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.


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.
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:
- Multiple fonts of character generator quality
- Color table and frame animations; sequenced graphic playback
- Paint system capabilities including variable airbrush, palette mixing, "gloves", "gleams" and transparent colors
- Stencils, grids, zoom and pan rotations
- Perspective "cut and paste"
- Full color digitizer

The Leader in Electronic Graphics
Colorgraphics Systems, Inc.
A Dynatech Broadcast Group Company
5725 Tokay Blvd., Madison, WI 53719 608-274-5786
Circle (3) on Reply Card
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.
Comark's “S” Series
UHF Television Transmitters

Simply Superior

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 SAW 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 ICFM correction systems, and the services of Comark’s 24-hour field operations group.

Simply Superior

Engineering
and Sales Offices
PO Box 275
Colmar, PA 18915
(215) 822-8777
Fax: 84-6075

Circle (4) on Reply Card

International Headquarters
PO Box 229
Rt 57, Feeding Hills Road
Southwick, MA 01077
(413) 569-5939
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 unnecessary, 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...
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, 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 auxiliary channels can be displayed on main and delayed time bases 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.

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.

LEADER Instruments Corporation
380 Oser Avenue
Hauppauge, N.Y. 11788 (516) 231-6300
Regional Offices: Chicago, Los Angeles, Dallas.
For Information Circle (5) on Reply Card
For Demonstration Circle (6) on Reply Card
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. Non-commercial 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. NRRA 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.
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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P.O. BOX 1114 GRASS VALLEY CALIFORNIA 95945 USA · TEL (916) 273-8421 TWX 910·530·8280
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Offices: Eastern Regional: 499 Thornall St, Edison, NJ 08817, (201) 549-9600 · Southeastern District: 1644 Tullie Circle N.E., Ste 102, Atlanta, GA 30329 (404) 321-4318 · Midwestern Regional: 810 West Bristol St, Elkhart, IN 46514 (219) 264-0931 · Northwestern District: 3585 North Lexington Ave, Ste 238, Arden Hills, MN 55112 (612) 483-2594 · Southwestern District: 316 Seminary South Office Bldg, Fort Worth, TX 76115 (817) 921-9411 · Western District: 1032 Elwell Court, Ste 244, Palo Alto, CA 94303 (415) 968-6680 · Western Regional: 21243 Ventura Blvd, Ste 206, Woodland Hills, CA 91364 (213) 999-2303

Circle (7) on Reply Card

September 1984  Broadcast Engineering  7
ES 160 Mounted in a 5 1/4" relay rack panel and chassis, displays six digits of information on 4" LED displays, in 12 hour format.

ES 160 has a three second accuracy. Its standard output is serial BCD, CMOS compatible and can drive 100 ES 151, 156, 171, 991, 992 Remote Displays without buffering. Diode Clock, 5 1/4" High x 19" Wide x 15" Deep $1100

ES 161 One second per month version of ES 150. $1287

ES 161 MTR

The most economical Masters, ES 192 (12-Hz) and ES 194 (24-Hz) are constructed using ES 112 or ES 134 digital clocks and adding the ES 187 Serial Time Code Generator to provide the output needed to drive Remote Serial Displays ES 151, 156, 171, 991 and 992 Displays. Are 55" gas discharge.

Dimensions: 2 1/4" High x 8" Wide x 3" Deep, $541

ACCESSORIES

ES 191 REMOTE DIGITAL DISPLAY Displays serial time data and displays digits of time on a digital display, in 12 or 24 hour format.

Dimensions: 10" Wide x 3 1/4" High x 4" Deep, $387

ES 192 IMPULSE DRIVER Plug 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.$220

ES 193 REMOTE DIGITAL IMPULSE DRIVER Similar to the ES 181 except that the ES 94 derives its count command from the ES 192 Impulse Driver, or any impulse clock drive circuits already installed.

Dimensions: 5" Wide x 2 1/2" High x 8" Deep $256

ES 195 IMPULSE DRIVER The ES 195 Impulse Clock Driver was designed to provide synchronized power to the ES 160 impulse Clock. ES 195 is capable of driving any ES 168 clocks and will keep them running accurately through twelve hours of power failure. The ES 195 derives its synchronization pulse from any one pulse per second source, such as an ES Master Clock and can also accept the time pulse per second, alternating 12 or 24 volt impulses from an existing impulse clock system.

ES 196 JUMBO 12" CLOCK DISPLAY Features six digits of one inch gas discharge display in 12 or 24 hour format. Receives serial time code input from any ESE Master Clock or ES 157.

Dimensions: 10 1/4" Wide x 4 1/4" High x 3 1/4" Deep, $538

ES 187A SERIAL TIME CODE GENERATOR An integral part of ES 156 and 192/194 Master Clocks. This unit can be added to any other ESE product, including ES 112, 124, 184, 992, 994, 750, 751, 753, 754 and all 790 Series Time Programmable Drives. Drives ES 151, 156, 171, 991 or 992 Remote Displays, 313

ES 166 IMPULSE CLOCK operates from the ESE input of the ES 165 Impulse Driver. As many as 51 ES 166 clocks 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 minute hands. 318

ES 171 CHANDELIER MOUNT REMOTE DISPLAY Receives the serial time code generated by any ESE Master Clock, or any ESE product containing the ES 157 serial time code generator, and displays it in bright red 4" LED's.

Dimensions: 2 1/4" High x 4 1/4" Wide x 4" Deep, $196

IMPULSE CLOCK When a sweep second hand is desired, specify the 3201."Extra Flash" impulse clock. This clock face is 12 inch diameter, with a .125 inch silence, and a selector switch for selecting the clock face, in 12 or 24 hour format. 319

ES 185 IMPULSE DRIVER The ES 165 Impulse Clock Driver was designed to provide synchronized power to the ES 160 impulse Clock. ES 185 is capable of driving any ES 168 clocks and will keep them running accurately through twelve hours of power failure. The ES 185 derives its synchronization pulse from any one pulse per second source, such as an ES Master Clock and can also accept the time pulse per second, alternating 12 or 24 volt impulses from an existing impulse clock system.

ES 184 REMOTE DIGITAL IMPULSE DISPLAY Similar to the ES 161 except that the ES 164 microprocessor based system is enclosed in a 5 1/4 inch relay rack panel and chassis.

STANDARD UNITS

ES 750L - ES 116 and one 8 Digit Program

ES 761L - ES 124 and one 8 Digit Program

ES 755L - ES 116 and two 8 Digit Programs

ES 754L - ES 124 and two 4 Digit Programs

ES 756L - ES 160 and two 4 Digit Programs

ES 780 - 10 Days, 10 Outputs, Hours, Minutes, Seconds

ES 783L - 10 Days, Hours, Minutes, Seconds

ES 784L - 100 Days, Hours, Minutes, Seconds

ES 785L - 100 Days, Hours, Minutes, Seconds

ES 786L - 100 Days, Hours, Minutes, Seconds

FOUR DIGITS OF PROGRAMMING CAPABILITY

ES 787L - 100 Days, Hours, Minutes, Seconds

ES 788L - 100 Days, Hours, Minutes, Seconds

ES 789L - 100 Days, Hours, Minutes, Seconds

The size of the unit is 5 1/4" High x 19" Wide x 10 1/2" Deep - Relay Rack construction, totally enclosed, with a screen top.

ES 993 0 DIGIT SERIAL INPUT SLAVE Features four digits of 2" high gas discharge displays.

Dimensions: 201 1/4" Wide x 22 1/2" High x 5" Deep, $1254

ES 992 2 DIGIT SERIAL INPUT SLAVE Features two digits of 2" high gas discharge displays and two digits of (Seconds) of 1" gas discharge displays. Receives serial time code input from any ESE Master Clock or ES 160.

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

ES 204 Video Time and Date Generator $495

The ES 204 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 ES 204 to add the data.

570 SERIES

THUMBWHEEL PROGRAMMER COMPARATORS

When programming up to eight time events, the 750 series is recommended. Thumbwheel switches are set to program the time information from an ES Clock or Timer. An output 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 3 1/4 inch high relay rack panel and chassis.

STANDARD UNITS

ES 750L - ES 116 and one 8 Digit Program

ES 761L - ES 124 and one 8 Digit Program

ES 755L - ES 116 and two 8 Digit Programs

ES 754L - ES 124 and two 4 Digit Programs

ES 756L - ES 160 and two 4 Digit Programs

ES 780 - 10 Days, 10 Outputs, Hours, Minutes, Seconds

ES 783L - 10 Days, Hours, Minutes, Seconds

ES 784L - 100 Days, Hours, Minutes, Seconds

ES 785L - 100 Days, Hours, Minutes, Seconds

ES 786L - 100 Days, Hours, Minutes, Seconds

FOUR DIGITS OF PROGRAMMING CAPABILITY

ES 787L - 100 Days, Hours, Minutes, Seconds

ES 788L - 100 Days, Hours, Minutes, Seconds

ES 789L - 100 Days, Hours, Minutes, Seconds

The size of the unit is 5 1/4" High x 19" Wide x 10 1/2" Deep - Relay Rack construction, totally enclosed, with a screen top.

ES 790 MICROPROCESSOR-BASED PROGRAMMABLE TIMER $3790

The size of the unit is 5 1/4" High x 19" Wide x 10 1/2" 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 are set by relay contact closures (single pole normally open) or remote serial input displays.

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 back-up ensures that the battery back-up is provided for unexpected operation.

ES 790 is enclosed in a rack mounting chassis with a front panel measuring 5 1/4 high x 19" wide. Depth behind panel 10".

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 H.F. equalization. A very wide range of channel level control can be obtained with the GA. Output video is expected to be set for 0 volts D.C. on the blanking or sync level, with video extending positive and negative at the same rate, for a range of 1 v.p.p. Typical gain control ranges are from 1/2 volt to 7/10 volts p.p.
ES 562/564
SIX DIGIT CLOCK/TIMER WITH MEMORY

ES 562 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, and the timer to time events, more than 24 hours apart. The clock will display the time of day, as well as the date, and can be set to any date in the future. The timer can be set to any time in the future, and will display the time of day when the timer has expired.

70 SERIES
CONSOLE MOUNT CLOCKS AND TIMERS

ES 112 SIX DIGIT -12 HOUR CLOCK. Three controls- Fast Advance, Slow Advance, and Hold. $211

ES 111 SIX DIGIT -12 HOUR CLOCK. Three controls- Fast Advance, Slow Advance, and Hold. $211

ES 280 AUDIO TIME CODE GENERATOR/READER

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 EBU, but is designed to be used with ESE's own audio tape format. The code is very flexible, and can be used to record and play back any information that can be represented by a binary code.

70 SERIES
JUMBO CLOCKS AND TIMERS

ES 510L FOUR DIGIT 60 MINUTE TIMER

ES 510L is a four digit, 60 minute timer with start, stop, and reset controls. It is a very flexible timer, and can be used to time any event that lasts up to 60 minutes. The timer can be set to any time in the future, and will display the time of day when the timer has expired.

80 SERIES
2 INCH DISPLAYS

ES 301 PRESENTABLE UP/DOWN TIMER. Displayable Minutes and Seconds. Uses Lavery/heel Preset. Controls are Count Up, Count Down, Stop, Reset and Hold. $511

Dimensions: 4.45" high x 10.38" wide x 6.58" Deep.

ES 903/905 - 8 Inch Clocks. ES 902 (12 hr) and ES 904 (24 hr) - Hours and Minutes on Two Inch Gas Discharge Displays. Seconds on One Inch Gas Discharge Display. Three top-mounted setting controls - Fast Advance, Slow Advance and Hold. $471

Dimensions: 5" high x 12" wide x 3/4" Deep

ES 301/302 100 MINUTE UP/DOWN TIMERS

ES 301 is a four digit, one hundred minute timer (00:59) with six controls: Count Up, Count Down, Stop, Minutes Advance, Seconds Advance, Reset. Counting can be at any rate, and can be set back to zero. "Stop" control is pressed, the four digit display will be held. The unit will be changed to a slide show with the display time on the video portion of a tape, or on a monitor. The unit will continue to run from zero if reset while running. $168

ES 302 is a 100 minute timer, using either up or down, but not both. While the timer is counting, the display will change back and forth. The speed of the display will change as the speed of the timer changes. $211

ES 500 - FOUR DIGIT, 60 MINUTE TIMER. Displays minutes and seconds. Fast control allows remote wiring of three momentary SPST controls - Start, Stop and Reset. Reset returns display to zero, and timer will begin to run from zero if reset without counting. $238

ES 80 Series slaves are also compatible with other ESE clocks and timers: ES 112/124, 301, 502 and 510.

ES 303/304/305 - Three models, with five memory locations.

12 Inch Gas Discharge Display. $538

Dimensions: 2.18" High x 4.5" Wide x 0.13" Deep

ES 111AL/124AL DIGITAL CLOCK

ES 111AL is a 12 hour digital clock. Can display 12 hour, 24 hour, or 100 minute times. Display is gas discharge, and 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 and time will continue to run. $173

ES 124AL is a four digit, one hundred minute timer with start, stop, and reset controls. The timer can be set to any time in the future, and will display the time of day when the timer has expired.

80 SERIES
JUMBO CLOCKS AND TIMERS

ES 301/302 are 100 minute timers, using either up or down, but not both. While the timer is counting, the display will change back and forth. The speed of the display will change as the speed of the timer changes. $168

ES 303/304/305 - Three models, with five memory locations.

12 Inch Gas Discharge Display. $538

Dimensions: 2.18" High x 4.5" Wide x 0.13" Deep

ES 352 - SMITH TIME CODE READER/COMPARATOR

ES 352 is a versatile eight-digit SMPTE time code reader, which displays hours, minutes, seconds and frames on an LED display. The ES 256 reproduces a digital clock system: When a bad frame of time code is detected, the display will switch to a frame counting mode.

ES 510L is a four digit, 60 minute timer (00:59) with start, stop, and reset controls. If the timer display will hold the number for 20 milliseconds, and when restarted will continue with next count from last displayed figure. If reset while running, timer will continue to run. $90

ES 510L is a four digit, 60 minute timer (00:59) with start, stop, and reset controls. If the timer display will hold the number for 20 milliseconds, and when restarted will continue with next count from last displayed figure. If reset while running, timer will continue to run.
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 inadvertently 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.
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.
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.

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

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Circle (11) for literature
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.
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.

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- NON-VOLATILE MEMORY STANDARD
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Get Moseley Tough.
Contact Moseley Marketing.
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 synonymous. 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
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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 its 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 1/4 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.

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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, tilting 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 be eliminated. (See Continued on page 257...
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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 ¼-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. 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 19kHz, even when the signal source is available for comparison.\(^3\) 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.
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 CRT's, 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.

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.

For more information on how Midwest and Ikegami can deliver world class performance for your company, contact any Midwest office in the U.S. or call toll free (800) 543-1584.

Circle (14) on Reply Card

Midwest road shows
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 psycho-acoustic 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

### 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 at operating level + 10dB
- 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
  - 50-5000Hz + 10dB
- Excellent performance
  - 30-5000Hz + 15dB
  - 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
- 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
At TASCAM, we know how exasperating the hi-fi deck can be in any professional environment. The audio quality doesn't approach that of the machines with which it attempts to interface. The biggest hassle is balancing the entire juggling act with transformers and cables that allow the deck to be imposed into the system in the first place.

Well, the fighting's finally over. Whether your needs are for broadcast, recording studio, or multi-image applications, production, on-air, or sound reinforcement systems, TASCAM's professional 122-B and 133-B Cassette Recorder/Reproducers have got your balancing act wired. Out of the box, ready to go, no modifications. With the flick of a switch, each machine offers full compatibility with both high level +4 dBm, XLR balanced and line level unbalanced systems.

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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, 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 at 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 OVU 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 OVU 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 objectives 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% 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.

The clipping objectives target audio clipping at the audio output, and pilot clipping at the composite output. Either will obviously abate from the audio wave 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 distortion in 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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dynamic range isn’t a limit at all unless the program input exhibits greater dynamic range. 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 barrier, but loudness continues to increase as the threshold of limiting is exceeded and compression begins. The processor input level for the automatic measurement 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**
- **Beautiful Music/Jazz**
- **AOR/Adult Contemporary**
- **Rock**

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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Ask for the time code book and the name of your nearest EECO Authorized Distributor.

References:

Final thoughts

Achieving the fidelity objectives suggested in the BE audio 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.

Editors 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.
New features for Optimod-AM.

Trying to deal with the varying processing requirements of the different AM stereo systems can make anyone feel a little schizophrenic! Fortunately, moving jumpers on our new optional second-generation #1-S card can change its personality to perfectly harmonize the processing to the stereo system you choose, even if you change later.

The new #1-S card limits single-channel negative modulation to -75% to prevent distortion in Motorola-system stereo receivers, or to avoid excessive "compatibility controller" gain reduction in Harris exciters. In Motorola installations, the single-channel modulation limiter also prevents mono distortion and excessive occupied bandwidth dynamically (instead of limiting separation above 5kHz). This permits use of large amounts of preemphasis and achieves the brightest stereo sound and best-defined stereo imaging. Unlike techniques used in other processors, this control occurs in the stereo difference channel and cannot punch "holes" in the mono or otherwise degrade the performance of mono radios.

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We offer multiple equalization personalities too! In addition to our original high frequency equalizer which is computer-optimized to yield an FM-like sound on today's typical AM radios, we now supply two alternate plug-in equalizers. One offers smoothest sound from the new wider-band AM stereo radios, while the other splits the difference.

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"AFTER SCOUTING THE PROSPECTS, WE CHOSE THE CAMERA WITH THE BEST SHOOTING RECORD."

ROB DALTON, PRESIDENT AND GENERAL MANAGER, KAKE-TV, WICHITA

"At KAKE in Wichita, we're as demanding as they come. But let's face it. When you're Wichita's number one metro station, an ABC affiliate, and have a schedule as hectic as ours, you have to be. And when it came to buying new cameras last year, we made no exceptions.

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For a demonstration or more information, contact your local dealer or write Sharp Electronics Corporation, Broadcast Group, 10 Sharp Plaza, Paramus, NJ 07652. (201) 265-5548.

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company in communications

GSA Contract # GS00K8401S0188.
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- Arriflex Corp.
White Crow Audio uses SONEX a little differently...

and so do thousands of others.

Just listen — 1. White Crow Audio in Burlington, Vermont attaches SONEX to plywood panels in the LEDE control room and studio. It works “quite nicely,” says Todd Lockwood.

2. “It’s fantastic!” says Jeff Edman of Results Broadcasting, who uses SONEX to soundproof his studio. “Nothing compares — SONEX is worth twice the price, or more!”


4. SONEX reduces ambient noise and smooths out frequency response for master tape work at KLOR-FM, Ponca City, Oklahoma. “SONEX works GREAT! It’s far superior to any other system we’ve tried,” says David Gates.


When we asked our customers to show us how they used SONEX, we weren’t surprised to hear that it did the job. We knew that this patented acoustic foam with a specially sculptured anechoic design absorbs sound successfully. What really amazed us was the number of different applications they showed us. And what you’re looking at here are just five responses out of the hundreds we’ve received. Even so, you can see (and hear) for yourself: Wherever sound is the problem, SONEX is the solution.

SONEX is manufactured by Illbruck/USA and distributed exclusively to the pro sound industry by Alpha Audio. Get all the facts by calling or writing:

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Acoustic Products for the Audio Industry

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CTR 100™ Series from Fidelipac

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The STANTRON VIDEO CENTER series has been designed primarily for production and post-production facilities. The modular "add-on" features allow for maximum flexibility in designing console arrangements for professional, educational, industrial and communication VIDEO CENTERS. "Designed-in" structural strength and aesthetic features, required by users, is "standard equipment" for every STANTRON VIDEO CENTER unit.

For a FREE copy of the STANTRON VIDEO CENTER CATALOG #200, please write or call.

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* Distributor Network as of July 15, 1984
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.

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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.
READY TO PLUG IN.

and back.

ADC's unique split-cylinder system features contacts that will accept 22, 24 or 26 AWG solid or stranded wires. The cylinders are housed in plastic insulating modules and are recessed to virtually eliminate shorting at the contacts. Both sides of the contact have two-wire capability providing for four gas-tight terminations per contact. The cylinders are also rated for a minimum 100 cycles and are easily replaceable. Triple strain reliefing is provided on all units.

Pro-Patch and Ultra-Patch—as well as many custom configurations incorporating the split-cylinder contacts—are fast setting the stage for a new industry standard of wire termination.

For more information on these truly state-of-the-art audio patching systems—or the name of your nearest ADC distributor—write or call ADC Magnetic Controls Co., 4900 West 78th Street, Minneapolis, MN 55435, (612) 893-3000.

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

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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.

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.


Take out the doubt.

Circle (41) on Reply Card
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Industry-leading technical performance.
For example, maximum audio output is +30dBm without requiring transformers and noise is over 105dB below maximum output.

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D:2000 ROUTING SWITCHERS
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The DP-4050-0M 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 1/2" 4-channel recorder for professional broadcast and audio post-production. It compares favorably against more expensive 1/2" 4-channel recorders. And for top quality audio-visual programs, the BOII (a 1/4" version of the MARK III/4) is the world’s best 1/4” 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 1/2" 2-channel for record mastering.

The MARK III/8. The most widely accepted 1/2" 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 transport 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. The industry standard audio machine for 1/4" 2-channel or mono recording. The 5050 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 MX-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.
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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

Circle (44) on Reply Card
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...
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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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 NCAM 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 these 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:
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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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.”

“Accept the Sentry challenge. Write to me today for the complete SENTRY family story: Greg Silsby, Electro-Voice, Inc., 600 Ceci Street, Buchanan, MI 49107.”

When quality really counts, professionals count on Electro-Voice.

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We couldn't improve the conditions you work under. So we improved the tape you work with.

HGX Pro 1/2” Videocassettes.

Differences you can see, hear. And retain.

At last, tape performance impervious to the whims of weather and the rigors of editing. Harnessing new tape technology, Maxell brings ENG dramatic improvements you can see, hear and retain.

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A bond immune to time, temperature or mechanical stress. With no need of plasticizers, so none can creep to the surface. Anticipate far fewer dropouts, less clogging and extended tape and head life.

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A shell made to the industry’s toughest standards.

Ours. The transport is quiet, jam-proof. The housing immune to temperature extremes.

From open reel tapes to a complete line of KCS/KCA U-Matic, audio and VHS/Beta cassettes, we’re getting quality down to a science. And in your hands, our science turns to art.

HGX Pro 1/2” Videocassettes in Beta and VHS.

Maxell Corporation of America, 60 Oxford Drive, Moonachie, N.J. 07074  201-440-8020

Circle (51) on Reply Card
Circuit Research Labs is proud to announce our latest system. It's the FM2 audio processor with the SG 800 Stereo Generator. This system will provide a substantial improvement in your on air signal. You will hear improved fidelity with better stereo separation. Best of all, you can improve the loudness of your signal as much as 6db compared to other processors.

With so many stations playing the same music it becomes very important that it sound the best on your station. It needs to be loud to maximize your stereo coverage. Put better sound and better coverage together and you have better ratings. And that can mean money in the bank.

Stations world-wide are discovering the advantages of CRL processing. But hearing is believing. Let us loan you the system of your choice for a free two week trial. Find out why broadcasters are upgrading to CRL. Radio stations all over America depend on CRL to give them their competitive advantage.

Why not give me a toll free call right now, and let me tell you all about it and send you complete information. It won't be long before another rating period starts, so don't wait.

Call Bob Richards at 800-535-7648.
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Can the Panasonic AK-30 stand head to head with the bestselling broadcast camera in the world?

You bet it can. In fact, when you compare picture quality, automatic features and price, you'll discover the Panasonic AK-30 is far and away your best bet.

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The Panasonic AK-30. Compare it to the world's bestselling broadcast camera. And see why it stands out far ahead. *Plumbicon is a registered trademark of N.V. Philips for TV camera tubes.

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In Canada call: (416) 624-5010

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- **Allied Broadcast Equipment**
- **Andrew Corp.**
- **Antenna Art Communications, Inc.**
- **Aries Antennas, Inc.**
- **Cablewave Systems Inc.**
- **Cetoic Antennas**
- **Comark Communications Inc.**
- **Emcee Broadcast Products EnCom Systems Inc.**
- **George Kleinknecht Inc.**
- **Microfilter Corp.**
- **Fred A. Nudd Corp.**
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- **Radiotechniques Consulting Engineers**
- **ROHN**
- **Edward A. Schober, P.E.**
- **Broadcast Consulting Engineer**
- **Steiger, Murray Associates Inc.**
- **Broadcast Tech. Consultants**
- **Turner Engineering**
- **Utility Tower Co.**
- **World Tower Co. Inc.**

### Calibration, Instrument

- **Bird Electronic Corp.**
- **The Narda Microwave Corp.**
- **NEP Supershooter’s Inc.**
- **Phillips Test & Measuring Instruments, Inc.**
- **Photo Research Div. of Kolimorgen Corp.**
- **Polometric Instruments, Inc.**
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### Editing/Teleproduction Facilities

- **ABP Systems Inc.**
- **AVT TV Productions**
- **All Mobile Video**
- **Allied Film & Video Services**
- **All+ WBS Film & Video Services**
- **CRX Inc.**
- **Center Video Center**
- **Centro Corp.**
- **John Crowe Productions**

### Engineering Consulting, Design/Plans

- **ABP Systems Inc.**
- **AEG-Telefunken Transmitter Div.**
- **A. T. Associates, Inc.**
- **AVT TV Productions**
- **Advanced Technology Div.**
- **Symbolized Systems, Inc.**
- **Peter Albrecht Corp.**
- **Allied Broadcast Equipment**
- **Alpha Video & Electronics Co.**
- **Antek Analysis Technologies, Inc.**
- **Arden Design**
- **Atlantic Research Corp.**
- **Audio-Video Consultants**
- **Dave Industries, Inc.**
- **B W Lighting Systems (formerly Panoak Lighting)**
- **Robert Bosch Corp.**
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- **Bown Broadcast Service Co., Inc.**
- **Walter S. Brewer Co., Inc.**
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- **Richard W. Burden Associates**
- **CRX Inc.**
- **Cat Systems Inc.**

### Video Pulse Cross

- **Amsu America, Inc.**
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- **Electo USA, Inc.**
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- **Electro-Michael Ltd.**
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- **Boonton Electronics Corp.**
- **John Fluke Mfg. Co., Inc.**
- **G E Datel**
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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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A DECADE OF PROGRESS...
A DESIGN FOR THE FUTURE

VIDEOTEK

Videotek, in only 10 years, has emerged as an industry leader on the strength of quality products, competitive pricing, and an unprecedented record of delivery and customer service.

The Studio 13 is the latest example of this Progress by Design, incorporating more features and a higher level of quality than any color monitor in its class.

Line Select and 1H/2H Mode highlight the 1984 refinements to the ever-popular TSM-5A Waveform Monitor and VSM-5A Vectorscope.

As we enter our second decade, our commitment to offer the best products, prices, delivery, and service remains an uncompromised goal.

VIDEOTEK

125 North York Street, Pottstown, PA 19464. (215) 327-2292. TWX 710-653-0125/9625 North 21st Drive, Phoenix, AZ 85021. (602) 997-7523. TWX 910-951-0621

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When Mike Fayette set out to equip Chicago's new state-of-the-art editing and special effects house, the production switcher he chose was a Ross 508.

"Superior performance at a reasonable cost"

Mike Fayette - owner/editor, Post Effects, Chicago

As Mike puts it, "With the Encore memory system and serial interface to our ISC editor, no other switcher came close to matching the Ross 508's capabilities."

The Post Effects switcher lived up to the Ross record for reliability too: "We knew it would work, right out of the box--without glitches, problems and downtime -- and it did."

Post Effects specializes in complicated multi-level, multi-pass special effects--a demanding situation for any switcher. How does the Ross handle it? "Our editors like it and our clients keep coming back. The Ross switcher has played a major role in our success."

Let us help you write your own success story with a switcher from Ross Video.

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Telex: 05-811579

USA:
Ross Video Inc
P.O. Box 880
Ogdensburg, New York
13669

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September 1984  Broadcast Engineering  103
Broadcast product manufacturers' addresses

Acoustinic Corp., 19 Mercer St., New York, NY 10013
Acquis Ltd., 18952 MacArthur Blvd., Irvine, CA 92715
Acrodyne Industries Inc., 516 Township Rd., Blue Bell, PA 19422
Adams-Russell Co., Inc., Video Info.
Advanced Systems Div., 1370 Main St., Wal- 

Adams-Smith, 34 Tower St., Hudson, MA 01845

AEG-Telefunken), Box 7647, Hol-
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One of the world’s smallest digital still stores is also one of the largest.

Introducing "Snapshot" from MCI/Quantel. Only 12¼ inches high by 19 inches—including removable cartridge Winchester disk drive!

Snapshot is not only the smallest of MCI/Quantel's DLS 6000 series units—it's one of the smallest digital still stores in the world.

Snapshot lets you capture pictures from live asynchronous feeds, store up to 400 of them with titles, and replay them on demand. You can prepare and edit sequences or stacks of sequences. And you can search by title.

Need more? You can increase Snapshot's storage to 1,600 pictures. Or you can upgrade it to a DLS 6020 with on-air cuts and dissolves. Or upgrade it further to a DLS 6030, the most powerful still store available with production effects that bring an exciting look to your stills.

If that's not enough, you can integrate up to seven Snapshots—or other DLS 6000 series units—as workstations into our Central Lending Library (CLL). Now you can store over 10,000 stills at each workstation and have simultaneous access to 100,000 more from the CLL. Plus unlimited off-line storage on disc cartridges or videotape.

You can even include MCI/Quantel's Paint Box as one of the workstations. So you can create the finest electronic graphics ever seen in television and have them instantly available for on-air use as well as library storage.

So whether you want a small system or a big system, Snapshot is the place to start.

Call your local MCI/Quantel office for more details. Or get in touch with us directly at 415/856-6226. Micro Consultants, Inc., P.O. Box 50810, Palo Alto, California 94303.

MCI/Quantel and "Snapshot" are trademarks of Micro Consultants, Inc.
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.

For your information, our name is Harris.
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.
This new series of microprocessor-based panels has been designed by Utah Scientific to meet the needs of the broadcast and teleproduction 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.
Be sure they all get the picture
with General Electric
Professional Large Screen
Video Projection

With General Electric's exclusive system for bright, sharp professional-quality pictures, up to 25 feet wide, General Electric Professional Large Screen Video Projectors are making presentations more dramatic, more productive, and more convenient.

Whether videotape, live transmission, TV programming or data direct from your computer, the pictures projected can be seen by everyone in the room, all at once, even when room lighting is provided so viewers can take notes and refer to written material.

The color projectors show every viewer the same accurate color reproduction. An exclusive General Electric system registers the colors for you, eliminating time-consuming manual adjustments.

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:

Education: Medical, dental, engineering, computer science instruction.
Business: Sales meetings, industrial training, product presentations, real-time display of computer-generated data, teleconferences.
Aerospace and Defense: Situation displays, simulator training.
Entertainment: Theatre television, closed-circuit TV events, overflow crowds, special effects.
Television Production: Backgrounds for news programs, special effects, data display, program previewing.

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

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.

SELL-OUT CROWDS at Fiske Planetarium, Boulder, watched live NASA transmission presented by General Electric projector.
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 break-
downs—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 com-
patibility with the Betacam®
camera/recorder, along with its
multiple video and audio out-
puts 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.

For more information,
call in New York/New Jersey
(201) 833-5350; in the Northeast/
Mid-Atlantic (201) 833-5375; in
the Midwest (312) 773-6045; in the
Southeast (404) 451-7671; in the
Southwest (214) 659-3600; in the
West (213) 841-8711.

After all, to err may be hu-
man. But there’s nothing divine
about having

a machine.

Sony Broadcast Products Co., 1600 Queen Anne Rd., Teaneck, NJ 07666. ©1984 Sony Corp. of America. Sony is a registered trademark and Betacart and Betacam are trademarks of the Sony Corp.
ITC announces a revolutionary departure from the traditional triple deck cartridge machine. The Delta III’s advanced modular design gives you three independently removable decks. This means that you can remove a deck for easy maintenance and still stay on the air.

That’s great news for you and your listeners because the Delta III’s superior sound will spoil everyone who hears it. You won’t want to settle for less, and neither will they.

The Delta III is part of the Delta series, ITC’s new generation of cartridge machines. Mechanically, electronically and physically superior to previous models, the Delta Series is fast becoming the new standard of the industry.

That’s something you need to know. Because you wouldn’t want to miss the revolution.

Don’t Miss The Delta Revolution

INTERNATIONAL TAPETRONICS CORPORATION
2425 South Main Street / P.O. Box 241 / Bloomington, Illinois 61701
Call Toll-Free: 800-447-0414
From Alaska, Hawaii and Illinois call collect: 309/828-1381

Don’t Miss The Delta Revolution
Chester's been doing it since 1946. Making sure your genius works by providing high quality cable that conforms to your designs. As a result of your challenges, Chester is fast becoming known as the most flexible and reliable source for high quality cable. With service that always measures up to your high standards. And with all the tools and manufacturing capabilities to give you quick and efficient turn-around time.

Thanks to your inventive minds, we can continue to cultivate our growing line of products. Whether it's standard, custom-made, audio, video, coaxial, triaxial, multi-conductor; whether it's medical, military, broadcast — or "breakthrough." We've got the cable creativity for just about anything that comes to light. And all at a much better value!

So call for a design consultation. And ask for the new Chester Cable Broadcast Products Catalog. Call Chester Cable today — and keep your ideas flowing!

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P.O. Drawer D
Chester, New York 10918
(914) 469-2141

Meetng the challenge.
A unit of Chester Cableware Systems Corporation

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Television Transmitters

Nearly 2000 transmitters in 70 countries worldwide. That is the solid fact of Pye TVT's success.

And if you look more closely at our range of UHF television transmitters you will understand the reasons why.

Naturally you can take for granted high reliability and performance. Really exceptional, however, is the low cost of ownership – resulting primarily from the use of Beam Control Klystron tubes. Initially developed by Philips, these tubes bring significant economies in the electrical power consumption of medium and high power transmitters. Yet they still retain the inherent advantages of the Klystron – high reliability, long life and freedom from catastrophic failure. On top of that, they need minimal maintenance and low spares holdings. Apart from the Klystron, they are completely solid state. They are also easy to install and – for their output – the most compact available.

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.

Radio Transmitters

The Type LDM 1200 series of FM radio transmitters (15W to 40kW) is outstanding for its sound quality, reliability and its low cost of ownership. Common drive modules allow maximum systems capability and minimum spares holdings. Designed to work unattended in a variety of operational configurations, the range meets or exceeds the world's most exacting broadcast standards.

Now with RGB

The LDK14 family of color television cameras is world renowned as the go-anywhere camera system with high performance capability wherever it is used – for ENG, EFP or in the studio.

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.

For further information use the reader reply nos or send the coupon to:

PHILIPS TELEVISION SYSTEMS, INC.
900 Corporate Drive, PO Box 618, Mahwah, New Jersey 07430, USA
Tel: 201-529–1550 Telex: 37–62558
Canada: Electro & Optical Systems Ltd., 31 Progress Court, Scarborough, Ontario, Canada M1G 3V5 Tel: (416) 439–9333 Telex: 065–25431
Varian GEN II KPA.
Pushing earth terminal technology through the 80's.

Designed specifically for today's modern world of earth terminal communications, the new Varian GEN II KPA simplifies complex communications problems with its advanced computer interface options. Easily adaptable, GEN II can be programmed to IEEE 488, RS-232 and RS-422 data busses.

Smaller, more modern design. Modular construction includes a proprietary, digitally-controlled, all solid-state, low noise regulated power supply.

Integrated in the RF section is a digitally-controlled PIN diode attenuator to provide precise setting of the RF output.

Controls/ Monitors/ Logic section circuits use C-MOS high noise immunity digital techniques to energize, protect, control and monitor KPA performance. The modern front panel features all-LED indicators and digital meter displays.

Enhanced Varian klystron for high efficiency. GEN II utilizes the original, field-proven Varian VA-936 series klystron, with enhanced specification including 24-channels for top performance.

GEN II provides high efficiency with only 12 kVA for a full 3.35 kW tube, less than 1 kVA in standby and automatic 10% reduction of heater-voltage for extended klystron life.

*Patent applied

More information on the new GEN II KPA for the 80's is available from Varian Microwave Components and Subsystems Division. Or the nearest Electron Device Group sales office. Call or write today.

Electron Device Group
Microwave Components and Subsystems Division
3200 Patrick Henry Drive
Santa Clara, California 95050
Telephone: 408-496-273
The document contains a list of manufacturers and their addresses, including regions and contact information for various companies. It appears to be an address page from a product directory.
An editing system should anticipate its operator the way a great car seems to anticipate its driver. When Convergence decided to build the 200 Series, the goal was to put the Editor in the driver's seat with an extra margin of control at his fingertips. Not just for those once-in-a-while problem situations but for the day-to-day editing tasks.

One designer said it should handle like a sports car—fast on the straightaway and quick in the turns.

Another imagined a fine touring car—built for going long distances in comfort.

A third visualized a four-by-four—able to cover rough terrain with power in reserve.

When the 200 Series was complete, we could see that each of them had made his mark. From the glow of the amber status display to the feel of the new joystick, this is an editing system made to be driven. The 200 Series...built for speed, cruising and the rough uphill climb.

Test drive one today.
Manufacturers' Addresses

Minerott Electronics, Inc., Uber Products, 946 Downing Rd., Valley Stream, NY 11580

Minneapolis Magnetics, Inc., 9969 Valley View Rd., Eden Prairie, MN 55344

Minita Corp., Industrial Meter Div., 101 Williams Dr., Ramsey, NJ 07040

Miyas Industries, 17192 Gillette Ave., Irvine, CA 92714

Mitchell Camera Corp., 11630 Tuxedo St., Sun Valley, CA 91352

Mitomo Co., Ltd., 8-11 Jinnan 1-Chome, Shibuya-ku, Tokyo, Japan 151 506

Modular Audio Products, Unit of Modular Devices, Inc., 50 Orville Dr., Bohemia, NY 11716

Modular Sound Systems Inc., DBA Bag-End, Box 488, Barrington, IL 60010

Modulation Associates Inc., 897 Independence Ave., Mountain View, CA 94043

Modulation Sciences, Inc., 59 Myrtle Ave., Brooklyn, NY 11201

Modulight Systems Inc., Box 1009, Lyndonville, NY 14098

Moore Electronics, Inc., 212 House Blvd., Lyndeboro, NH 03764

Morgens Computer Corp., 52 Domino Dr., Concord, MA 01742

Tommy Moore, Inc., dba Fort Worth Tower Co., Box 8597, Ft. Worth, TX 76124-0597

R. K. Morrison Co., 819 Coventry Rd., Kensington, CA 94070

Moyle Associates Inc., 111 Castilian Dr., Goleta, CA 93117

Charles F. Rockhill, Tarry, Sheffied (805) 986-9821

Mole-Richardson Co., 937 N. Sycamore Ave., Hollywood, CA 90038-2384

Monroe Electronics, Inc., 212 Housel Ave., Lyndeboro, NH 03764

Montage Computer Corp., 52 Dominio Dr., Concord, MA 01742

Tommy Moore, Inc., dba Fort Worth Tower Co., Box 8597, Ft. Worth, TX 76124-0597

R. K. Morrison Co., 819 Coventry Rd., Kensington, CA 94070

Moyle Associates Inc., 111 Castilian Dr., Goleta, CA 93117

Charles F. Rockhill, Tarry, Sheffied (805) 986-9821

Mole-Richardson Co., 937 N. Sycamore Ave., Hollywood, CA 90038-2384

Montage Computer Corp., 52 Dominio Dr., Concord, MA 01742

Tommy Moore, Inc., dba Fort Worth Tower Co., Box 8597, Ft. Worth, TX 76124-0597

R. K. Morrison Co., 819 Coventry Rd., Kensington, CA 94070

Moyle Associates Inc., 111 Castilian Dr., Goleta, CA 93117

Charles F. Rockhill, Tarry, Sheffied (805) 986-9821

Manufacturers' Addresses
There are also some unique features such as trim files that compensate for differences between the internal pattern projector and the external scene caused by chromatic aberrations in the lens.

Finally, compare its performance to any other camera. An honest resolution of 800 lines at center, a practically noiseless S/N ratio of up to \(-58\) dB and a virtually unmeasurable .05\% registration error over the entire raster.

Best of all, the HK-322 is ready right now to fit into your idea of an ideal studio/field camera. Without compromise, but with plenty of accommodation.

Contact Ikegami. See for yourself. Ikegami Electronics (USA) Inc. 37 Brook Avenue, Maywood, NJ 07607

Northeast: (201) 368-9171
Midwest: (314) 878-6290
West Coast: (213) 534-0050
Southwest: (214) 233-2844
Southeast: (813) 884-2046

Circle (88) on Reply Card
Sharp® took a look at the best high resolution monitors around and found room for improvement.

The Price.

When Sharp got through looking at the competition, we had a clear picture of the features you want in a color monitor.

Features like:
- 0.31 mm dot pitch
- over 600 lines of resolution
- U.S. standard controlled phosphors
- switchable comb or notch filter
- cross pulse display
- normal or under-scanned picture mode

So Sharp combined all those features with the quality you expect in a broadcast grade monitor, and came up with one incredible unit, the XM-1300, Sharp's new 13" High Resolution Monitor. Then we topped it all with an unbeatable price, only $2,995. But don't take our word for it, come in and see it for yourself. Because with this monitor—one picture is worth a couple of thousand dollars.

For more information, contact your local dealer or write: Sharp Electronics Corporation, Professional Products Division, 10 Sharp Plaza, Paramus, NJ 07652 (201) 265-5548.

*Manufacturer's suggested retail price.
News is a race — first getting it right, then reporting it first — airing it first — winning your share, then keeping it. You need all the help you can get.

There's another race in news—the newsroom computer race. It seems everybody's telling you they can do everything better than everybody else. But, only QUANTANEWS™ has proven its networking, archiving, editing, and overall performance superiority under the toughest network conditions.

QNEWS is a winner. Check it out for yourself.
Don't wade through 1000 different product brochures...
Use BE's *Spec Book* instead!

Broadcast Engineering's 4th Annual *Spec Book* is designed to save you valuable time. And that makes it an essential tool for any broadcast equipment buyer.

**Comprehensive Equipment Listings**
*Spec Book* provides reliable specifications on nearly 1,000 different broadcast and broadcast related products, making it the industry's only single-source equipment comparison reference encyclopedia.

**Spec Book is Unique**
*Spec Book* is vastly different from buyers' guide directory issues, because it lists performance specifications, model numbers and special product features.

**Easy-to-Read**
*Spec Book*'s convenient format developed from your feedback on past Spec Books, allows you to gather information quickly and efficiently. This way, you spend less time searching through product literature, and more time studying valuable equipment comparison data.

**Spec Book Also Includes:**
- Reader service numbers — for each listed product. So you can request additional manufacturer information quickly and easily.
- How-to editorial — hands-on technical articles designed to help you stay informed on the latest technology. Expertly edited by BE's radio and television editors, both FCC-licensed engineers.

**SPEC•TACULAR Reader Contest**
*Spec Book* is a proven winner with equipment buyers like you. And now you can be a winner, too! With the 2nd Annual SPEC•TACULAR Reader Contest.

On the front cover of the forthcoming *Spec Book* you'll see 25 sections of equipment specs carefully selected from inside the issue. If you can match the cover specs with their exact location inside *Spec Book*, you can win one of two Studer ReVox B225 Compact Disc Players—valued at over $1,000 each. The B225 is suitable for home or broadcast use and performs every programming function imaginable.

You'll find complete contest rules and an entry blank inside the 4th Annual 1984 *Spec Book*. Don't miss your chance to win—enter the *Spec Book* SPEC•TACULAR Contest! And watch for this valuable issue coming to you in November.

Circle (71) on Reply Card
Shure Brothers Inc., 222 Hartrey Ave.,
Shively Laboratories, Div. of Howell
Sharp Electronics Corp., Professional
Shallco, Inc., Box 1089, Smithfield, NC
Manufacturers’ Addresses

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Product Directory begins on page 38
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.

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.

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 ±300 ohms. The OIB-3 extends the range to 1000 ±900 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.

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.

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 over-modulation 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.
Exclusive Features:

- **New printed circuit design**...greatly improves reliability compared to conventionally wired batteries.
- **New technology NiCad cell**...provides greater capacity, improved voltage plateau, more reliable fast charging, and virtually eliminates "memory" problems.
- **100% overcharge protection**...every cell is individually monitored during the Anton/Bauer Lifesaver® charging routine.
- **Tricon™ connector**...includes cell monitor output for safe and dependable charging. (Patent Pending)
- **New cold temperature protection circuit**...eliminates danger of destroying a cold battery during charging.
- **100% computer tested**...a printout of test results is delivered with each battery.
- **Rugged design features**...new steel reinforced molded cable strain relief and high impact molded case.
- **Direct replacement for Sony BP-90 VTR battery.**

Call or write for our illustrated system brochure, price list and the name of your local dealer.

*The quality standard of the video industry.*
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.
  - 96 x 96 video plus audio with redundant power supplies in only 72 RUs.
- Field expandable from 32 x 32 up to 512 x 512.
- 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, 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

Being delivered now.
### Manufacturers' Addresses

<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
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<tbody>
<tr>
<td>Wilk Power &amp; Video Inc.</td>
<td>16255 Ventura Blvd., Suite 1001, Encino, CA 91436</td>
</tr>
<tr>
<td>Wilkinson Radio Div., Television Tech. Corp.</td>
<td>2360 Industrial Lane, Broomfield, CO 80020</td>
</tr>
<tr>
<td>The Will-Burt Co., TMD Div., Inc.</td>
<td>Box 900, Orrville, OH 44667-0900</td>
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<tr>
<td>Martin R. Williams, P.E.</td>
<td>7401 East 14th St., Indianapolis, IN 46219</td>
</tr>
<tr>
<td>Winsted Corp.</td>
<td>9801 James Circle, Minneapolis, MN 55431</td>
</tr>
<tr>
<td>Wireworks Corp.</td>
<td>380 Hillside Ave., Hillside, NJ 07205</td>
</tr>
<tr>
<td>Wold Communications</td>
<td>10880 Wilshire Blvd., #2204, Los Angeles, CA 90024</td>
</tr>
<tr>
<td>Wolf Coach Inc.</td>
<td>7 'B' St., Auburn, MA 01501</td>
</tr>
<tr>
<td>Woodward Measurement Lab</td>
<td>9108 New Delaware Rd., Mt. Vernon, OH 43050</td>
</tr>
<tr>
<td>Frank Woolley &amp; Co.</td>
<td>529 Franklin St., Reading, PA 19602</td>
</tr>
<tr>
<td>World Tower Co., Inc.</td>
<td>Box 405, Mayfield, KY 42066</td>
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<tr>
<td>World Video Inc.</td>
<td>Box 117, Boyertown, PA 19512</td>
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<tr>
<td>Yamaha International Corp.</td>
<td>Combo Products Div., Box 6600, Buena Park, CA 90622</td>
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**REGIONAL SALES CONTACTS:**

**CA**: Progressive Marketing, 1821 Placentia Ave., Anaheim, CA 92802 (714) 774-4820


**TX**: Active Marketing, Inc., 2815 Valley View, Suite 125, Dallas, TX 75234 (214) 243-2584

**Z** The Zei-Mark Corp., Box 182, Brookfield Center, CT 06805

**Y** Zellan Enterprises, Ltd., 250 West 57th St., New York, NY 10107

**Z** 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 products handled and the territory served for 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.

Typical listing
1) Jones Broadcast Sales, 2912 W. 10 St.,
   Kansas City, MO 64105
   816-842-1234
   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 | AL | ALA | AR | AZ | CA | CO | CT | DC | DE | FL | GA | GA | HI | IA | ID | IL | IN | KS | KY | LA | MA | MD | ME | MI | MN | MO |
|----------------|----|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| (including recorders, microphones, mixers, consoles, cart machines, turntables, processing devices, etc.) | Alaska | Alabama | Arkansas | Arizona | California | Colorado | Connecticut | District of Columbia | Delaware | Florida | Georgia | Guam | Hawaii | Iowa | Idaho | Illinois | Indiana | Kansas | Kentucky | Louisiana | Massachusetts | Maryland | Maine | Michigan | Minnesota | Missouri |

Key to geographical area code

| AK | AL | AR | AZ | CA | CO | CT | DC | DE | FL | GA | GA | HI | IA | ID | IL | IN | KS | KY | LA | MA | MD | ME | MI | MN | MO |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Alaska | Alabama | Arkansas | Arizona | California | Colorado | Connecticut | District of Columbia | Delaware | Florida | Georgia | Guam | Hawaii | Iowa | Idaho | Illinois | Indiana | Kansas | Kentucky | Louisiana | Massachusetts | Maryland | Maine | Michigan | Minnesota | Missouri |

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(Names of provinces in Canada)

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

(Abbreviations for Canadian provinces)
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 straightforward 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.
ALABAMA

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.; Transmitters, Antennas & Transmission Systems; Tape; Vacuum Tubes; Film Equip.; Service & Repair; System Design; Used 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
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 (714-998-7224) U.S.A. Tape; Broadcast Cartridges Reel-to-Relief; Alignment Tools, Storage Systems; Reloading Service; Fone Box
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, Sacramento, CA 95865 (916-332-8700) AZ, CA; NV Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tube; System Design; Used Equip.
Communications Co., 3940 Noell St, San Diego, CA 92110 (619-297-3261) CA Audio Equip.; System Design
ECD Industries, Inc., 2034 Armacost Ave., Los Angeles, CA 90025 (213-820-3009; 800-421-7152) U.S.A. and Canadian Electronic Tubes; Semiconductors
The ENG Shop, 214 1/2 Cedar Ave., Inglewood, CA 90301 (213-415-0309) 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.
ALMARCO, Box 828, Hollywood, CA 90078 (213-703-0381) AK, AZ, CA, HI, NV, OR, WA Audio & Video Equip.; Transmitters, Antennas & Transmission Systems; System Design
Marteit Electronics, Inc., 920 E. Orange Grove Rd., Anaheim, CA 92801 (714-971-7102) U.S.A. Audio Equip. including all types of Recorders, Microphones, Mixers, & Audio Tape
Pacific Coast Marketing, 14125 Capri Dr., Los Gatos, CA 95030 (408-370-3505) CA, NV Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems
Satellite Systems
Sonong, 2001 Bryant St., San Francisco, CA 94110 (415-285-8900) AK, AZ, CA, CO, HI, ID, MT, NV, NM, 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 Investments, Box 4139, Thousand Oaks, CA 91359 (818-991-3400) AK, AL, AR, CA, CC, FL, HI, IL, IN, IA, KS, LA, MI, MS, MO, NV, NC, OK, OR, SC, TN, TX, UT, WA, WY Audio & Video Equip.; Test & Measurement Equip.
Sprague Magnetics, Inc., 15004 Strathern St. #12, Van Nuys, CA 91406 (213-994-6602) AL, AZ, AR, CA, CC, FL, HI, IL, IN, IA, KS, LA, MI, MS, MO, NV, NC, OK, OR, SC, TN, TX, UT, WA, WY Audio & Video Equip.; System Design
Stage Lighting Distributors, 1563 N. Argyle Ave., Hollywood, CA 90028 (213-466-8234) U.S.A. and Canada Video Equipment; Lighting & Controls; 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
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.

The best wireless gets even better.
At last, a practical solution to the age-old problem of color balancing your picture monitors—the PM5539 color analyzer.

Working directly off the screen with three color-sensitive photodiodes, the PM5539 gives you quick and easy readings of the three primary colors—separately or simultaneously—referred to a previously-set white standard.

This means that in a matter of minutes every color monitor you need to watch can be set up to have the same color temperature and intensity. Once the PM5539 matches all your monitors, you'll see all the difference in the world. The PM5539 is the quantitative way to eliminate the qualitative "calibrated eye-ball."

For nationwide sales and service information call 800-631-7172, except in Hawaii, Alaska and New Jersey. In New Jersey call collect (201) 529-3800, or write Philips Test & Measuring Instruments, Inc., 85 McKee Drive, Mahwah, NJ 07430.

Color temperature should normally be adjusted at both high and low light levels. Balance of the three primary colors should track at the "grey" levels in between. To facilitate "grey scale tracking," the PM5539 has a wide sensitivity range (1 to 300 NIT's full scale).

For Philips rental information call 800-527-4334
Dealers/distributors…continued (see page 142 for key to listings)


See advertisement on page 234

Elvis 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, 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 Communication 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


Lita Broadcasting Distributors, 715 N.W. 72nd Ave., Miami, FL 33166 (305-887-1223) FL, Central & South America, Caribbean Audio Equip.; Transmitters, Antennas & Transmission Systems; Tape, Vacuum Tubes

GEORGIA


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 (912-832-2121) AL, AR, FL, GA, LA, NC, TN, TX Audio & Video Equip.; 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.

HAWAII

Broadcast Services Inc., 2877 Kalauea Ave., Honolulu, HI 96815 (808-521-6311) HI Audio Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Vacuum Tubes; Service & Repair; System Design; 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 Systems; 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.
Dealers/distributors...continued (see page 142 for key to listings)

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. Ogden 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, Carrol Stream, IL 60188 (312-231-7120) AZ, AR, CO, DC, FL, GA, IL, IA, KS, KY, LA, MO, MI, MN, MS, MO, MT, NE, NY, NC, ND, OH, OK, SC, SD, TN, TX, UT, WA, 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

Rocor Corp., 6160 Oaktown, 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

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.

INDIANA

Allied Broadcast Equipment, #One, 635 South E St., Richmond, IN 47374 (317-962-8596) Intl. calls 317-935-1704 Worldwide Largest independent distributor of Audio & RF Broadcast & Professional Equipment


Midwest Broadcast Systems, 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.

KANSAS


See advertisement on this page

RSC Electronics, Inc., 131 Laura; Box 1220, Wichita, KS 67201 (316-267-5213) KS, OK Audio Equip.; Video & Audio Equip.; Test & Measurement Equip.; Tape; Vacuum Tubes


LOUISIANA


AudioMedia Associates, Box 29264, New Orleans, LA 70189 (504-586-0149) AL, AR, FL, IA, 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-
Radio’s newest and most innovative audio console features premium modular design with

- Internal cartridge sequencing
- Remote control facilities
- Multi-band equalization
- 4-line telco mix-minus
- Delay control sub-system
- 4 stereo inputs with logic
- 3 stereo and 1 mono outputs, fully metered
- 10, 16 and 24 input mainframes
- Intermediate pricing

SAC is a product of Soundcraft, the international audio company of Los Angeles, New York, Montreal, London and Tokyo. See SAC at the RCPC or send for our brochure.

You are invited
To the coming out party
Of the year.

The Stereo Air Console
by
Soundcraft
Shall debut at the
Radio Convention
and
Programming Conference,
Booth 5012,
September 15 thru 19,
in Los Angeles
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.
We know you need a videotape that can take the punishment of relentless editing. So we've taken the number one 1-inch tape in the world—our own Scotch® 479—and topped it with Scotch 480. With the same excellent electromagnetics as 479. The same superior dropout performance. And the same laser-tested consistency. But with 480, we've made a tape that's still more rugged—capable of retaining original picture quality even after 1000 edit passes from the same pre-roll point. With less than 1½ dB loss. Without stiction. And with the backing of Scotch engineers just a call away. Scotch 479 and 480. Two of the tapes that make us...number one in the world of the pro.
Dealers/distributors...continued (see page 142 for key to listings)

MICHIGAN

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

R. T. Pitts Co., 501 W. 5th St.; Box 57, Winona, MN 55957 (612-452-2629); Outside MN: 800-533-8092; MN Only: 800-642-2384 U.S.A. Complete equip. & supplies for the cable TV industry including some services.


R. T. Pitts Co., 501 W. 5th St.; Box 57, Winona, MN 55957 (612-452-2629); Outside MN: 800-533-8092; MN Only: 800-642-2384 U.S.A. Complete equip. & supplies for the cable TV industry including some services.

Broadcast Engineering's "Help Wanted" ads are well-read. Call today to place your low-cost ad.

Broadcast Engineering  September 1984

154
ANNOUNCES THE NEW ERA IN LOW COST EDITING

Breaking the price/performance barrier

Designed in the tradition of the famous Z6000 series of editors

STANDARD FEATURES:
- Distributed intelligence
- 25C event memory
- Animation
- Printer output
- Status display generator
- Frame accurate
- Built in sync generator
- Much more...

OPTIONS:
- List management
- Dual disk operating system
- Off line communications package (an industry first)
- A/B roll & sync roll
- General purpose interface (for external devices)

FOR THE DEALER IN YOUR AREA CALL (408) 745-1700

Circle (82) on Reply Card
### MONTANA
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

### 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.; Film Equip.; Vans & Accessories; System Design

### 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., 253 Mt. 18, East Brunswick, NJ 08816 (201-390-7700) 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

### 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; System Design; Used Equip.
DYMA Engineering, Inc., Box 1535, Las Lunas, NM 87031 (505-865-6700) AZ, CA, CO, KS, NV, NM, OK, TX, UT Audio & Video Equip.; Test Equip.; Transmitters, Antennas & Transmission Systems

### NEW YORK
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 (718-276-9084; 800-221-5802) U.S.A. Vacuum Tubes
Audio Video-Corp., 213 Broadway, Menands (Albany), NY 12204 (518-497-7219) MA, NY, North-PA, VT Audio & Video Equip.; Test & Measurement Equip.; Tape, Vacuum Tubes; Vans & Accessories; Service & Repair; System Design; Used Equip.
Barbinz Electric Co., Inc., 426 West 55th St., New York, NY 10019 (212-586-1802) CT, DE, DC, FL, GA, IL, IN, KY, ME, MA, MI, MN, MS, MO, MS, NC, NH, NJ, NY, OH, PA, RI, SC, TN, VA, WI, WV, All Types of Lamps & Sockets; Gaffer’s Tape; Hot Mill Gloves; Light Control & Diffusion Media; Color Media; Dimming Equip.
Boynton Studio Inc., Melody Station Farm, Morris, NJ 10908 (607-263-5695) U.S.A.; BC; BAR, MAN, NB, NS, ONT, PEI, QUE, SASK Audio Equip.; Test Equip.; Transmitters, Antennas & Transmission Systems; Tape; Service & Repair; System Design; Used Equip.
CeCo Communications 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; Receiver Tubes; Industrial Tubes; Vacuum Tubes
Darmstetter Associates, 41 R. Osweego St., Baldwinsville, NY 13027 (315-638-1261) NY Audio Equip.
Henry Grossman Associates, 519 South 5th Ave., Mount Vernon, NY 10550 (914-664-5393 or 337-2600) CT, DE, DC, ME, MA, NH, NJ, NY, PA, VT, VA Audio & Video Equip.; Test & Measurement Equip.; Tape; Vacuum Tubes; Vans & Accessories; Service & Repair; System Design; Used Equip.
Laumic Co., Inc., 306 East 39th St., New York, NY 10016 (212-889-3300) CT, DE, DC, ME, MA, NH, NJ, NY, PA, RI, VT, VA Audio & Video Equip.; Test & Measurement Equip.; Tape; Vacuum Tubes; Vans & Accessories; Service & Repair; System Design; Used Equip.
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, OH, OK, PA, RI, SC, SD, VT, VA, WA, WI, WV, All Types of Lamps & Sockets; Gaffer’s Tape; Hot Mill Gloves; Light Control & Diffusion Media; Color Media; Dimming Equip.
MPC 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.
Martin Audio/Video Corp., 423 West 55th St., New York, NY 10019 (212-515-5000) CT, DE, DC, ME, MA, NH, NJ, NY, PA, RI, VT Audio & Video Equip.; Test & Measurement Equip.; Tape; Service & Repair; System Design; Rentals
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 & Measurement...
And now a message on Yamaha’s new RM1608 recording mixer.
SPECIFICATIONS

TOTAL HARMONIC DISTORTION (T.H.D.)
Less than 0.1% at +4 dB *output, 20 Hz to 20 kHz (all Faders and controls at nominal)

HUM & NOISE (20 Hz to 20 kHz) Rs = 150 ohms
(INPUT GAIN "- 60")
- 128 dB Equivalent Input Noise (E.I.N.)
- 80 dB residual output noise: all Faders down.
- 64 dB (68 dB S/N) PGM Master volume control at maximum and all CH PGM assign switches off.
- 73 dB (77 dB S/N) STEREO Master Fader at maximum and all CH STEREO level controls at minimum level.
- 64 dB (68 dB S/N) STEREO Master Fader at maximum and one CH STEREO level control at nominal level.
- 75 dB (65 dB S/N) ECHO SEND volume at maximum and one CH ECHO volume at nominal level.

CROSSTALK
- 70 dB at 1 kHz: adjacent Input.
- 70 dB at 1 kHz: Input to Output.

MAXIMUM VOLTAGE GAIN (INPUT GAIN "- 60")

<table>
<thead>
<tr>
<th>Mode</th>
<th>Voltage Gain</th>
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</thead>
<tbody>
<tr>
<td>PGM</td>
<td>74 dB: MIC IN to PGM OUT.</td>
</tr>
<tr>
<td></td>
<td>24 dB: TAPE IN to PGM OUT.</td>
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<tr>
<td></td>
<td>34 dB: ECHO RETURN to PGM OUT.</td>
</tr>
<tr>
<td></td>
<td>14 dB: PGM SUB IN to PGM OUT.</td>
</tr>
<tr>
<td>STEREO</td>
<td>74 dB: MIC IN to STEREO OUT.</td>
</tr>
<tr>
<td></td>
<td>24 dB: TAPE IN to STEREO OUT.</td>
</tr>
<tr>
<td></td>
<td>34 dB: ECHO RETURN to STEREO OUT.</td>
</tr>
</tbody>
</table>

CHANNEL EQUALIZATION
± 15 dB maximum
HIGH: from 2 kHz to 20 kHz PEAKING. MID: from 0.35 kHz to 5 kHz PEAKING. LOW: from 50 to 700 Hz PEAKING.

HIGH PASS FILTER: - 12 dB/octave cut off below 80 Hz.

OSCILLATOR: Switchable sine wave 100 Hz, 1 kHz, 10 kHz

PHANTOM POWER: 48 V DC is applied to XLR type connector's 2 pin and 3 pin for powering condenser microphone.

DIMENSION (W x H x D) 37-1/2" x 11" x 30-1/4" (953 mm x 279.6 mm x 769 mm)

The specs speak for themselves. But they can't tell you how natural, logical and easy the RM1608 is to work. All the controls and switches are logically arranged to help you get the job done quickly and accurately.

And in the tradition of Yamaha's sound reinforcement mixers, the RM1608 sets new standards of reliability as well as ease of operation. For complete information, write: Yamaha International Corporation, P.O. Box 6600, Buena Park, CA 90622. In Canada, Yamaha Canada Music Ltd., 135 Milner Ave., Scarborough, Ont. M1S 3R1.
Dealers/distributors... continued (see page 142 for key to listings)

East-KY, NC, SC, East-TN, VA, WV
Mixers, Mics, Amps; Video Production Switchers; Monitors, Cameras, DA's; Analyzers; Frequency Counters; Power Meters, Voltmeters; Test & Measurement Equip.; Distortion Analyzers; Transmitters & Antennas; STL

Midwest Corp. Communications, 2894 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.

Northern 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.


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 & Measurement Equip.; Transmitters; Tape; Vacuum Tubes; Film Equip.; Service & Repair; System Design; Used Equip.

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

See advertisement on this page

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

NORTH CAROLINA

Broadcast Services Co., Rt. 3 Box 45-E, Four Oaks, NC 27524 (919-934-6869) NC, SC, VA Full Line of Broadcast Audio & Radio Equip.

Electronic Merchandising Enterprises, Inc., 112 Buena Vista, High Point, NC 27260 (919-869-3335)

Cartwright Communications Co., 855 Bay Drive, 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.


KAVCO, Div. of Daycom Corp., 3931 Image Dr., Dayton, OH 45414 (513-898-2003) IL, IN, KY, MI, OH, WY 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, Antennas & Transmission Systems; Tape; Service & Repair; System Design; Used Equip.

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 & Transmission Systems; Tape; Vans & Accessories; Service & Repair; System Design; Used Equip.


OKLAHOMA


See advertisement on this page


Delcom Corp., 6019 S. 66th 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

Bill 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-TSL-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, WA, WY Audio Equip.; Transmitters, Antennas & Transmission Systems; Service & Repair; System Design; Used Equip.

United Radio Supply Inc., Box 14040, Portland, OR 97214 OR, WA Test & Measurement Equip.; Vacuum Tubes

### STAGE LIGHTING DISTRIBUTORS

**FREE LIGHTING CATALOG**

346 W 44th St NYC NY 10036 Hollywood, CA 90028

212-489-1370 213-466-8324 1-800-228-0222

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Dealers/distributors...continued (see page 142 for key to listings)

**Pennsylvania**

Alpha Video & Electronics Co., 28 E. Mall Plaza, Carnegie, PA 15106 (412-923-2070) MD, NC, 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 & Framps; Studio Furniture & Accessories; Used Equip. & Trade-Ins


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.


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 (215-233-8200) 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


Peirce-Pelps Inc., 490 S. St. Johns Rd., Canty Hill, PA 17011 (717-761-2040) U.S.A.; GU, PR, VI Audio & Video Equip.; Tape; Vans & Accessories; Service & Repair; System Design

Peirce-Pelps 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


Val-Tronics Inc., Penn Park Blvd., Pottstown, PA 18640 (717-655-5937) U.S.A. Cart Machines; Consoles; Transmitters; Audio Carts; Tape Recorders & Turntables; Microphones; Optimodos; Antennas; Transmission Lines; Cabinets; Phono Cartridges; Replacement Heads; Amplifiers; Dummy Loads

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 James-town 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; 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, NV, OK, SD, TX, WI, WV Audio & Video Equip.; Test & Measurement Equip.; Film Equip.; Vans & Accessories; Used Equipment

M&Z 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; Game Console; Film Equip.; Vans & Accessories; Service & Repair; System Design


**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, UT, WV 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 (804-358-3552) 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

See advertisement on page 17

**Tennessee**

Broadcast Equipment & Supply Co., Inc., Box 3141, Bristol, TN 37625 (615-878-2531) U.S.A. Audio Equip.; Tape


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

Micro Controls Inc., Box 728, Burleson, TX 76028 (817-295-0965) AR, LA, MS, MO, MT, NE, NV, OK, TX Audio & Video Equip.; Test & Measurement Equip.; Transmitters, Antennas & Transmission Systems; Test & Measurement Equip.; Film Equip.; Vans & Accessories; Service & Repair; System Design


Professional Audio Services, 3837 East Loop 820 South, Ft. Worth, TX 76119 (214-451-7643; 800-433-7668) TX Only 800-233-8273 Worldwide Complete Line of Audio & Video Equip.; Supplies

See advertisement on page 17
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.

Or compare the highlight image performance of Leddicons with other tubes. The difference is that the retention effect is minimised by a unique target manufacturing process — even in the very difficult extended red channel where other tubes are simply unable to cope.

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!

Then there's geometry. The optimised electron optical design of Leddicons ensures the best possible geometry. Registration too is equally distortion free — we can, in fact, supply computer-matched sets for all three channels.

And what about microphony? With EEV's unique antmicrophonic 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.

But don't leave it at that.

Next time specify Leddicons for your new equipment and as replacements and find out what that definition really means in practice.

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Dictaphone's Veritrac™ voice communications recorder systems are as important to stock brokers as they are to public safety agencies. In fact, wherever people rely on phones they rely on Dictaphone's Veritrac loggers. They record up to 60 channels of telephone and radio messages simultaneously so verification of who said what is both simple and sure.

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PBE-94

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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.

Circle (86) on Reply Card
A satellite receiving antenna from Plessey/Scientific-Atlanta is only one of many CATV and satellite broadcast-related products shown at CABLE '84.

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 compatibility, could form feeder lines to individual receiver decoders.

Don't wade through 1000 different product brochures... Use BE's Spec Book instead!
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.
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- Production and Post-Production studios.
- Switching and Control centers.
- Professional equipment for the monitoring, synchronising and distribution of video and audio signals.

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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.

For your information, our name is Harris.
EECO's 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.
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

Notice the advantages:

**One site:**
Lower real estate costs

**One tower:**
Only one FAA and Environmental permit

**Four or more stations:**
All at the same maximum height & power

**One Broadcaster antenna**
- Superior circularity & axial ratio
- Omni-directional, with no unexpected nulls

Our secret of superior operation at any channel of the band is no secret anymore. We made each individual dipole with an absolutely flat response wider than the entire band. This means plenty of individual channel bandwidth, but it also means there are no nulls generated in the antenna pattern by uneven impedances in the system.

Power handling capability is properly planned in the Cetec design. Carefully chosen sizes to match system requirements. Completely dry air pressurized feed system. Pure teflon insula tion. Grounded dipoles for maximum lightning protection. And maximum service is designed into your Cetec Broadcaster antenna.

Check today with Cetec factory sales, or your favorite dealer for this antenna and future advancements. We're ready to quote with a turnkey response, if that's desired.

Cetec Antennas

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Telex: 377321

Circle (89) on Reply Card
EECO's largest product line is switches, including electromechanical and membrane devices for front panel and printed circuit board use. Various part numbers include thumb-wheel, 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.

Component products

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...
The WESTAR is a 24 mixing bus, in-line, dual path, multi-function recording/post-production console featuring:
- A modular frame — assembled to 20, 28, 36, 44, 52 or more inputs, and easily expandable.
- Plug-in interchangeable preamplifiers — differential or transformer, with single or dual inputs.
- A choice of plug-in interchangeable equalizers — 4-band, switched frequencies; 4-band, fully parametric; or 10-band graphic EQ.
- A plug-in VCA card, with choice of VCA.
- An interchangeable fader system — audio fader, VCA fader, or an automated fader using the Q.E.W. Intelligent Digital Fader module.

WESTAR — world class, yet affordable; the technology of tomorrow can be yours today.
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 EEKO 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.
THE BEST DIGITAL TBC IS NOW DYNAMICALLY BETTER!

FOR-A's Digital Time Base Corrector (FA-410) now offers Dynamic Tracking compatibility for both the SONY Broadcast U-Matic (BVC-820) and the PANASONIC VHS (NV-8950) V-TRs. 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.

This, in addition to FOR-A's Performance-Plus features like 8-bit component encoding for highest signal-to-noise ratio and lowest distortion, a digital dropout compensator and full compatibility with 3/4" and 1/2" VTRs, makes the FA-410 the first choice of professionals.

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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Headquarters: 49 Lexington St., West Newton, MA 02166 (617) 244-3223
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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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Call Continental for the best in AM & FM broadcast equipment.

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- 5 kW
- 10 kW
- 50 kW

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- 1.25 kW
- 2.5 kW
- 10 kW
- 20 kW
- 25 kW
- 27.5 kW
- 40 kW
- 50 kW
- 55 kW
- 60 kW

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See Us at Booth 3010 at NRBA

Call Continental for the best in AM & FM broadcast equipment.
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 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. 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.

If you’re a Decision Maker, here’s an easy one:

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<tr>
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<td>$ 9,000</td>
<td>Included</td>
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<td>Picture compression/position</td>
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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.

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Broadcast Engineering September 1984
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Deciphering FCC antenna proof requirements

By Dane E. Ericksen, P.E., Systems Design

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 ensure 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 pre-selector 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
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
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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In any monitor, especially a near-field type, response will vary from a $2\,\pi$ (wall/soffit) to a $4\,\pi$ (free field/console) environment.

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They also take lots of power without distortion or complaint. They are stunning.

Audition the Near-Field Point Source Reference Monitors. From Fostex. RM-765 (6½" woofer) and RM-780 (8" woofer). Both with patented RP Technology. For flat response in both $2\,\pi$ and $4\,\pi$ environments.

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.
Now... remote, automatic control of your entire transmitting facility...

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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.
Advances in AM radio design

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,
"Microdyne's satellite radio network gives us better signal quality and saves us over $120,000 a year."

Reduced costs — fast payback

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If saving thousands of dollars a month while improving performance appeals to you, call our Marketing Department at the number below. Ask for our free brochure on satellite radio systems. It could brighten your budget for years.
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 micro-controller 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 introduction 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

---

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Figure 3. A design example (using the National Semiconductor LM1863) of an AM radio based on current integrated circuit technology.

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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
Over 200 broadcasters bought the Harris Medalist audio console in its very first year! Here's why.

Wide input switching flexibility. Transparent audio performance. Choice of attenuators. Adaptability to any application. Excellent cost/benefit ratio. Broadcasters across the country cite these as major reasons for choosing the new Medalist dual stereo audio console over all others.

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sensitivity and image rejection. Unlike the ferrite rod, the whip antenna 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 D1 and D2. Using two tuned circuits with an RF gain stage to compensate for insertion loss provides excellent sensitivity (2.2μV), 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

The Ultimate Mic Processor

Now, your on-the-air personalities can tailor their sound and enhance it with high quality audio signal processing. The Model 431 Dyna-Mic/Dyna-Mite combination can sweeten the microphone with its low-noise preamplifier and three band equalizer, then limit, expand, or "gate" the signal for increased punch or ambient noise control. Additionally, the 431 can perform effects such as de-essing or voice-over. In all, the Model 431 is capable of 18 different operating modes.

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198 Broadcast Engineering September 1984
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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, referred 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 45kHz 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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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.
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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, tweaking 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-compatibility 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 compatibility. 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

<table>
<thead>
<tr>
<th>VIDEO AND SYNC</th>
<th>NTSC/PAL-M 525/60</th>
<th>PAL/SECAM 625/50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>Flat to 4.2 MHz ± 0.5 dB</td>
<td>Flat to 5.0 MHz ± 0.5 dB</td>
</tr>
<tr>
<td></td>
<td>–3 dB at 5.0 MHz</td>
<td>–3 dB at 6.0 MHz</td>
</tr>
<tr>
<td>S/N</td>
<td>–46 dB peak-to-peak video to RMS noise on interchange basis</td>
<td>–43 dB peak-to-peak video to RMS noise on interchange basis</td>
</tr>
<tr>
<td></td>
<td>2% blanking to white (maximum)</td>
<td>2% blanking to white (maximum)</td>
</tr>
<tr>
<td></td>
<td>4% blanking to white (maximum)</td>
<td>4% blanking to white (maximum)</td>
</tr>
<tr>
<td>LF Lin.</td>
<td>4&quot; at 35.5 MHz off-tape (max)</td>
<td>4&quot; at 44.5 MHz off-tape (max)</td>
</tr>
<tr>
<td>Differential Gain</td>
<td>20 nsec (maximum)</td>
<td>25 nsec (maximum)</td>
</tr>
<tr>
<td>Differential Phase</td>
<td>10000 units of subcarrier (through TBC-3)</td>
<td>100000 units of subcarrier (through TBC-3)</td>
</tr>
<tr>
<td>Chrominance/Luminance Delay</td>
<td>25 nsec (maximum)</td>
<td>20 nsec (maximum)</td>
</tr>
<tr>
<td>2T sin2 Pulse &amp; Bar</td>
<td>–40 dB color bars, 75% amplitude</td>
<td>–36 dB color bars, 75% amplitude</td>
</tr>
<tr>
<td>More</td>
<td>35.5 MHz subcarrier</td>
<td>44.5 MHz subcarrier</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>NTSC/PAL-M 525/60</th>
<th>PAL/SECAM 625/50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record Time</td>
<td>190 minutes nominal, 9200 feet of tape on 14&quot; reel</td>
<td>230.8 minutes nominal, 10,800 feet of tape on 14&quot; reel</td>
</tr>
<tr>
<td>Shuttle Time</td>
<td>less than 72 seconds for 60 minute tape, 3.5 minutes for a 3 hour tape</td>
<td>94.4 minutes nominal, 6000 feet of tape on 14&quot; reel</td>
</tr>
<tr>
<td>Tape Speed</td>
<td>224 ± 0.5 mm/sec</td>
<td>224 ± 0.5 mm/sec</td>
</tr>
<tr>
<td></td>
<td>9.605 ± 0.002 in/sec</td>
<td>9.605 ± 0.002 in/sec</td>
</tr>
<tr>
<td>Video Writing Speed</td>
<td>10000 in/sec</td>
<td>10000 in/sec</td>
</tr>
<tr>
<td>FM Carrier Frequencies</td>
<td>7.5 MHz blanking</td>
<td>7.68 MHz blanking</td>
</tr>
<tr>
<td>Audio Equalization</td>
<td>16 microseconds</td>
<td>16 microseconds</td>
</tr>
<tr>
<td></td>
<td>3180 microseconds</td>
<td>3180 microseconds</td>
</tr>
<tr>
<td>Lockup time from Ready Mode</td>
<td>20 milliseconds</td>
<td>20 milliseconds</td>
</tr>
</tbody>
</table>

Selected manufacturer's specifications.
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 setup, 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...
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

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Broadcast Engineering  September 1984

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51

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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 offline 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
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- 16 Control Ports for VTRs and Switchers
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- 132 Column Wide Form Printer
- Jogger Motion Control
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- 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
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- Recall
- Replace
- Move Groups
- Shift Groups
- User-Bit Time Reference
- Real-Time Edit Mode
- 10 Macro Functions, with Nesting
- Three Freeze Modes
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  - Direct Film Entry
  - Slate Calculation
  - 35/16 mm Centered Dissolve
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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.
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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.
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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.

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• For... Superb copies of CD’s and digital masters
• For... Outstanding high frequency sensitivity and headroom
• For... Stable stereo phasing
• For... Maximum reliability and longest life
• For... Compatibility with all cart machines
• For... Stations who care how they sound

THE AUDIOPAK AA-4 IS FOR YOU

The True Blue Cart – From Capitol

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Circle [128] on Reply Card
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.

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For more information on the Ampex VPR-3, contact Ampex Corporation, 401 Broadway, Redwood City, CA 94063.

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Circle (129) on Reply Card
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.
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-

---

**Getting the most for your Time**

Skotel Time Code Generators and Readers open up the full capabilities of the Code to give you:

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**Video Character Generator/Inserter** displays User and Time Data in picture monitor. Display may be held to capture information without stopping VTR. Display may be positioned anywhere on the monitor, or inhibited. (An optional module for TCG-80N and TCR-80.)

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- Low level input for direct head connection.
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Circle (130) on Reply Card

---

September 1984  Broadcast Engineering  215
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Figure 4. (Left) The record-playback frequency response of the unit at 1⅛ ips.
Figure 5. (Above) The record-playback frequency response at 3⅓ ips.

- 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.
The operator can also select the equalization and bias for a particular type of tape—normal, cobalt (Co) or chromium dioxide (CrO₂). 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.
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 1⅛ips and 3⅛ips. 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-

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Circle (133) on Reply Card
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☐ User controls interact intelligently to simplify and speed setup, and to prevent pumping and other audible side-effects.

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San Francisco, CA 94107 (415) 957-1067

The proof is in the listening.

The surprise is the price. $425.
Dolby HX noise reduction

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 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.

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.
...insist on a Jensen!

Choose from a wide variety of types and packages

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- 100% tested — consistent quality
- Low distortion  • Wide bandwidth
- Minimum transient distortion

INPUT TRANSFORMERS AND SPECIAL TYPES

<table>
<thead>
<tr>
<th>Model</th>
<th>Application</th>
<th>Impedance Ratio</th>
<th>Turns Ratio</th>
<th>20Hz Max Input Level</th>
<th>Typical THD Below Saturation (%)</th>
<th>Frequency Response (dB ref 1 V / Hz)</th>
<th>Bandwidth -3 dB (kHz)</th>
<th>20 kHz Phase Response (degrees)</th>
<th>Over-Shoot (%)</th>
<th>Noise Figure (dB)</th>
<th>Magnetic Shield (dB)</th>
<th>Number of Faraday Shields</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>J-E-15-A</td>
<td>Mic in for 900 ohm</td>
<td>1:2</td>
<td>1:2</td>
<td>8</td>
<td>0.08 - 0.05</td>
<td>200</td>
<td>-8</td>
<td>&lt;1</td>
<td>1.7</td>
<td>-30</td>
<td>1</td>
<td>A-1</td>
<td>B-2</td>
</tr>
<tr>
<td>J-E-15-B</td>
<td>Mic in for 900 or 1C</td>
<td>1:5</td>
<td>1:8</td>
<td>0.08 - 0.21</td>
<td>85</td>
<td>-19</td>
<td>&lt;2</td>
<td>2.3</td>
<td>-30</td>
<td>1</td>
<td>A-1</td>
<td>B-2</td>
<td>64.21</td>
</tr>
<tr>
<td>J-E-115-E</td>
<td>Mic in for 1C, opamp</td>
<td>1:10</td>
<td>6</td>
<td>0.50 - 0.10</td>
<td>115</td>
<td>-5</td>
<td>&lt;7</td>
<td>1.5</td>
<td>-30</td>
<td>1</td>
<td>3</td>
<td>42.03</td>
<td>28.07</td>
</tr>
</tbody>
</table>

LINE INPUT

| J-E-11P | Line in | 15K-15K | 1:1 | 26 | 0.025 | 0.003 | -0.03 | -0.30 | 52 | -28 | <3 | -30 | 1 | 1 | 103.47 | 69.13 | 47.69 |
| J-E-11P-1 | Line in | 15K-15K | 1:1 | 17 | 0.045 | 0.003 | -0.03 | -0.25 | 85 | -23 | <1 | -30 | 1 | 3 | 40.05 | 26.76 | 20.90 |
| J-E-501K-B | Line in for bridging | 30K-2200 | (10K x 200) | 4:1 | 24 | 0.000 | 0.002 | -0.02 | -0.09 | 125 | -12 | <1 | -30 | 1 | 8 | 6.67 | 42.01 | 30.83 |
| J-E-501KB-C | Line in for bridging | 30K-1800 | (10K x 600) | 4:1 | 19 | 0.033 | 0.003 | -0.11 | -0.08 | 160 | -9 | <2 | -30 | 1 | 3 | 41.56 | 27.76 | 19.16 |
| J-E-11SSP-6M | Line in / repeat coil | 600-150-600 | 1:1 | 22 | 0.035 | 0.003 | -0.03 | -0.00 | 120 | -9 | <3.5 | -30 | 1 | 4 | 151.90 | 101.47 | 70.01 |

SPECIAL TYPES

| J-E-11P-1 | Line in | 15K-15K | 1:1 | 17 | 0.045 | 0.003 | -0.03 | -0.25 | 85 | -23 | <1 | -30 | 1 | 3 | 40.05 | 26.76 | 20.90 |

NICKEL CORE OUTPUT TRANSFORMERS

<table>
<thead>
<tr>
<th>Model</th>
<th>Construction</th>
<th>Nominal Impedance Ratio</th>
<th>Turns Ratio</th>
<th>20 Hz Max Output Level</th>
<th>DC Load Loss (dB)</th>
<th>DC Resistance to Ground (ohms)</th>
<th>Typical THD Below Saturation (%)</th>
<th>Frequency Response (dB ref 1 Hz / Hz)</th>
<th>Bandwidth -3 dB (kHz)</th>
<th>20 kHz Phase Response (degrees)</th>
<th>Over-Shoot (%)</th>
<th>Magnetic Shield (dB)</th>
<th>Number of Faraday Shields</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>J-E-123-BMCF</td>
<td>Quadrifilar</td>
<td>620-600</td>
<td>1:1</td>
<td>28</td>
<td>2</td>
<td>-0.1</td>
<td>20</td>
<td>0.002</td>
<td>0.002</td>
<td>-0.2</td>
<td>-0.02</td>
<td>&gt;450</td>
<td>160</td>
<td>-1</td>
</tr>
<tr>
<td>J-E-123-BMCFO</td>
<td>Quadrifilar</td>
<td>620-600</td>
<td>1:2</td>
<td>21</td>
<td>1.0</td>
<td>19</td>
<td>0.004</td>
<td>0.002</td>
<td>-0.2</td>
<td>-0.01</td>
<td>&gt;450</td>
<td>230</td>
<td>-1</td>
<td>2</td>
</tr>
<tr>
<td>J-E-123-BLCFO</td>
<td>Quadrifilar</td>
<td>620-600</td>
<td>1:1</td>
<td>32</td>
<td>2</td>
<td>-1</td>
<td>20</td>
<td>0.041</td>
<td>0.003</td>
<td>-0.02</td>
<td>-0.01</td>
<td>&gt;450</td>
<td>170</td>
<td>-1</td>
</tr>
</tbody>
</table>

6. Multifilar construction has no faraday shield: cannot be used as input transformer. All specifications are for 01 source, 6001 load.
7. Max output level = % THD, dB = dBv ref. 0.775 V
8. Source amplifier = 3 dB to 10 kHz
9. Output transformers are horizontal channel frame type with wire leads, vertical channel frames available

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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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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 1½ips, 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, i.e., 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-
increases 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 17 ips. 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, 33 1/2 ips. 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 17 ips and 33 1/2 ips, 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 17 ips. 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 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.
Figure 13 shows the same parameters for 3Wips 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 $2\Sigma$ 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.

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For more information on the TASCAM 122-B cassette recorder, readers may contact Teac Corporation of America, 7733 Telegraph Road, Montebello, CA 90640.
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 severely 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.
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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 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.
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...
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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 ringing 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 preceding 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 magnitude 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.

Bibliography:

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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 WOSU Broadcast Engineering Conference was the banquet address by Joe Flaherty of CBS, which dealt with the future of the broadcast industry.

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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...
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The chairman and driving force behind the WOSU conference is John Battison, a long-time radio and TV broadcast engineer and author.

The 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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terminated 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
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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 Compressed 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.

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 datagathering 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.

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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.
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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 wide-band, 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-servos 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 F2.1 for 30mm Cameras

KEY SPECIFICATIONS

- Focal length: 15-270mm
- Max. Relative Aperture: 1:2.7 (15-218mm)
- Aperture: 1:2.7 at 270mm
- Angular Field of View: 59° x 45.8° at 15mm
- Maximum 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) 620-3941
Chicago Office: 140 Industrial Drive, Elmhurst, Ill. 60126 (312) 833-3070
West Coast Office: 123 Paularino Avenue East, Costa Mesa, Ca. 92626 (714) 979-8000
Canon Canada, Inc., 3245 American Drive, Mississauga, Ontario L4V1B6, Canada (416) 628-2730

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modate 1/2-inch or front-loading 3/4-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 frequencies are 35 to 50MHz, 66 to 88MHz and 806 to 890MHz, in addition to its present ranges of 136-174 MHz 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.

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

Video microwave system

MA-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 preemphasis 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 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 an 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 downloading 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 440 Vac. 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


Circle (460) on Reply Card

Illuminance meter

The Minolta illuminance meter is suitable for measuring illuminance instantaneously and continuously. 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 (451) 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-

Cipher Digital's Model 735CD Time-Code Reader/Event Controller

The Model 735CD — a full function, full speed Time Code Reader with eight-channel event controller/coincidence detector — incorporates features you won't find anywhere - at any price. Easily programmed from the front panel or optional RS-232/422 serial port, the 735CD provides frame accurate, contact closure control of remotely activated devices.

TYPICAL APPLICATIONS

<table>
<thead>
<tr>
<th>Video Production:</th>
<th>Machine Control:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Character Generators</td>
<td>Activating VTR’s, Film Chains, etc.</td>
</tr>
<tr>
<td>Animation Stands</td>
<td>Multiple VTR Sequencing</td>
</tr>
<tr>
<td>Switchers</td>
<td>Time-of-Day Events</td>
</tr>
<tr>
<td>Special Effect Generators</td>
<td>Alarms</td>
</tr>
</tbody>
</table>


For detailed information or demonstration of the innovative Model 735CD, contact our Sales Department:

Cipher Digital
Sales/Marketing Headquarters:
150 Huntington Avenue • Boston, MA 02115
Tel: (617) 267-1148 • Telex: 940536
Superior Time-Code Products

Circle (187) on Reply Card
INSTANT AUDIO SYSTEMS
IMPAC™ SERIES

For IMPAC Series Plug-In Cards. Frame will accommodate wide range of modules:
- MIC Preamps
- Line Amplifiers
- Phono & Tape Preamps
- VCA Modules
- Monitor Amplifiers
- Power Supplies
- Switcher Cards
- Distribution Amps

SEND FOR DATA

ALLEN AVIONICS Video & Pulse Delay Lines replace 75 ohm coaxial cable,

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Delay Range (Nano-Sec)</th>
<th>Delay Steps (Nano-Sec.)</th>
<th>Method of Variation</th>
<th>Maximum Insertion Loss (db)</th>
<th>Amplitude Flatness at Any Delay Setting (5.5 MHz)</th>
<th>Max. Rise Time (Nano-Sec.)</th>
<th>Package Size (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAR0005</td>
<td>3-7</td>
<td>Continuous</td>
<td>Trimmer</td>
<td>20</td>
<td>3.5 x 1 1/4 x 1 1/2</td>
<td>N.A.</td>
<td>3% x 1 1/2 x 1 1/4</td>
</tr>
<tr>
<td>VAR011</td>
<td>0-11</td>
<td>Continuous</td>
<td>Trimmer &amp; Toggle</td>
<td>20</td>
<td>3.5 x 1 1/4 x 1 1/2</td>
<td>N.A.</td>
<td>4% x 2 1/4 x 1 1/4</td>
</tr>
<tr>
<td>VP0175</td>
<td>0-10.5</td>
<td>Continuous</td>
<td>Trimmer</td>
<td>15</td>
<td>4 1/2 x 3/4 x 1 1/4</td>
<td>N.A.</td>
<td>4 1/2 x 3/4 x 1 1/4</td>
</tr>
<tr>
<td>VP0175</td>
<td>0-25.5</td>
<td>Continuous</td>
<td>Toggle</td>
<td>15</td>
<td>4 1/2 x 3/4 x 1 1/4</td>
<td>N.A.</td>
<td>4 1/2 x 3/4 x 1 1/4</td>
</tr>
<tr>
<td>VP2075</td>
<td>0-2075</td>
<td>Continuous</td>
<td>Toggle</td>
<td>15</td>
<td>4 1/2 x 3/4 x 1 1/4</td>
<td>N.A.</td>
<td>4 1/2 x 3/4 x 1 1/4</td>
</tr>
<tr>
<td>VS0315</td>
<td>0-315</td>
<td>Continuous</td>
<td>Strip</td>
<td>25</td>
<td>4 x 2 x 1/4</td>
<td>N.A.</td>
<td>4 x 2 x 1/4</td>
</tr>
<tr>
<td>VS0635</td>
<td>0-635</td>
<td>Continuous</td>
<td>Strip</td>
<td>60</td>
<td>5 x 2 x 1 1/4</td>
<td>N.A.</td>
<td>5 x 2 x 1 1/4</td>
</tr>
<tr>
<td>VS1275</td>
<td>0-1275</td>
<td>Continuous</td>
<td>Strip</td>
<td>125</td>
<td>5 x 3 x 1 1/4</td>
<td>N.A.</td>
<td>5 x 3 x 1 1/4</td>
</tr>
<tr>
<td>VS2075</td>
<td>0-2075</td>
<td>Continuous</td>
<td>Strip</td>
<td>250</td>
<td>6 1/2 x 3 1/2 x 2 1/4</td>
<td>N.A.</td>
<td>6 1/2 x 3 1/2 x 2 1/4</td>
</tr>
</tbody>
</table>

**RACK MOUNTABLE VIDEO & PULSE DELAY LINES**

A complete Rack Mountable series of Video & Pulse Delay Lines, with the capability of replacing up to 1450 feet of cable, is now being marketed by Allen Avionics. (See listing in table at left.)

Impedance: 75 ohms.

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

Working Voltage: 100 volts maximum. 50 volts maximum for Rack Mountable series.

Return Loss: 20db minimum. 15db minimum for VP2075, VS2075 and Rack Mountable series.

Delay Tolerance: 5% or 1 nanosecond, whichever is greater.

We also specialize in Delay Equalized Lowpass Filters for the Video Industry.

CALL/Write

For Delay Lines & Filters Catalog

ALLEN AVIONICS, INC.

224 EAST SECOND ST., MINEOLA, NY 11501

Phone: 516-248-8000

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 Siemens 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 JBL. 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, precipitation 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

Broadcast Engineering's "Help Wanted" ads are well-read. Call today to place your low-cost ad.
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."

Contact:
Solway Inc., P.O. Box 7647, Hollywood, FL 33081, Phone (305) 962-8650, Telex 467257

The Battle...is won

Most of today's type B VTRs are equipped with telcom c4  

Users already selected telcom c4 as the most suitable NR System for type C VTRs. The new telcom c4 units are now designed to improve the sound of type C VTRs. telcom c4 creates lower distortion from tape, better cross-talk attenuation, improved headroom plus a 25 dB gain in dynamic range. No line-up procedures. telcom c4 units for VTRs are available for 1,2 (stereo) and 3 channels, for simultaneous encode/decode and automatic switching. Furthermore, telcom c4 is used in connection with ATRs, line and satellite transmission. Don't you also need super sound for stereo or copying?

Just contact us for further information.

Contact:
ANT Telecommunications
ANT Nachrichtentechnik GmbH
Lindener Str.15 D-3340 Wolfenbüttel
Phone (05331) 83-0 Telex 95651 antd

Circle (173) or Reply Card
IN SEARCH OF EXCELLENCE.

Long before it was a popular management theory, broadcasters were searching for excellence. Excellence of Sound. The search is still on, but the goal is now within the reach of every FM broadcaster.

The 695 is an exciter without equal ... in quality sound ... in versatility ... and in value. Any type of distortion you can name (THD, TIM, IMD) is less than .025 percent. This isn't an environmentally controlled lab figure, but rather one that is measurable over the operating temperature range of the equipment. Moreover, noise is so low that it's virtually impossible to measure.

QEI's 695 offers features that the competition has never even dreamed of. A peak counter with LED display, modulation measurements on the front panel, and a measurements grade linear demod built in. It is synthesized, has wideband circuitry, a 3-color LED bar graph for modulation display, a 10-position meter, and many other features that are best described in our new brochure.

For more information on QEI and the 695 Exciter just write or call us. You'll see why our search for excellence has produced the best value on the market today.

QEI Corporation
One Airport Drive P.O. Box D
Williamstown, NJ 08094 (609) 728-2020

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.

STOP GROUND-LOOP HUM!

VIDEO HUM STOP COIL...HSC 1

Will ELIMINATE HUM and other INTERFERENCE in Video Lines caused by differences in Ground Potential.

- For Color and Black and White.
- FLAT-DC to 5.5 MHz.
- No Low-Freq. or Hi-Freq. Roll-off.
- No Differential Phase Distortion.
- No Differential Gain Distortion.
- No Envelope Delay.
- Passive Device - Failure Free-Low Price.
- Small Compact Package 4” x 4” x 2-1/4”.

ELIMINATES HUM AND INTERFERENCE:

IN STUDIO
- Between Buildings
- On long runs in Buildings
- Between Studio and Transmitter
- On Incoming Telco circuits
- On Outgoing Telco circuits

IN FIELD
- Betw. Remote Truck and Telco
- Betw. Remote Truck and Microwave
- For Intertruck Hookup
- For VTR Units
- For Monitoring Lines

Available on 10 day free trial

AUDIO-VIDEO ENGINEERING COMPANY
65 Nancy Blvd., Merrick, N.Y. 11566
Tel. (516) 546-4239

Circle (174) on Reply Card

Circle (175) on Reply Card
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.

**THE TRUE MEASURE OF PERFORMANCE**

The CB5 3A1 combines a color bar generator and character generator in one versatile instrument you can take right into the field for remotes and on-location shooting. It generates SMPTE and Y/REF color bars, plus red bar, black burst, multiburst, cross-hatch and dot signals. Standard NTSC sync signals and the gen-lock function are built-in.

You can insert character information into each signal using a special keyboard with Random Access Memory that retains the signals even if your power is lost. The CB5 3A1 gives you a total of 31 character spaces on 2 lines.

- Black burst output.
- Selectable black or white color background.
- External or internal switching for video and audio signals.
- Output range of +8 dBm to −50 dBm for 400 Hz and 1 kHz audio signals.
- RF signal on USA channels 3, 4 and 6.
- AC-DC operation.
- Available in NTSC; PAL B, M, N; and SECAM systems.

Measure your performance with the best.

**ASACA/SHIBASOKU CB53A1 Color Bar Signal Generator**

For complete specifications, write:

ASACA/SHIBASOKU CORP. OF AMERICA
12509 Beatrice Street, Los Angeles, California 90066
Sales, Service: (800) 423-6347 • (213) 827-7144
Circle (177) on Reply Card
One SPIKE Can Cost DOWNTIME!

Overvoltage transients can bring the biggest installation down in a microsecond, or damage it cumulatively.

Surge-Master Heavy Duty Power Line Protectors give complete protection against all transients.

All audio and video transmission equipment is vulnerable to transients on AC power lines caused by heavy motors starting up (even elevators or testing your auxiliary power system), power company load adjustments — and of course, lightning! Even if your equipment operates from batteries charged by a UPS, you're not safe. If lightning knocked out your UPS, how long could you keep going?

The MCG Surge-Master offers two stage protection. The first reacts in nanoseconds to absorb lesser transients and the leading edges of major ones. The second stage absorbs the big ones, and has three modules on each line. So, in the unlikely event that one module should be knocked out, there are still two protecting you. And a system of indicator lights tells you not only when a fault has occurred, but exactly where it is. Modular construction (and the fact that Surge-Master is connected in parallel) makes replacement of damaged modules quick and easy. Initial installation requires minimal power interruption.

Available with capabilities from 100 to 3000 amps; for 120, 240 and 480 VAC; and for single, 3-phase, wye and delta power systems. MCG also manufactures smaller units for protecting individual pieces of equipment. To learn contact Bill Purcell at 516/586-5125 or at the address below.

Protecting industry since 1967

MCG ELECTRONICS, INC.
12 BURT DRIVE
DEER PARK, N.Y. 11729

Circle (178) on Reply Card

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 Furquern 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.

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The VS-10 W12 Video Switcher

It's a 10x1 video routing switcher with two channels of audio following each video input.

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DEALER INQUIRIES ARE INVITED

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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.

Our FM Monitor Deserves a Second Glance. But it doesn't need it.

Engineers look twice when they first see our 691 Stereo and SCA Monitor. But when they start to use it, they find the 691's meters are easily tracked in a single glance. Like everything else about the 691, its measurement displays are very well thought out.

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Other benefits of the 691 include over 40 proof-of-performance and signal quality measurements. Add a scope and use the 691 as a spectrum analyzer... or get a vector display of L/R phasing. Perform a Bessel-Null calibration in minutes. Measure clipped composite accurately and quickly.

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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 Chromaflex 786, 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, Pay Sony $14,000 or Pay Us $360

The Logitek PAI-4

PRO AUDIO INTERFACE

To add hum-resistant balanced audio to your \( \frac{1}{4} \) system, you could replace your VTR with a new $14,000 model, or, for just $360, you can add Logitek's PAI-4 to the machine you already have. Either way, you'll get compatibility with your balanced mixers, amps and DAs.

Plus, the PAI-4's front-panel playback controls let you combine tracks and adjust levels without using your mixer, so mixing hiss is eliminated. And Logitek backs the PAI-4 with a 5-year limited warranty and Instant Action service that you don't get with your VTR at any price.

Call 800-231-5870
(Texas, Alaska, Hawaii 713-782-4592)
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 (T&TC) 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-

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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, extra-vehicular 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-
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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.

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.
Strictly TV
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 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.

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
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**Figure 3.** Output response for a klystron properly tuned for visual service.

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 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 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 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**

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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 wide-band 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.1-7(3)4(2)0
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MAINTENANCE TECHNICIAN: Immediate opening for experienced television maintenance technician. Minimum 2 years experience in component level repair of TV broadcast equipment. Must have FCC license experience helpful. Contact Ken Preston, Director of Engineering, KSEE, P.O. Box 2400, Fresno, CA 93779. (209) 237-2424 EOE M/F.

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HELP WANTED (CONT.)

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GRASS VALLEY 1600-7K studio switcher. Almost new condition and 5 RCA TK-44 studio cameras with lens rentals and RCPs. Contact Joe Berini, Chief Engineer, KRON-TV, (415) 561-8036.

CONVERGENCE AVS-1000 audio/video switcher. Convergence SE-100 mix/effects switcher. (212) 265-3576. Almost new!

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NEW O'CONNOR 102B Hydropod, white, Pro-Junior Base, Deluxe 3 Inch Casters with Cables/Bag ($750.00). Used, as excellent condition $1500 each. Call (918) 663-2371, Directly to Mary.


HIgh-Price PAID for 112 Phase Monitors and Receiver. All equipment mounted in 19" screw racks. Meets all ICSC specifications. As new condition. EIDSON Equipment, 20K -25K, depending on experience. Send resume to: Advisory Systems, Incorporated, Department T, 1601 Tonne Road, Elk Grove Village, Illinois 60007, equal opportunity employer m/f.

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ENGINEER: Chief engineer for WIZE Radio, Springfield, MA. Must have self - directed - ability. Must be totally versed with FCC regulations. Attractive salary and benefits. Send resume to: Director of Engineering, Great Trails Broadcasting, 4 South Main, Dayton, Ohio 45402. Equal Opportunity Employer.

WEST COAST CABLE SYSTEM with master control and production facilities seeks maintenance engineer with related technical training and 3-4 years experience. Must be knowledgeable on all tape machine formats, especially the 1/4 inch format. Must be able to troubleshoot, analyze and digital circuits to component level. Call Bob Martin or Jack Goldie, 415-996-7344, EOE.

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NEW O'CONNOR 102B Hydropod, white, Pro-Junior Base, Deluxe 3 Inch Casters with Cables/Bag ($750.00). Used, as excellent condition $1500 each. Call (918) 663-2371, Directly to Mary.


HIgh-Price PAID for 112 Phase Monitors and Receiver. All equipment mounted in 19" screw racks. Meets all ICSC specifications. As new condition. EIDSON Equipment, 20K -25K, depending on experience. Send resume to: Advisory Systems, Incorporated, Department T, 1601 Tonne Road, Elk Grove Village, Illinois 60007, equal opportunity employer m/f.

SERVICE MANAGER: Leading Florida video communication company is looking for an exceptional individual to fill this key position. This is a rare opportunity to build a first class service department from the ground up. Responsibilities include new installation, bench work and service department management. Must be experienced in maintaining state-of-the-art computed equipment. Salary commensurate with experience and qualifications. Good benefits, etc. Send resume to Dept. 612, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212.

ASSISTANT CHIEF ENGINEER: UHF, not affiliate looking for quality oriented candidates with 3-5 years of broadcast TV maintenance experience. Must have solid background in electronics: solid-state, digital and line. Must be knowledgeable on all tape machines and related equipment. Excellent opportunity for the right candidate. Please respond to: Engineering Communications, 12901, Overland Park, KS 66212.

ENGINEER: Chief engineer for WIZE Radio, Springfield, MA. Must have self - directed - ability. Must be totally versed with FCC regulations. Attractive salary and benefits. Send resume to: Director of Engineering, Great Trails Broadcasting, 4 South Main, Dayton, Ohio 45402. Equal Opportunity Employer.
HELP WANTED (CONT.)

**CHIEF ENGINEER** of 50K AM/ FM COMBO in North- east immediate opening, must be self-starter, FCC license, 3 yrs, experience, references, excellent salary and benefits, send resume to Director of Engineering, Chirlom Group, P.O. Box 416, Poughkeepsie, New York 12601.


**TELEVISION MAINTENANCE ENGINEER** Candidate WXXI Personnel Dept., P.O. Box 21, Rochester, NY 14603, must have 5 years experience at network or major market television station, with experience in microwave and maintenance systems. Maintenance of equipment including Sony BVU 200 & 800 VTRs and editors, Ikegami HL-79 and Thompson 501 cameras and related technologies. Must be experienced in microwave and recording systems. Salary commensurate with experience. Send resume to: John S. Beauchamp, P.O. Box 1856, Tacoma, Washington 98408.

**TELEVISION MAINTENANCE SUPERVISOR** for Installation and repair of Studio and Transmitting equipment for company owned and affiliated stations in Los Angeles, CA 90078. Excellent salary and benefits. Good working conditions and a spirited environment. Please forward resume to: Tom Monjack, PO Box 12901, Overland Park, Kansas 66212.

**TELEVISION/ ENG ENGINEER** If you have experience in maintaining and repairing Sony Electronic News Gathering equipment, and you are interested in working with a spirited team 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 1565 Los Angeles, CA 90078

**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

**TELEVISION POST-PRODUCTION FACILITY SEeks chief engineer for maintenance of broadcast-quality video equipment. Applicant should have 3+ years experience with quad and helical VTRs, TC editing, color cameras and audio systems. Astro Video Service, 51 W. Erie St., Chicago, IL 60610.

**VIDEOTAPE MAINTENANCE ENGINEERS, VIDEOTAPE OPERATORS, AMPLEX 2, 1" TYPE C and 4" BUD EQUIPMENT**. Immediate position available. Must have good experience with VTR's, TC's, and editing equipment. Must be experienced in all aspects of tape duplication. Send resume to: Ron Rose Productions, 29277 Southfield, Southfield, MI 48076. ATTN: Mr. D. Wooster.

**ENGINEERS AND MANUFACTURERS DIGITAL AND ANALOG RECORDING HEADS RECONDITIONING — MODIFICATIONS — MOUNTS NORTON ASSOCIATES, INC. 10 DR TOMAS COURT • COPAGUKE, NY 11726 (516) 842-4666 — OUR 30TH YEAR —**

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**HEA ENGINEER—TELEVISION PRODUCTION STUDIES** working with 1" and 4" BUD equipment. No degree required. Good fringe benefits and retirement program. Leadership ability and four years' studio maintenance experience expected. 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.

**TV MAINTENANCE SUPERVISOR.** For installation and repair of studio and transmiter equipment. Required: FCC; good working knowledge of studio and transmiter equipment, as well as, our operator oriented and experienced 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 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: Throm Pratt, Cox Cable Santa Barbara, P.O. Box 3920, Santa Barbara, CA 93130, 805/963-0911.

**CHIEF ENGINEER—Major midwest market 50kw—AM and 100kw—FM, union shop. Must have strong radio engineering background. Send resume and salary requirements to Dept 624, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. An Equal Opportunity Employer.**

**TV MAINTENANCE SUPERVISOR.** For installation and repair of studio and transmitter equipment. Required: FCC; good working knowledge of studio and transmitter equipment, as well as, our operator oriented and experienced 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 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: Throm Pratt, Cox Cable Santa Barbara, P.O. Box 3920, Santa Barbara, CA 93130, 805/963-0911.

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**ELECTRONIC ENGINEER: HIGH-SPEED TAPE DUPlication.** Bonnieville 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 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. Professionals please note that all engineering and production areas are designated “NO SMOKING.” Please reply to: John S. Beauchamp, P.O. Box 1856, Tacoma, Washington 98408.

**TV Chief Engineer**

**P.O. Box 1856**

**Los Angeles, CA 90078**

**EOE M/F/HC/VET**

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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.

Without any exception whatever!

The 6112 is the most advanced compact switcher available

Unless you own a 6112, you cannot appreciate just how much it is capable of doing. It's two pattern generators and a full preview system provide tremendous production power. It is possible to preview a masked key, then dissolve that in on the Program bus; then without affecting Program, you can go to preview, add another insert with a different pattern, then wipe in this new insert on Program. The optional chroma keyer (RGB or Encoded) permits a wipe over or behind the key. Just try to do anything like this with any other similar switcher, and you will understand why the 6112 is by far the most advanced compact switcher around.

The switcher is user friendly. There are separate fader arms for each ME system. We strongly believe a positioner should operate normally (try setting a pattern on switcher with a "rate control" type positioner).

The switcher is available in three versions
Basic 6112 with LED push-buttons
6112BH with incandescent lamp buttons
6112AK with full microprocessor control
NTSC & PAL

The choice is yours

Now consider post-production applications
The 6112 can be controlled from almost every editor currently on the market.

Crosspoint Latch is the leader with editor control of switchers, with several levels of control - very important for post-production. There is also the 6800 Audio Mixer specifically designed for post-production.

For full computer control of the switcher the 7239 AUTO DRIVE is the most sophisticated and comprehensive device in the industry. There is nothing that compares with it at any price. Crosspoint Latch Serial protocol is simple, direct and provides fast access. The 6112AK is fully microprocessor controlled and can be externally accessed with the optional SMART INTERFACE module.
Now there's even more to look into

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 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) 334-0050 • Southwest: (713) 445-0100 • Southeast: (813) 884-2046 • Canada: (201) 368-9179

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Ward-Beck responded by creating this unique low-profile mainframe design featuring a satellite meter unit.

An inspired solution to an interesting challenge!

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