: cask, precussion plate, chamber and reverse reverb.

Circle (457) on Reply Card

VPR-6

Design criteria for the *Ampex* VPR-6 C-format VTR and TBC-6 include ease of operation, servicing and troubleshooting. Advanced tape handling offers any reel size mix, shuttle speeds to 500ips, – 1x to + 3x play speed range and special unthread



mode to protect the six individually replaceable scanner heads. Auto scan tracking and audio/video confidence are standard features. Options include a sync channel and the 4th EBU audio channel in Europe. The new VTR system, in various configurations, will be ready to ship after the IBC-'84 exhibition in late September.

Circle (462) on Reply Card

Arabic/Latin character generator

Careful keyboard design and sophisticated software results in the *Aston 3* character generator capability to produce high quality, fully accented, proportionally spaced Arabic text. Software ensures that the correct form of the character is selected as the text is entered. Dual-engraved keys show both Arabic and Latin characters, while mode switching is handled by two keys.

Circle (468) on Reply Card

PC phone jacks

Low-profile and right-angle features are included in the *Switchcraft* PC-mount phone jacks for use in telecommunication, audio and data processing applications. The 2- and 3-circuit units allow high-density packaging in sturdy molded housings.

Circle (449) on Reply Card

Editorial

Continued from page 16

"Third, we must compete in a free marketplace environment. A benevolent FCC, who for 50 years promulgated broadcast technical standards, will do so no longer!

"We, in our scientific and trade organizations, must produce whatever standards there will be, and we must do so at a time when the pace of technological advance defies the very concept of standardization.

"As to standards, our record is not unblemished. Indeed there would be an AM stereo standard and a teletext standard if the NAB and EIA respectively had been able to recommend one to the FCC. There would be a small-format ENG standard had the SMPTE been able to find consensus.

"The CCIR agreement on a world-compatible digital video standard and the recent EIA recommendation on a television stereo standard is progress, but progress only if we support the standards.

"Success in future standardizing work, such as that under way at the ATSC (Advanced Television Systems Committee), depends absolutely on our wholehearted support in cooperation with the manufacturers of both professional and consumer equipment.

"In this regard, broadcasters must recognize that improvements in quality and the introduction of new services depend heavily on the cooperation of television set manufacturers. The introduction of stereo sound demodulators and teletext decoders are recent examples of this.

"Therefore, I believe broadcasters should open a formal dialogue with the receiver industry, since none exists today. This can help ensure that both ends of the broadcasting chain work toward similar goals in a timely and cost-effective manner.

"Finally, while we must continue to upgrade our plants to improve near-term quality, we must look further ahead to the all-digital plant and to the transmission of enhanced and even high-definition television.

"To this end, we must stimulate, and share the cost of, research to develop compatible digital sound and HDTV transmission systems for VHF and UHF services—a development that will certainly require an 'intelligent receiver.'

"Such action is required today because only those distribution media able to meet the new quality standards and match the consumers' level of expectation will dominate in the 21st century. Those that cannot, or will not, will simply become secondary services."

We couldn't have said it better.

people

Crown International has announced the addition of **D. B. (Don) Keele Jr.** to the Tecron Division, Crown International, Elkhart, IN.

BASF Systems, Bedford, MA, has named **Gay F. S. Spiegel** product manager for audio magnetic products. Also **Rocco J. Rotolo** has been appointed regional sales manager for the Midwest.

Larry G. Waterhouse has been named vice president of administration for the Texas Cable Network. Waterhouse is responsible for personnel, financial and facilities management for the statewide network with offices in Austin, Houston and Dallas.

Virgil Lowe has been elected to a 2-year term as a section manager for SMPTE's Atlanta chapter. Lowe is executive vice president and director of advanced development for Fortel.

Victor Duncan, Irving, TX, has announced that **Richard Crandall** has joined the sales department as sales representative.

Steven D. Briggs has been promoted to manager of product marketing for Mycro-Tek, Wichita, KS.

Robert E. Klein has been appointed senior scientist at Townsend Associates, Westfield, MA. Klein, previously with the Harris Corporation, Quincy, IL, served as staff engineering consultant in Harris' Broadcast Products Division.

Delta Electronics, Alexandria, VA, has announced the appointment of **Russell E. Geiger** as president. Geiger replaces retiring president and Delta co-founder Stephen Kershner.

Audio Services Corporation, Hollywood, has announced that **Henning Moller** has joined ASC as director of engineering. Moller comes to ASC from Bruel & Kjaer Instruments, where his most recent assignment was the introduction of the 4000 series line of professional recording microphones into the United States.

One Pass, San Francisco, has announced the appointment of **Kathleen McGlaughlin** as chief financial officer.

Aries Productions, Grand Prairie, TX, announces the addition of **Christopher Robbins** and **Dana Wilson** as new staff members, and the promotion of **Joe Wilson,** staff producer, to vice president/director of marketing.

Michael J. Rowny has been promoted to the position of senior vice president, finance, for MCI Telecommunications, Washington, DC.

Paul A. Hulbert has been named president of Halcyon Communications, San Jose, CA. Hulbert previously held the position of executive vice president and general manager.

Noreen Williams has been appointed an assistant treasurer of Viacom International, New York. She will be responsible for investor and shareholder relations, corporate insurance and public financing.

Augat, Attleboro, MA, has announced the promotion of **Domenic B. Rignanese** to regional sales manager for the northeast region.

Comsearch, Reston, VA, has promoted **Michael K. Morin** to vice president of the Mass Media Services Division. Comsearch Mass Media Services provides engineering and consulting for cellular radio, multipoint distribution systems, digital termination systems and other over-the-air telecommunications systems.

Moseley Associates, Goleta, CA, has announced the appointment of **W. R. "Terry" Sheffield** U.S. sales manager.

Robert C. Hagerty, operations manager at Digital Equipment Corporation's computer products manufacturing plant in Phoenix, has been appointed manager of Ampex's video products manufacturing facility in Colorado Springs, CO.

Scientific-Atlanta, Atlanta, GA, has appointed **J. Benson Furqueron** as sales support manager, Optima Division.

Yoichi "Sonny" Kawakami, has returned to the Tokyo headquarters for Mitsubishi Electric's North American Digital Audios' operation to coordinate worldwide marketing strategies.

Yong T. Lee has been appointed president of M/A-COM MVS, Burlington, MA. He has held both line and corporate staff positions at M/A-COM. Most recently, Yong was division vice president of M/A-COM's Microwave Defense Subsystems Group.

Harry N. Larkin has been appointed vice president and director of marketing of Belar Electronics Laboratory.

Vicon Industries has announced the appointment of **Marvin Harlan** as Eastern sales manager for its CCTV security equipment.

Telemet, Amityville, NY, has announced the appointment of **Leo Lazarus** to the post of customer service manager.

Christopher Pettit has been appointed managing director of Eddystone Radio Ltd., a member of Marconi Communication Systems Ltd., Chelmsford, U.K.

Charles J. Bierbauer has been appointed chief White House correspondent for Cable News Network. In addition to covering the White House, he will provide political news analysis and moderate CNN's Election Watch, a roundtable discussion with members of the press on the week's election developments.

The Magnetic Tape Division of Agfa-Gevaert has announced the appointment of two technical sales representatives and a laboratory engineer. **Gerald J. Mahler** has joined the company as a technical laboratory engineer. **James G. Hamilton** has been appointed technical sales representative for the Midwest. **Brian J. Kelley** has been appointed technical sales representative for the Atlantic region.

Stanley H. Burg has joined the Jerrold Division of General Instrument Corporation, Hatboro, PA, as vice president of marketing for the Distribution Systems Division.

business

CORPORATE DATA

Pennington/Wilke Associates Ltd. specializes in corporate TV consulting services. The newly formed company, located at 260 Madison Ave., New York, combines the talents of Bruce Pennington and Hubert Wilke. Their object is to develop communications programs, teleconferences and other such services for management and financial reporting, marketing, training, promotion and shareholder relations.

Pennington, formerly in network broadcasting and with experience in organizing teleconferences, created the concept of televising a corporate annual report in 1980.

Wilke is chairman and CEO of Hubert Wilke, Madison Avenue, a communications facilities consulting firm, internationally recognized for design and engineering projects for audio-visual audio, TV and telecommunications systems.

Tektronix, Beaverton, OR, has named EIL Instruments as distributors for the 2200-series portable oscilloscopes, as well as all TEK scope accessory probes, carts and CRT cameras.

Chroma Digital Systems, Los Gatos, CA, has announced an 18-distributor network to handle its recently introduced Chromafex 766, a unit that combines TBC, synchronizer, frame storage and digital effects capabilities.

ADDA Corporation, Los Gatos, CA, is manufacturing the AC-21 PAL dual-channel TBC and frame synchronizer in a new manufacturing facility in Waterford, Ireland, UK.

Interactive Motion Control, Culver City, CA, assisted **Optimus,** Chicago, IL, solve some special animation and keying problems in commercial productions with their computer-controlled animation stand.

The Elcon 254 dedicated 1-inch videotape cleaner/profiler, available through **Television Equipment Associates,** South Salem, NY, is rejuvenating videotape at CBS, Disney, Modern Video and other facilities.

Fuji Photo Film

In our May issue, we reported on significant achievements of manufacturers throughout our industry. Two of the photos were incorrectly iden-

tified. We provide them here with correct identification of Fuji staff. Again our compliments to Fuji Photo for their work for the industry over the years.

1982. In September, Bernie K. Yasunaga, vice president of Fuji Photo Film, received the EMMY from John Cannon (left), NATAS president, for his contribution in developing color negative and positive materials. In March, Fuji won an Oscar for the same achievement, becoming the first company to earn these top honors from both the motion picture and TV industries.

1982. Hirozo Ueda, senior managing director of Fuji Photo Film, receives the SMPTE Kalmus Gold Medal from Charles Anderson (left), SMPTE president, for his efforts in developing color films.

ADC Magnetic Controls, Minneapolis, has received the 1983 *Ad of the Year Award* from **Broadcast Engineering** for having created the most effective ad to appear in the magazine during 1983.

The award culminates a 12-month program, during which one ad from each monthly issue of **BE** was selected by a panel of publishing and marketing authorities and named the *Best Ad of the Month.*

VCA/Teletronics' use of **Ampex,**

ADO and **Quantel** special effects capability contributed to its winning of the 1984 VPA Monitor Award for *Best Achievement in Special Effects—Post-Productions.*

Microwave Mobile Systems, Huntington Beach, CA, cooperated with the satellite systems division of **Bonneville Telecommunications Corporation** to transmit live and taped coverage of the Democratic National Convention in San Francisco for numerous group and individual TV stations around the country.

RCA Astro-Electronics, East Windsor, NJ, has installed a worldwide, ground-based network to carry out launch operations for communications satellites. The network includes a satellite operations control center (SOCC) at the Astro facility, a transfer orbit station (TOS) on the Island of Guam, and a tracking, telemetry and control (TT&C) station that will be located in the New Jersey area.

D/FW Metroplex, Irving, TX, will gain dimension and flexibility in communications by satellite as **Uplinks Unlimited** inaugurates services to link the Metroplex to any location around the world. Uplinks Unlimited, the first independent satellite carrier in the Metroplex, offers video, data and audio uplinking to any satellite.

Turner Engineering, Mountain Lakes, NJ, now serves as a distributor for **Datum,** Anaheim, CA. It distributes SMPTE/EBU longitudinal and vertical interval time code products in New York City and northern New Jersey.

Oak Industries, Rancho Bernardo, CA, and **Leitch Video Ltd.,** Toronto, Canada, have announced an agree-

ment granting Oak an exclusive license for Leitch designs and technology for scrambling satellite TV signals.

BASF Systems Corporation, Bedford, MA, has reorganized its audio-video marketing/sales operations to reflect the company's growth in videotape and floppy disk sales and significant gains in audio market share. In addition to two internal promotions, new product managers will be added to the staff.

EQUIPMENT SALES

Spantel International, formerly the international division of **Reach,** has moved into new offices located at 710 Kipling St., Suite 405, Lakewood, CO 80215; 303-235-0640.

NEW ADDRESSES, DIVISIONS

Marconi Communications Systems, Ltd., Chelmsford, UK, commissioned two containerized 11-14GHz satellite earth stations for the Mercury Communications Ltd., London, Isle of Dogs site. One of the systems will work through an Intelsat satellite, providing international TV services to the United States. The other is designed to work to an Eutelsat system for dedicated TV transmitting services to European CATV users.

Arriflex Corporation, Blauvelt, NY, provided two unmodified 35-3 cine cameras for the space shuttle flight in February. One was used for in-cabin filming activities, while the second was used to record cargo bay, extravehicular and satellite deployment activities.

Conus Communications, a division of Hubbard Broadcasting, has enjoyed a flurry of activity for their NEWSTAR transportable Ku-Band uplink unit, including stations KPRC-TV, Houston; WLS-TV, Chicago; and KSTP-TV, St. Paul, MN.

Modulation Associates, Mountain View, CA, is providing SU-10 solid-state uplink equipment for the Kavouras (Minneapolis) satellite data network. For airlines, broadcasters, utility companies and governmental agencies, the network receives 56kbit/second data through Data-SAT downlinks.

RCA Laboratories, Princeton, NJ, has selected **United Media's** Commander II video editing system for manufacturing in-house videodiscs. Other Commander II sales include **Mark III Productions,** Miami, and **Sperry Cor-**

poration, St. Paul, MN, for their computer systems division.

Cosmos Broadcasting Corporation, Greenville, SC, has recently purchased the Vidifont Graphics V character/graphics system, manufactured by **Thomson-CSF,** Stamford, CT, for each of the group's six stations.

Burbank Studios, home of Warner Brothers and Columbia Pictures, selected a Mitsubishi X-800 32-track digital recorder for its Scoring Stage #1. The Mitsubishi machine will be used primarily to record the musical portions of motion-picture soundtracks.

Broadcast Equipment Rental Company, Burbank, CA, has boosted its business with three complete Sony Betacam camera/VTR systems. Among the first uses of the new ½-inch camera/VTR system was taping last year's *Johnny Carson's Greatest Practical Jokes.*

Custom-built for **Film/Video Equipment Service Company,** Denver, the Dual-Truck remote production system consists of a self-contained engineering vehicle and a control-room vehicle, and can be split up or used as one unit in various configurations. It was recently used in downtown Denver by Midtown Video to cover a Mobil Oil annual employee meeting.

Pye TVT Ltd., the broadcast company of Philips, is supplying more than $30 million in TV broadcasting equipment to Mexico's Televisa S.A. to cover the World Cup in 1986. The contract includes more than 100 of Philips' LDK 6 cameras, 60 LDK 14 portable cameras and nine completely equipped outside broadcasting vehicles.

Continued from page 20

Figure 1.) The linear portion of the curve will not produce the greatest efficiency, however. As a result of constantly increasing power costs, many transmitters have been adjusted for maximum efficiency.

The aural transmitter PA has been relatively easy to handle. Because only a relatively narrow bandwidth is

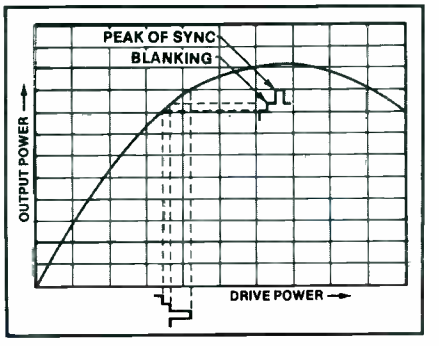


Figure 1. Output power and sync response of a klystron properly tuned for visual service. An increase in drive results in sync compression distortion.

required, a synchronously tuned klystron (in UHF service) can be adjusted for a reasonable efficiency figure. All cavities are essentially tuned to the same frequency and the drive is adjusted to just below the klystron saturation level. (See Figure 2.) Saturation for the klystron is that input power level beyond which an increase in input power results in a decrease in the output level. Your transmitter book should properly describe the method for your system.

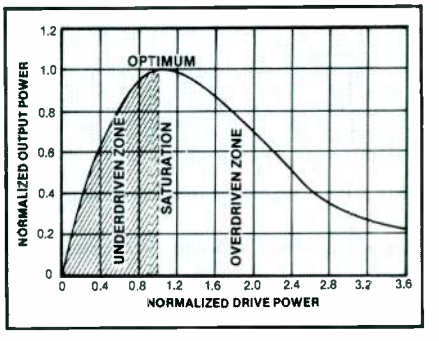


Figure 2. RF output power as a function of RF drive power. Proper drive levels fall in the cross-hatched area.

In visual service, however, the situation is somewhat different, particularly for UHF systems. A broadband response is essential to cover the band of frequencies required for the TV visual information. Suddenly, each cavity must be tuned to a certain point within the bandwidth of the signal in order to achieve picture detail and color fidelity. (See Figure 3.) The ideal

response of the amplifier and klystron is flat for white to blanking (black) picture levels. For sync and saturation, peaking of the response occurs at the visual carrier frequency.

Proper tuning takes time and patience. Then, when the input power

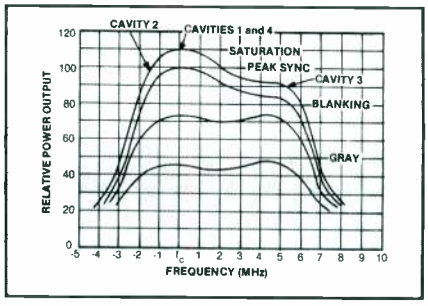


Figure 3. Output response for a klystron properly tuned for visual service.

drive level is adjusted to slightly less than the saturation point, all should be well. Note! All should be well, but may not be. The difficulty now depends on the theory of operation of the klystron. (See Figure 4.)

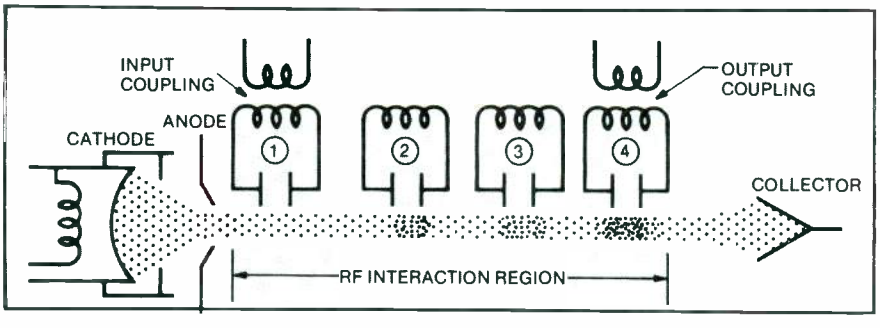
Inside the klystron, electrons are generated by heating the cathode. Ultimately we want the majority of the electrons to arrive at the collector. Biasing voltages and current are used in magnetic assemblies and on the cathode, anode and collector to focus the electrons into a narrow beam as they pass through the tube. Information is applied to (and excites) the input cavity (1). Depending upon its polarity, electrons passing the cavity gap as 1 may be momentarily slowed down or speeded up. Thus, a change occurs in the density of what was a homogeneous stream of electrons.

As the electrons pass gap 2, the tuned circuit of cavity 2 begins to pick up energy from the electrons. The tuned cavity, however, also begins to cause an additional bunching of the electrons in accordance to its frequency. Similar action occurs at the gaps of cavities 3 and 4, providing gain as a result of the increased and decreased electron densities caused by each cavity's resonant frequency.

At cavity 4, a coupling device is inserted into the tube to extract energy from the bunched electron stream. The extracted energy is routed through the coaxial plumbing to the diplexer and then to the antenna. With all adjustments properly made, the electrons are grouped according to the amplitude of the driving signal.

Enter ICPM

As sync pulses occur in the input, however, the drive is suddenly increased, and may result in saturation or overdrive. (Remember that maximum modulation occurs during the transmission of the sync tip.) When this happens, some of the electrons are thrown out of step or phase with the rest. When such phase changes occur at the 60Hz sync rate, a consistent phase error in a few of the electrons results. The error is carried on to the output, the antenna and, eventually, to the IF strip of the receiver. When the



Schematics courtesy of Varian

Figure 4. Schematic equivalent circuit of a 4-cavity klystron.

visual information in the received carrier is used to mix with the sound information, the newly introduced phase errors are mixed into the detected sound, resulting in a buzz from the speaker.

Although most problems occur with UHF, VHF transmitters are not immune to ICPM problems. The wideband response needed for the visual information is developed with the circuitry surrounding the typical tetrode final amplifier. Proper adjustments of bias and drive, however, must still be observed for acceptable operation.

Once ICPM is introduced into the signal, it is difficult to remove completely. Some receivers have used a narrow bandwidth detection system, which effectively reduces the phase distortion. The need for a wider aural bandwidth in MTS transmissions, however, places new requirements into the system.

Cures

Getting rid of ICPM, or at least reducing the phase error, in the transmitter is possible, according to Carl Eilers of Zenith. In older transmitting systems, careful adjustments may help. A pre-correction network may also be possible.

Newer systems, particularly those using low-level modulation, can be aided by optimum adjustment of the carrier injection levels into the amplifier chain. The use of a small amount of quadrature (90° shifted) carrier around the modulator may also be needed.

High-level modulation transmitters must be approached differently. Pre-correction is almost always required. Such pre-correction may be found in newer exciter models as several levels of correction relative to visual modulation. Sync-level correction is included.

Conclusions

The problems of ICPM and buzz are not new. Their interplay in MTS transmissions, however, suggests a new look at their causes and cures. Without attention to adjustments and transmitter setup, you may expect to hear from many of your viewers, whose perfect televisions are suddenly producing a most annoying buzz. Reduction, and perhaps elimination, of the distortion is possible at the transmitter now. Perhaps the future will also bring receivers that are not susceptible to these distortions.

As you approach the problems of buzz and ICPM in your station, start by contacting your tube and transmitter manufacturers. Both will have advice on the proper methods to be used in your particular situation.

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STUDIO MAINTENANCE TECHNICIAN needed by this 15th market VHF independent. We are looking for someone to help us maintain our RCA, Grass Valley & Sony equipped facility in the beautiful Pacific Northwest. Qualifications include 3-5 years of system maintenance experience and a general class FCC license. SBE certification, operational experience or tech school also helpful. This is not an entry level position. Send resume to: Larry Brandt, KCPQ-TV, POB 98828, Tacoma, Washington 98488. EOE. 9-84-1t

MAINTENANCE ENGINEER to build and maintain recording studio in Tampa, Florida area. First 6-8 weeks to be spent in Southfield, Michigan at Corporate Headquarters. Salary $18-20,000 plus major benefits. Send resume to: Ron Rose Productions, 29277 Southfield, Southfield, MI 48076. ATTN: Mr. D. Wooster. 9-84-1t

THE OLYMPIC FLAME IS OUT! Join Us and Rekindle the Spirit. Video Maintenance Engineer — If you're a self-starter and competent with the new series VCR's, ENG/EFP cameras, production van and other TV equipment, as well as, client oriented oriented and excited at the prospect of participating in the design of new facilities; then this is for you. Cox Cable Santa Barbara is located in one of the world's most desirable areas and is involved in delivering a 24 hour local channel with aggressive ad sales and delivery of production services. Send your resume to Thom Pratt, Cox Cable Santa Barbara, P.O. Box 3920, Santa Barbara, CA 93130, (805) 963-0911. 9-84-1t

CHIEF ENGINEER — Major midwest market 50kw — AM and 100kw — FM, union shop. Must have strong radio enginering management experience. Send resume, references and salary requirements to Dept. 624, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. An Equal Opportunity Employer. 9-84-1t

TV MAINTENANCE SUPERVISOR. For installation and repair of studio and transmitter equipment. Requires FCC general class license, good supervisory skills and minimum three years maintenance experience. Knowledge of TV broadcast, production and related equipment essential. PBS affiliate. Competitive salary and excellent benefits. Send resume to: WXXI Personnel Dept., P.O. Box 21, Rochester, NY 14601. EOE. 9-84-1t

TELEVISION MAINTENANCE ENGINEER: Candidate should be experienced in the maintenance of ¾ inch, 1 inch, and 2 inch VTR's, broadcast quality cameras and UHF transmitter. Send resume to: KITN-TV, 7325 Aspen Lane, N, Minneapolis, MN 55428 E.O.E./m.f. 9-84-1t

The Good Life Beckons

ENG MAINTENANCE ENGINEER

A major VHF independent television station, located in Los Angeles, is actively seeking an ENG Maintenance Engineer to coordinate, repair, troubleshoot, and maintenance of our news gathering technical systems.

Principal activities will include engineering maintenance of broadcast tape, and edit equipment including the BVU 200 & 800 Sony VTRs and editors, IKEGAMI HL-79 and Thompson 501 cameras and related technologies. Your experience in microwave and recording systems is highly preferred. The ability to work effectively with others is essential.

To investigate the superior salary and benefits program we offer in a progressive team spirited environment, please forward resume to:

TV Chief Engineer
P.O. Box 1856
Los Angeles, CA 90078

EOE M/F/HC/VET

ELECTRONIC ENGINEER: HIGH-SPEED TAPE DUPLICATION. Bonneville Media Communications has an immediate opening for an Electronic Engineer for our High-Speed Tape Duplication facility. This is a new position. We are expanding our staff in the pursuit of excellence in tape duplication. This position requires a BSEE degree or equivalent technical background plus 3-5 years experience with professional audio equipment and/or high-speed tape duplication equipment. Experience with Gauss or other loop-bin duplicator systems is very desirable. Excellent self-motivation and self management skills are required as is an ability to work well with people. The ability to demonstrate a professional track record of accomplishment is required. A very complete resume which details specific areas of expertise and interest is expected. Prospective candidates please note that all engineering and production areas are designated "NO SMOKING." Please reply to Ellen Richardson, Director of Human Resources, Bonneville Media Communications, 130 Social Hall Avenue, Salt Lake City, Utah 84111. "AN EQUAL OPPORUTNITY EMPLOYER." 9-84-1t

TELEVISION POST-PRODUCTION FACILITY SEEKS chief engineer for maintenance of broadcast-quality video equipment. Applicants should have experience with quad and helical VTRs, TC editing, color cameras and audio systems. Astro Video Service, 61 W. Erie St., Chicago, IL 60610. 9-84-1t

MOPIX/TV FACILITIES MANAGER (Technical Operations Manager): Supervises Washington, D.C. plant of 85 employees. Position requires at least 10 years experience at network or major market television station. Skills should include extensive studio maintenance of state-of-the-art television equipment, hands-on experience with studio color cameras, video tape machines (¾-Quad-1-inch), signal converters, and engineering gear. Must be proficient in the technologies of computer operations, satellite, teleconferencing communications. A strong, technically fluent leader is needed. Graduate engineering degree preferred. Salary range from $59,223 to $69,900. Senior Executive Service. Send resume or application before October 1, 1984 to: U.S. Information Agency, Room 524, 301 4th Street, S.W., Washington, D.C. 20547. USIA IS AN EQUAL OPPORTUNITY EMPLOYER. 9-84-1t

TELEVISION/ENG ENGINEER

If you have experience in maintaining and repairing Sony Electronic News Gathering equipment, and you are interested in a career with a TV station in southeast Texas, we'd like to hear from you. Excellent company benefits, a friendly environment, good working conditions and a competitive salary can be yours if your qualifications meet our needs. Reply to:

KJAC TELEVISION
P.O. Box 3257
Port Arthur, TX 77643

Attn: Charlie Ravell, Chief Engineer
An Equal Opportunity Employer M/F

TRANSMITTER SUPERVISOR: 220 KW Channel 21 Transmitter. Applicants must be experienced in the maintenance of high powered UHF TV transmitters, preferably those using parallel amplifiers. Must also have experience with microwave transmitter and receivers and be capable of making proof of performance measurements. Additional background in the maintenance of studio cameras and VTR's would be helpful but is not essential. Send resume to: Dept. 620, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 9-84-1t

HEAD ENGINEER — TELEVISION PRODUCTION STUDIO, working with 1 in., 2 in. and ¾ in. ENG equipment. No degree required. Good fringe benefits and retirement program. Leadership ability and four years' studio maintenance experience. Contact Mr. Bill Henry, Associate Personnel Officer, P.O. Box 5446, Mississippi State University, Mississippi State, MS 39762. Mississippi Cooperative Extension Service is an AA/EOE. 9-84-1t

CHIEF ENGINEER FM RADIO: Two station responsibility in central Florida. Technical education, FCC First, or General, license, FM studio and transmitter maintenance experience required. SBE certification desirable. Fringe benefits. Send resume to Director of Engineering, 6400 York Road, Baltimore, Maryland 21212. 9-84-1t

SALES — BROADCAST MICROWAVE SERVICES, INC. is seeking a highly motivated individual to join our marketing team. You will be responsible for selling microwave video equipment to TV Broadcasters in a five state area, based in Dallas, TX. Salary to commensurate with experience. An Equal Opportunity Employer. Send Resume to BMS, Attn: Jeff Harding, 7322 Convoy Ct., San Diego, CA 92111. 9-84-1t

ASSISTANT CHIEF ENGINEER: Denver station is seeking applicants with extensive technical and managerial skills, experience in commercial television and dedication to excellence. Full facility station has challenging opportunities for aggressive go-getter. KWGN-TV, P.O. Box 5222, Englewood, CO 80155. EOE. 9-84-1t

VIDEOTAPE MAINTENANCE ENGINEERS, VIDEOTAPE OPERATORS. AMPEX 2", 1" TYPE C and ¾" BVU EQUIPMENT. Immediate openings for experienced personnel. Please reply to: TOM MONJACK, 1541 North Vine Street, Hollywood, CA 90028, (213) 460-2112. 9-84-2t

People
Continued from pae 251

VideoStar Connections, Atlanta, has announced the appointment of **David Green** as marketing director, Private Satellite Networks.

Joseph W. Hanf has joined Western Broadcast Systems, Cupertino, CA, as regional sales manager.

Walter B. Freas Jr., director of educational services for New Jersey Network, has been elected vice chairman of the Central Educational Network's (CEN) Educational Technology Council.

Keiichi Takeoka, president and chief executive officer of Matsushita Electric Corporation of America (MECA), Secaucus, NJ, has announced the election of **Joseph Dillon** to the position of president, Matsushita Engineering and Service Company.

Auditronics, Memphis, TN, has appointed **Michael Uhl** to national sales manager.

Augustine A. Campiglia has been elected vice president, finance, at RCA American Communications, Princeton, NJ.

Andre Macaluso has been named general manager of Audio Plus Video International, Northvale, NJ.

Tom Shearer has been named Midwest regional manager for Sony Video Communications, Park Ridge, NJ. I:(=)))))

Now there's even more to look into

TM14-9RH

TM20-9RH

Ikegami's new Broadcast Color Monitors

Ikegami has just made it impossible for any quality-minded high resolution color monitor user not to consider looking into an Ikegami monitor.

They call it the 9-Series, two new monitors (13V and 19V) with standard features that include a High Resolution Shadow Mask CRT with a Self-Converging In-Line Gun; American Standard Matched Phosphors; a Comb Filter to preserve luminance resolution; pulse cross and R-Y/B-Y outputs. We think you'll call it just what you've been looking for.

Along with its streamlined design and easily serviced modules, Ikegami's new monitors follow in a tradition of excellence. Each offers high stability, exceptional performance and proven reliability. Together with Ikegami's Delta-Gun Series, the 9-Series provides yet another reason to look into the monitors that more and more video users are spending their time looking into.

Isn't it time you looked into Ikegami monitors?

Ikegami

9-Series monitors

Ikegami is the supplier of Color Monitors to ABC for its coverage of the 1984 Winter and Summer Games.

Ikegami Electronics (USA) Inc., 37 Brook Avenue, Maywood, NJ 07607 (201) 368-9171 • Northeast: (201) 368-9171
West Coast: (213) 534-0050 • Southwest: (713) 445-0100 • Southeast: (813) 884-2046 • Canada: (201) 368-9179

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When the 5,000 seat Auditorium of the Akron Baptist Temple was planned, a console offering the ultimate in performance and flexibility was required for both sound reinforcement and broadcast functions. At the same time an unobstructed view forward of the controls was essential.

Ward-Beck responded by creating this unique low-profile mainframe design featuring a satellite meter unit.

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