

# BROADCAST<sup>®</sup> engineering

March 1985/\$3

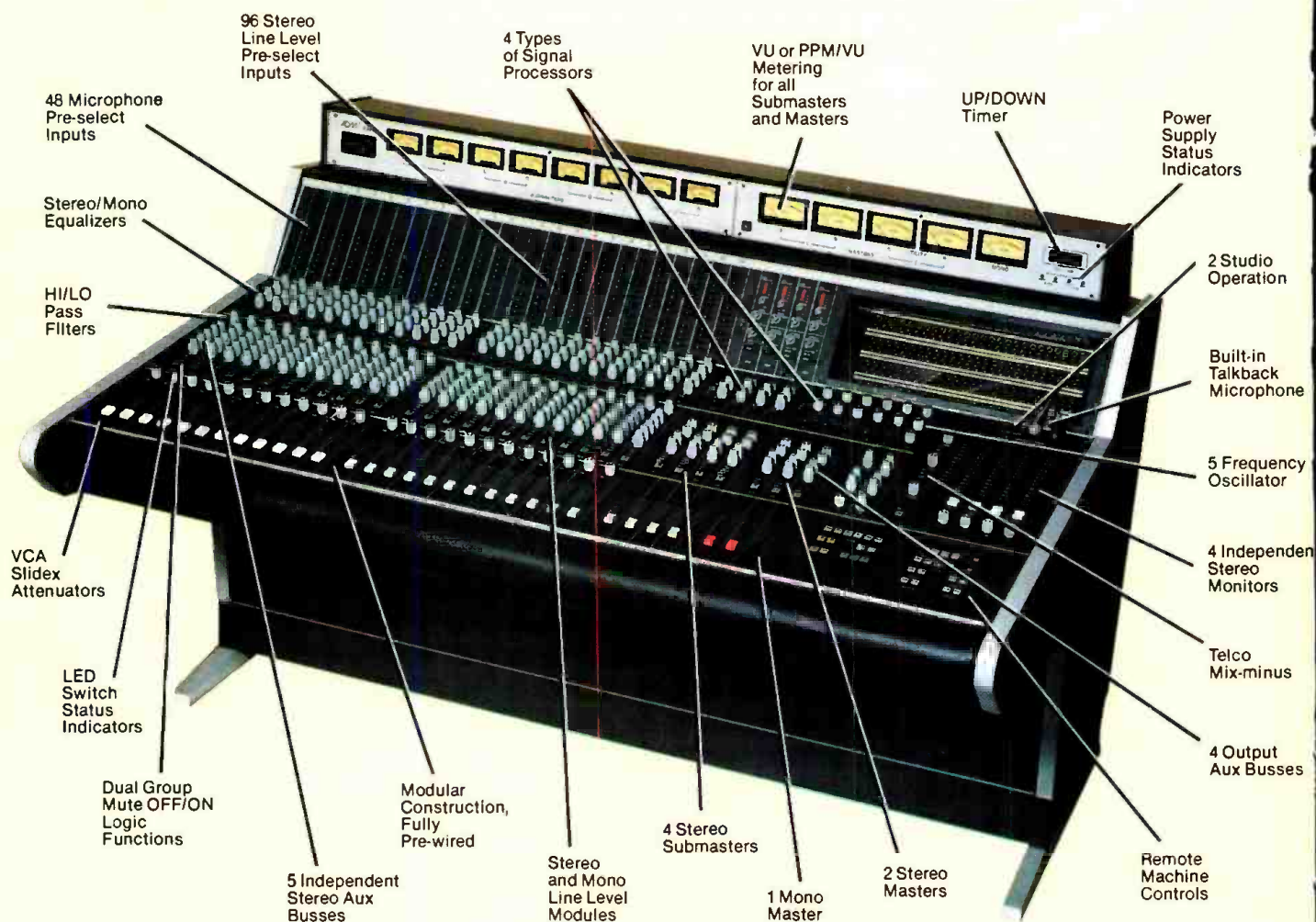
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*The journal of broadcast technology*

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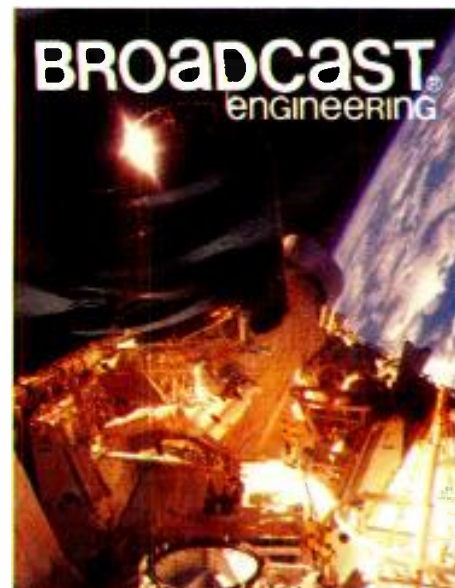
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**THE COVER** this month shows the inauguration of a new aspect in satellite technology—satellite recovery. The November Space Shuttle mission, which recovered two satellites in useless orbits, revitalized the industry. New technologies and techniques such as satellite recovery are presented in **BE's** section on "Breaking New Ground." (Photo courtesy of NASA.)

## **Coming events**

### **May 7-11**

American Women in Radio & Television,  
Hilton,  
New York

### **May 12-15**

Broadcast Financial  
Management,  
Chicago

### **May 14-15**

LPTV,  
Western Bonaventure,  
Los Angeles

### **May 15-18**

Public Broadcasting Service/  
National Association of  
Public Television Stations,  
St. Francis Hotel,  
San Francisco

### **May 19-23**

National Public Radio,  
Mariott City Center,  
Denver

### **May 29-June 1**

ITVA Conference,  
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## **NEXT MONTH**

Automation in broadcast stations

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- Transmitter automation development
- Audio program controls systems
- Video cart automation systems



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# people

**Eric Neil Angevine, P.E.**, has joined the technical consulting staff of **Broadcast Engineering** as broadcast acoustics consultant. Angevine is vice president of Angevine Acoustical Consultants, West Falls, NY, which specializes in acoustics, noise and vibration control. He received a bachelor's degree in architectural engineering and a master's in architectural engineering with a specialty in acoustics from the University of Texas at Austin.

**Rainer von Rabenau** has been named European sales manager for the microwave division of Wiltron, Mountain View, CA. He is responsible for Wiltron's sales and support in the United Kingdom and Europe.

Dielectric Communications, Raymond, ME, has appointed **Oliver Bjerke** as regional sales manager for all TV and radio broadcast products, covering broadcast stations, distributors and OEMs in the mountain and Pacific time zones.

**Jesse D. Camacho** has been appointed Western regional sales representative

for For-A, West Newton, MA, operating from the company's new West Coast sales office. He will be responsible for 13 Western states.

JBL, Northridge, CA, has hired four engineers to work on the design and development of professional sound products: **Drew Daniels** is applications engineer; **Roy Cizek**, senior engineer; **Henry Martin**, senior engineer; and **Paul Apollonio**, acoustical engineer.

**Don Reynolds** has been appointed engineering manager, analog products, for Utah Scientific, Salt Lake City, with chief responsibilities in audio and video signal handling systems and product development.

**Lawrence Weiland** has been named vice president and director of marketing at CMX, Santa Clara, CA.

**Daniel D. Roberts**, vice president of the professional video communication division of JVC, Elmwood Park, NJ, was elected to the board of directors of the International Tape/Disc Association. He is one of six new

directors, and will serve a 1-year term.

**Bret Lukezic** has been appointed chief engineer for California Communications, a Los Angeles-based video rental and post-production facility. He previously handled camera and VTR maintenance in the company's rental department.

Comsearch has named **Michael K. Morin** general manager, a new position with overall responsibility for the company's Reston, VA, operations for earth station, terrestrial microwave and mass media services. He previously was vice president of the mass media services division.

Crown International, Elkhart, IN, has appointed four engineering specialty managers: **Tom Lininger**; **Tom Szerencse**; **John Bachman**; and **Jim Marks**.

The board of directors of Scientific-Atlanta, Atlanta, has named **David A. Eggers** as a vice president. He has been general counsel and secretary.

!:-~)))))

## BROADCAST engineering

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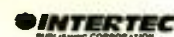
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# Strictly TV

By Carl Bentz, technical editor

## The future of NTSC

Has NTSC reached its limits? Many say it has.

They cite degradation caused by the color subcarrier and suggest the 6MHz channel bandwidth limits improved definition.

The ideal picture transmission amplitude characteristic (Figure 1) indicates luminance bandwidth without attenuation is 4.2MHz. With attenuation, visual information extends another 0.3MHz. Some new receivers

might surpass 4MHz, but few are able to display detail up to 3.5MHz, even in monochrome.

The fact that color is situated around 3.58MHz is a consideration, but if NTSC is to blame, receiver design is also at fault.

The 1.25MHz below the visual carrier is, in essence, wasted space. A lower sideband is the by-product of amplitude modulation. The carrier is needed for the demodulation, but a complete lower sideband is not required. As a result, only a vestigial sideband remains.

FCC rules state it must be attenuated by 20dB and 42dB below the visual carrier at -1.25MHz and -3.58MHz from the visual carrier, respectively, before the signal is fed to the antenna.

### Playing with NTSC

The General Electric Com-Band was designed for CATV. This innovation simultaneously placed two unrelated, but synchronous, video signals onto a single visual carrier. A decoder was required to get images with slightly more grain than normal. From a typical viewing distance, the picture was asily watchable.

Com-Band took advantage of several factors. Parts of the NTSC signal are inefficiently used. Luminance and chrominance bandwidths are limited in the receiver. A great deal of redundancy occurs between consecutive TV lines.

This redundancy allowed consecutive pairs of lines (L1/L2, L3/L4, etc.) from a field of video 1 (followed by video 2) to be matrixed, creating sum (L1+L2) and difference (L1-L2) signals.

Then, in an overall 525-line structure, the sum and difference of L1/L2 video 1 became line 1 of the transmitted field. Line 2 came from video 2, line 3 from video 1, etc.

The difference, a narrowband signal, contained vertical detail and fit into the area occupied in part by the vestigial sideband. With quadrature phasing, similar to I/Q color signals, the detail was quadrature modulated on the visual carrier to a  $\pm 1.25$ MHz bandwidth.

Modulation control was needed. Combined difference and sum modulation could not exceed 100%. To insert the detail signal, the sum modulation was reduced, at least to 1.25MHz above the carrier (Figure 2).

I and Q color signals, at  $\pm 500$ kHz bandwidths, centered on 3.58MHz. Two full-time FM audio channels were located at 4.4MHz and 4.6MHz.

At the receiver, rematrixing difference with sum information developed the missing lines. Thus, (L1 + L2) + (L1 - L2) = L1, and (L1 + L2) - (L1 - L2) = L2. Logic selected the desired channel lines from the carrier for rematrixing process.

The sum-difference concept has served FM stereo well. In Com-Band, instead of a pilot carrier to assist decoding, the two signals required frame synchronizers on both video signals prior to input processing. Decoding depended upon proper timing signal structures.

The system was not FCC-approved for broadcast use. It did suggest expanding a cable system channel count less expensively than rebuilding the entire system for a greater bandwidth.

The point is not that Com-Band improved pictures, but rather that one channel could accommodate additional information without major degradation. If related secondary information were placed in the NTSC signal and displayed with the primary signal, could an improved resolution image result? If it has been tried, the results are not well-known.

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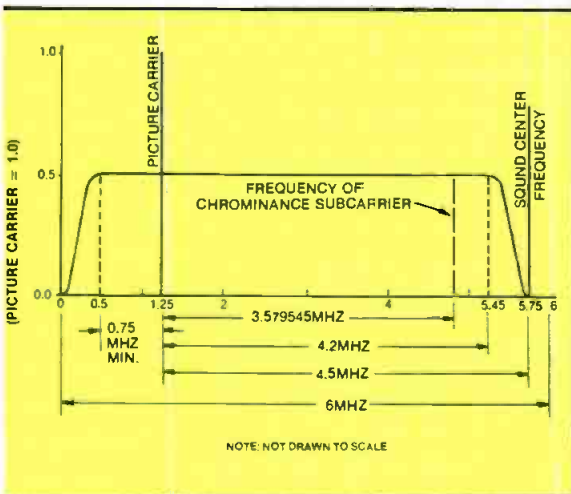


Figure 1. Ideal picture transmission amplitude characteristic (FCC, 73.669, Figure 5).

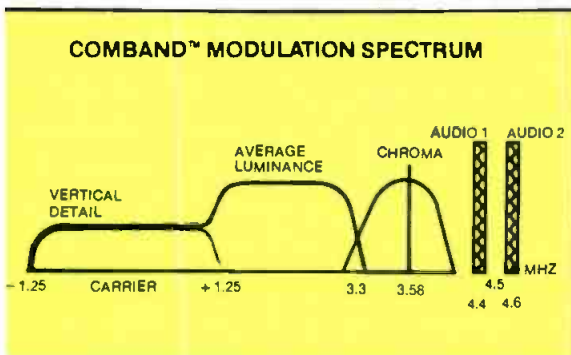


Figure 2. Transmission spectrum of the GE Comband System.



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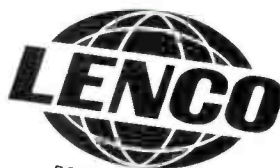
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There are fundamental differences in the audio processing requirements of AM and FM stereo systems.

Consider a center channel ( $L = R$ ) FM stereo signal, which is by definition a monaural signal. As shown in Figure 1, the  $L-R$  channel is zero and the  $L+R$  channel is maximum and carries the full signal.

With FM stereo, the intelligence (modulation) must fit within a single communications channel, which is specified as  $\pm 75\text{kHz}$  deviation of the RF carrier. The monaural (center channel stereo) signal will fully modulate the entire communications channel (ignoring the modulation level of the pilot and SCA signal, if used).

With AM stereo, however, there are two communication channels to carry the audio signal: envelope modulation

of the carrier for the  $L+R$  audio component and angular modulation of the carrier for the  $L-R$  component. Each communications channel may be modulated independently. The modulation of one channel does not affect the available modulation for the other, as it does in FM stereo systems.

By definition, the AM stereo center channel audio signal will envelope modulate the AM carrier. Angular modulation of the RF carrier (again, ignoring the pilot tone) will be zero. This is illustrated in Figure 2.

#### Single channel modulation

If one audio channel is removed so that a left only (or right only) audio signal exists, some interesting things happen.

In an FM stereo system, the stereo

generator will create two signals, the  $L+R$  main channel and the  $L-R$  stereo subcarrier. These audio signals (ignoring the pilot) now share the communications channel. This condition is shown in the right half of Figure 1. (The main channel and stereo subcarrier have been sketched separately for emphasis. This is not a sketch of a composite FM stereo signal.)

The FM stereo communications channel is still fully modulated, but the main ( $L+R$ ) audio channel is modulated only 50%. The remaining 50% of the available FM signal is taken up by modulation of the stereo subcarrier.

Consider what happens to the audio signal in an FM receiver as a transition is made from center channel to single channel program conditions. The stereo receiver reproduces all of the transmitted signal, just as it existed in the studio. The monaural FM receiver, however, reproduces only half of the signal with single channel programming.

There is no change in the transmitted RF power or total modulation. In a sense, there is no change in coverage area. However, the stereo receiver loses the audio energy in one channel (but not the noise) and the mono receiver loses three-quarters of its audio power output with the same noise floor.

The station's coverage area is, therefore, effectively degraded as the single channel stereo content of the program material increases. The degradation is uniform over the entire coverage area, but it may be more noticeable in fringe locations.

#### The AM difference

If you are an engineer at an AM station, imagine the reaction when the general manager learns that full stereo effects would result in the same

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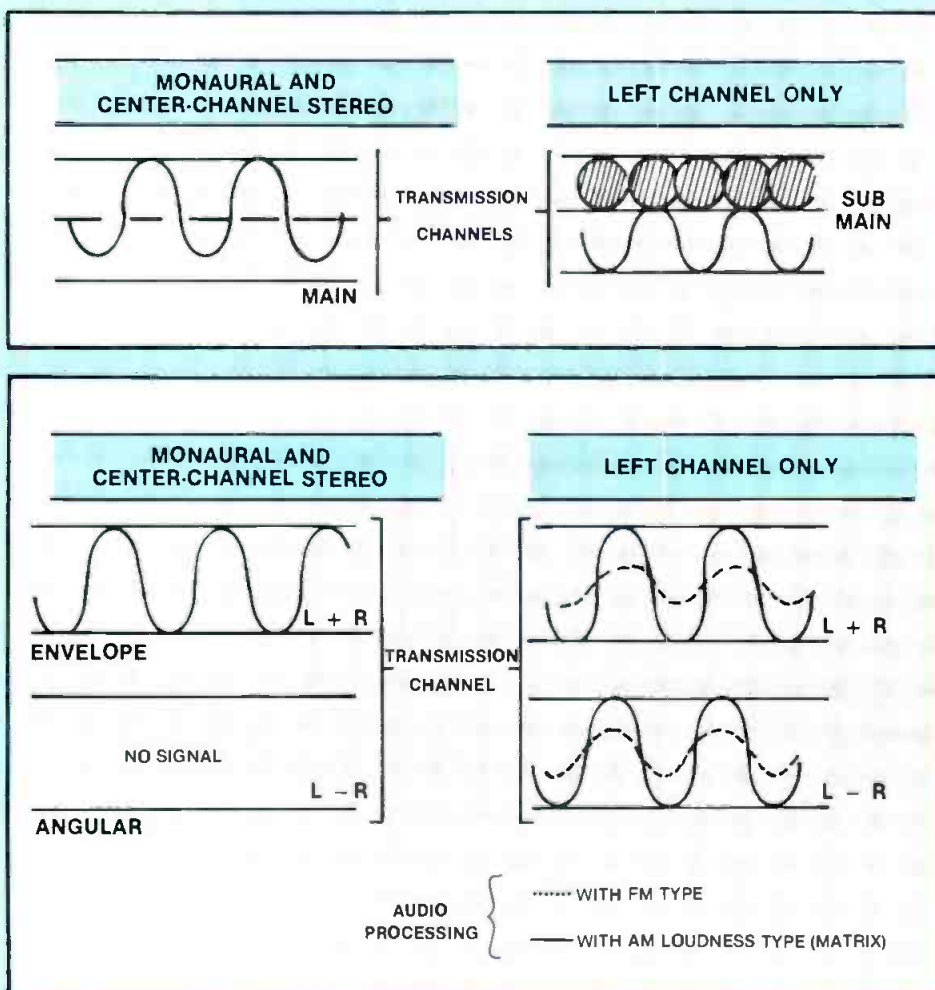


Figure 1. FM stereo modulation capabilities (top).

Figure 2. AM stereo modulation capabilities.





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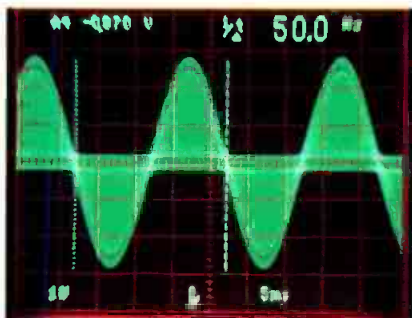
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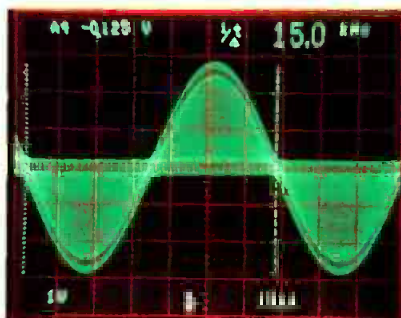
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# Satellite update

By John Kinik, satellite correspondent

Congressional and business activity in the past six months may have a great impact in determining the growth of the satellite industry.

In October, Congress passed the Cable Act, which also clarified the legal status of unauthorized reception of satellite television by the growing backyard dish market, setting off what is expected to be an unprecedented increase in the total number of installed dishes.

In December, the most prominent player in the budding high-power DBS market, Comsat's Satellite Television, dropped out of the race completely, culminating a shakeout that also saw such major corporations as CBS, Western Union and RCA shelve their plans at least temporarily.

In January, NBC began operation of a major satellite network, utilizing a medium-power Ku-band satellite, underscoring the fact that this technology will play an increasingly important role in satellite broadcasting.

These developments have established the three technologies—C-band, medium-power Ku-band, and high-power Ku-band (DBS)—in their proper place for the next five years.

C-band delivery direct to homes is now recognized as a legitimate contender for a significant portion of the estimated 15-to-20 million homes that will never be served adequately by cable systems or broadcasting. Growing slowly over the past few years as a semi-underground industry, it is now poised to expand rapidly in spite of Cable Act requirements of payment for services that charge for use of their channels.

DBS, in contrast to C-band, has been relegated to a future role, which is more realistic in view of the state of development of the technology required to make DBS feasible.

Ku-band technology, already proven in operating satellite systems, will grow in importance as the NBC network expands, and as more of these

satellites are launched for the immense business communications market.

A more detailed examination of each type of technology is in order to establish why these trends have become dominant.

## C-band

C-band satellites have been in operation domestically for more than 10 years, with a gradual increase in channel signal power (EIRP) over the years so that antennas as small as eight feet in diameter are common.

Two factors prevent any further decrease in receive antenna size: satellite EIRP is limited to the current 36-to-37dBW per channel by international regulations that protect terrestrial microwave systems operating in the same band; and the proposed 2-degree satellite spacing does not allow general use of smaller antennas because of the interference that would result from adjacent satellites.

In spite of the relatively large antenna size, C-band backyard dishes are quite acceptable in rural areas and many communities where zoning laws are not a factor. The number of installations can be expected to increase to fill the market need, with up to 10 million installed dishes possible eventually.

This market, disdained by Home Box Office and the other premium programmers for the past few years, is now getting a lot of attention because the same programmers have failed to meet their anticipated growth rates.

To capture this new market, the premium services plan to scramble their signals and sell decoders to users. Decoder technology has only recently been developed to where it is cost-effective and can be mass-produced.

Other satellite services that do not plan to scramble must work out another way to collect from those receiving their signals. One possible method is a surcharge on equipment sold, as in the case of video cassette recorders.

One of the primary features of the Cable Act is that it establishes a set of regulations to prevent unauthorized

reception of services that charge a fee. This satisfies demands that program originators and the cable industry have made for several years. At the same time, it establishes a mechanism whereby backyard dish owners can deal with program suppliers.

## DBS

High-power DBS satellites received a great deal of premature attention for the past two years because the FCC stimulated a burst of applications in 1983 by opening the doors to prospective DBS systems. The reality that emerged a year later was that few of the original applicants had a solid business plan.

Technology was a major problem area, because the 100-to-200W class of traveling wave tube (TWT) power amplifiers required for each DBS channel on the satellite had not been developed to the point that reliability in orbit could be assured.

Programming was an equally important problem. Even the established satellite programmers have been struggling, partly because of a lack of programming and the cost of producing original programming.

In spite of the dropouts, three companies remain in the running with FCC authority to construct their systems. These companies, expected to be operating in 1987, are: Direct Broadcast Satellite, Dominion Video Satellite and United States Satellite Broadcasting.

In addition, the FCC accepted four new DBS applications in December, with the applicants required to show in a year evidence of "due diligence" to construct and operate their systems. The four new players are: Satellite Syndicated Systems, National Christian Network, Advanced Communications, and Hughes Communications Galaxy.

The new systems, if they meet FCC requirements and are authorized to construct, can be operational sometime in 1988 to 1990. Each of the seven planned DBS systems utilize two satellites, with one satellite serving each half (eastern and western zones) of the country.

Continued on page 164



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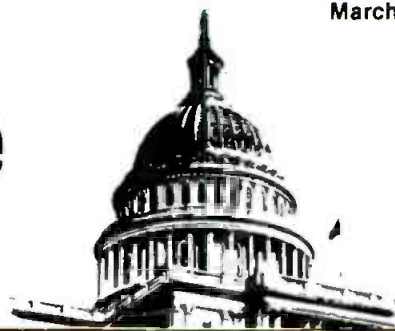
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Circle (9) on Reply Card



# FCC update

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



## More 'underbrush' removed

In its ongoing "underbrush" proceeding, in which the FCC is attempting to eliminate unnecessary regulatory policies, doctrines and rulings dealing with business practices, the following subject matter areas have been eliminated from the agency's purview:

- Distortion of audience ratings.
- Employee conflicts of interest. (Accepting payola for promotion of records still is illegal.)
- Sports announcer selections.
- Promotion of the non-broadcast business of a licensee and use of a station's monopoly power for personal advantage in other business activities.
- Concert promotion announcements.
- Failure to perform sales contracts.
- False, misleading and deceptive commercials.

In a separate but related notice of rulemaking, the FCC proposed deleting rules and policies in the following areas:

- Fraudulent billing practices.
- Network clipping.
- Combination advertising rates and joint sales practices.

The policies affected by these changes and proposals involve either business practices permitted by federal antitrust laws or practices forbidden by other laws or regulations. The commission said it should not attempt to outlaw business practices sanctioned by the antitrust laws, and

that it does not need to intervene where other federal or state laws provide remedies for misconduct.

The commission's actions are consistent with previous rulings in the underbrush proceeding in which the FCC has endeavored to remove itself from the enforcement of essentially private rights unless a clear and convincing showing is made that its oversight is necessary to protect viewers and listeners.

## Disruptive contests

In a related action, the FCC has eliminated a policy statement, adopted in 1966, that cautioned broadcast stations against airing contests and promotions that threaten public safety or encourage encroachment on others' legal rights. Examples of problems that resulted in the adoption of the policy statement:

- A contest that resulted in a vast accumulation of scrap metal, blocking access to nearby commercial establishments.
- A contest that had listeners choose names at random from a telephone directory and call the persons listed at all hours.
- Contests that caused traffic jams or encouraged speeding.
- The broadcast of scare announcements designed to mislead or frighten the public: for instance, a potential disaster.

The commission determined that many of the situations that arose

under its policy statement did not warrant FCC attention. It noted that alternative remedies are available under local civil and criminal law when trespass, nuisance, invasion of privacy or disturbing the peace occur.

## Network contracts

Citing the costs and burdens involved, the FCC has proposed to delete the requirement that network affiliation contracts be filed with the agency. Currently, rules require the filing of licensee program contracts with network organizations such as ABC, CBS, NBC, Mutual, RKO, Sheridan Broadcasting Network, the Black Network, UPI, AP and more than 98 regional networks.

In suggesting the elimination of the filing requirement, the commission said the public interest may be better served by conducting special ad hoc studies of network affiliation matters, as needed, rather than requiring the continued filing of all contracts.

Such special studies could be tailored to specific FCC needs and would be more cost effective and less burdensome when obtaining information on network relationships.

The commission also asked for comments on whether it should continue to require that network affiliation contracts be placed in stations' local public inspection files. Alternate plans permitting public access to the contracts will be considered.

[-:->)]))

## Strictly TV

Continued from page 6

### Better color

Color improvement is possible with comb filtering to separate color and luminance components. To avoid all color problems and keep a strict NTSC format may not be possible.

Digital TV sets, already being tried in Europe and shown at the recent CES exhibition in Las Vegas, NV, should offer better color. MAC formats produce pictures without a chroma subcarrier for reduced degradation. But digital and MAC are not garden variety systems.

More resolution in vertical and horizontal directions is desirable. You

can increase the line count in the picture. Doubling the horizontal line rate should double vertical detail. Instead of 525 lines (less blanking), you use a raster of 1050 lines (1250 for PAL/SECAM), with less blanking.

Adding more lines increases the channel bandwidth. You might somehow interleave additional information into the existing modulation envelop, but either way you have non-standard NTSC.

Increased vertical and horizontal resolution definitely needs a greater band of frequencies per RF channel than is used now.

Practical limits exist regarding pic-

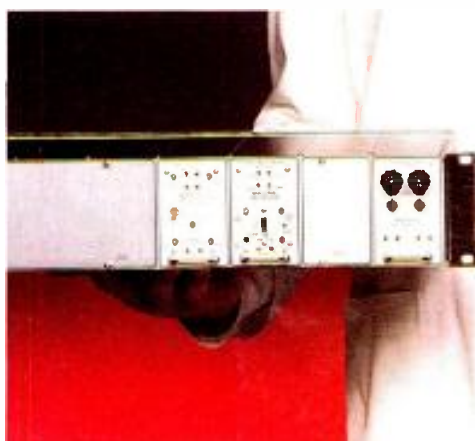
ture elements. The size of the electron spot (the width of a scanning line) that creates the image is a finite size. Presumably that spot is circular. With current CRTs in home receivers, developing a horizontal element dimension much smaller than the width of a TV line is a futile effort.

For the ultimate TV picture, the NTSC system seems eventually doomed. Just how soon is uncertain. No quick move to something completely different can be made because consumers will not accept it. For the TV broadcast industry, it is not economically feasible.

[-:->)]))



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## Moving with the times?

For better or worse, radio broadcasting is changing. The progress of technology in our industry, incremental at first, is steadily gaining momentum. The road from low-tech to high-tech has been traveled with the help of radio engineers. Engineers who now face an uncertain future unless they are willing—and able—to adapt to a new way of doing things: to move with the times.

To understand today's situation, we must go back to the era of great broadcasting expansion that followed World War II.

There was considerable prestige in being an engineer. The public and entrepreneurs of the day regarded the radio engineer as something of a wizard. A wizard that could understand and control that almost magical thing, the radio transmitter.

With a rapid expansion in the number of radio stations on the air, broadcast engineers were much in demand. A person who held a first class radiotelephone operator's license from the FCC—not at all easy to obtain in those days—was highly respected and sought after.

To fulfill the demand for first phone licenses—and to make a nice profit—numerous radio schools sprang up, taking advantage of the GI benefits of World War II veterans. Because the first phone license was a virtual guarantee of employment, the schools often concentrated only on question-and-answer type teaching.

Frequently, graduates were left with only a license and little—if any—useful technical knowledge. There were many so-called engineers whose skills and knowledge bordered on incompetence. With this situation came the first devaluation of the FCC license.

It should be pointed out that many of these new engineer/operators did little to enhance their own image, position and standing with management. All too often the engineer was unwilling to perform any task other than transmitter operation and keeping the log, leaving repair and maintenance to the chief engineer, who was kept busy changing 6SN7s and 5U4s.

There seemed to be a widespread attitude among the engineer/operators that, "They can't get along without me and my first phone license." The next sentence would generally begin with, "The FCC rules say...". This often uncooperative, independent attitude only added fuel to the fire. Some of the problems that existed then—and, indeed, still exist today—were born out of the engineers' attitude during a time when they seemed to have the upper hand.

During the 1940s and 1950s, radio stations were built and operated primarily for the immediate return and cash profits they could produce. They were not built and held for the profit of appreciation only. As competition for the advertising dollar increased, however, managers began looking for ways to reduce operating costs. Because the largest salary expenses lay in announcing and engineering, owners sought to combine these positions.

Because of the shortage of first phone operators, the need to cut operating costs and the cantankerous attitudes of some first phone operators, station owners appealed to the FCC for relief. Opinions and lobbying efforts were strong on both sides of the issue. In the end, the commission amended its rule to allow the use of third class operators, except for certain duties.

At the same time, the FCC allowed remote control of AM transmitters, except when operating with a directional antenna or above certain power levels. These actions in the early 1950s were milestones in broadcasting. They set in motion a trend toward automation and streamlined operation that continues.

The rule changes were necessary for business reasons. They were made possible, however, by technical advancements in broadcast equipment design and construction.

Reliability had increased, stability had improved and operation had been simplified. The days of the first phone operator sitting at the transmitter doing little, except making an occasional minor adjustment and keeping the transmitter log, were numbered.

This discussion has more importance than a simple history lesson. Many parallels can be drawn between the radio industry of today and that of 30 years ago. We are poised on the threshold of technological breakthroughs that make transmitter remote control look pale by comparison.

In large measure, the broadcast engineer's fate and fortune has hinged on the value of that first class license, posted on the wall next to the transmitter. As the license declined in value, so did the stature and status of the engineer, at least in the eyes of some.

*Continued on page 16*



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## Editorial

Continued from page 14

We can argue whether the FCC was right in eliminating the first class license. We can also argue the advisability of recent technical deregulation. Unfortunately, however, things are as they are. Time and energy would be better spent dealing with the situation as it exists.

A new breed of engineer has evolved today as a result of the changes. This engineer is often the chief and sometimes the only technical person on the radio station staff. To survive and prosper, engineers must recognize where the radio industry is going and direct their efforts toward meeting new challenges and opportunities, rather than clinging to days gone by.

To be a successful broadcast engineer today and in the years to come, know your trade, learn the technology that makes the equipment work and—equally important—assume a positive interest in your company. While you develop and expand your technical knowledge, also expand your rapport with management and co-workers. By doing this, you will learn how each department in the station contributes to the end product, and how engineering can contribute.

The same disciplines of logic and reasoning that are required to solve engineering problems can also be used to solve management and communication problems.

Engineers, think in the direction of management, not just engineering management, but overall company management. In so doing, you will improve your image and position within the station and, perhaps, open the door to new opportunities within the company.

Managers, take a serious interest in the engineering personnel at your station, if not the technology itself. The engineering department can be a valuable resource for information on new developments that allow increased operating efficiency or expansion into new business ventures such as subcarrier data transmission or utility company load management.

The engineering department may also be a valuable resource for ideas not related to technology. Excellent suggestions can often come from engineering personnel, who may be sufficiently removed from the operation of other departments to see solutions to a problem or need that may not occur to those more closely involved.

In many respects, the engineer/management relationship is a people problem. It is, in fact, a personal relations problem that has little to do with technical matters.

Radio engineering is a profession that has both engineers and managers concerned. Engineers see the changes that have occurred during the last 10 years and are alarmed. Managers see stiff competition for competent engineers and are also alarmed.

Higher salaries in the computer and aerospace industries have siphoned off talented engineers as they graduate from colleges and universities. Television has complicated the problem by diluting still further the supply of broadcast engineers.

To attract and hold competent engineering help, the salaries and opportunities available in other professions must be matched, or at least approximated. You get what you pay for. This applies to broadcast engineering personnel, just like anything else.

Radio engineers must learn to adapt to changing technology and a changing industry. Those who cling to the past face a future as bleak as that of elevator operators of some years ago. They have been replaced not so much by advancing technology as by the realization that their work was largely non-productive.

The only way for radio engineers to maintain the compensation and respect they deserve is to recognize where our industry is, and where it is going. In short, move with the times.

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The 39th annual NAB Broadcast Engineering Conference will examine a wide range of topics of interest to engineers, from multichannel TV sound to transmitter maintenance.

The conference, April 13-17, held in conjunction with the annual NAB convention, has been designed to provide engineers of varied interests and responsibilities with useful, back-to-basics information. In addition, new developments in emerging technologies, such as HDTV and computerization of news gathering activities, will be presented.

Again this year, the conference will begin with radio and TV technical sessions on Saturday. This follows the positive response received to last year's experiment with Saturday sessions. Special studio and transmitter maintenance workshops have also been scheduled for both radio and TV engineers.

#### Radio sessions

- "AM Technical Improvement" (Saturday, April 13, at 9:30 a.m.)

Experts on the difficult subject of how to improve AM broadcasting will discuss the work and recommendations of the NAB's AM Improvement Committee. The session will include reports on transmitter transient distortion, broadbanding antenna systems, station-to-receiver audio frequency response, receiver improvements and interference sources. Significant new ideas are expected to be presented at the session on the technical future of AM radio.

- "Radio Engineering" (Saturday at 2 p.m.)

Topics of general interest to engineers will include a new design for wideband FM transmitting antennas, standby power systems for broadcast facilities, the effects of quarter-wave stubs on AM towers and the design of air handling systems for transmitters located in tall buildings.

## Looking toward the future

By Ed Williams, staff engineer, NAB

- "Radio RF Maintenance Workshop" (Saturday at 5 p.m.)

Keeping a station on the air is the function of a good maintenance program. How to set one up and keep it going is the thrust of this workshop. After reports on a model station maintenance program and the importance of proper transmitter cooling, a panel of station engineers and manufacturer representatives will discuss RF maintenance requirements.

- "Radio Studio Maintenance Workshop" (Sunday, April 14, at 10 a.m.)

The scope of a studio maintenance engineer's job is changing. Servicing digital audio equipment, automation systems, satellite receivers, microprocessor-based tape machines and other studio gear demands a broad range of maintenance abilities. This workshop will begin by outlining a model station maintenance program for the studio. A panel discussion will follow featuring station engineers and manufacturer representatives.

- "AM-FM allocations" (Monday, April 15, at 8 a.m.)

This popular session will feature recognized experts in international broadcasting who will report on the status of

important radio frequency

allocation negotiations. Special attention will be given to how these talks affect U.S. broadcast services.

- "Radio Subcarriers" (Monday at 10 a.m.)

FCC deregulation of subcarrier use has opened the door to many new opportunities for AM and FM broadcasters. This session will feature reports from stations that are utilizing subcarriers for a wide variety of commercial ventures and how to adjust FM transmitters to reduce crosstalk. The use of AM subcarriers to relay data will also be examined.

- "Radio New Technology" (Tuesday, April 16, at 8 a.m.)

Technological developments are providing broadcasters with new solutions to old problems. This session will feature reports on a broadcast version of the compact disc, recordable discs, use of computers in the newsroom, development of an improved FM transmission system and a means to evaluate FM signal penetration in a given geographical area.

- "Radio Production" (Tuesday at 10 a.m.)

Two of the most difficult problems that many stations continually face are how to set up stereo microphones and how to make a telephone interface system work. This session will feature presentations on a new digital telephone company interface and how to arrange microphones for the best stereo in the studio or in the field.

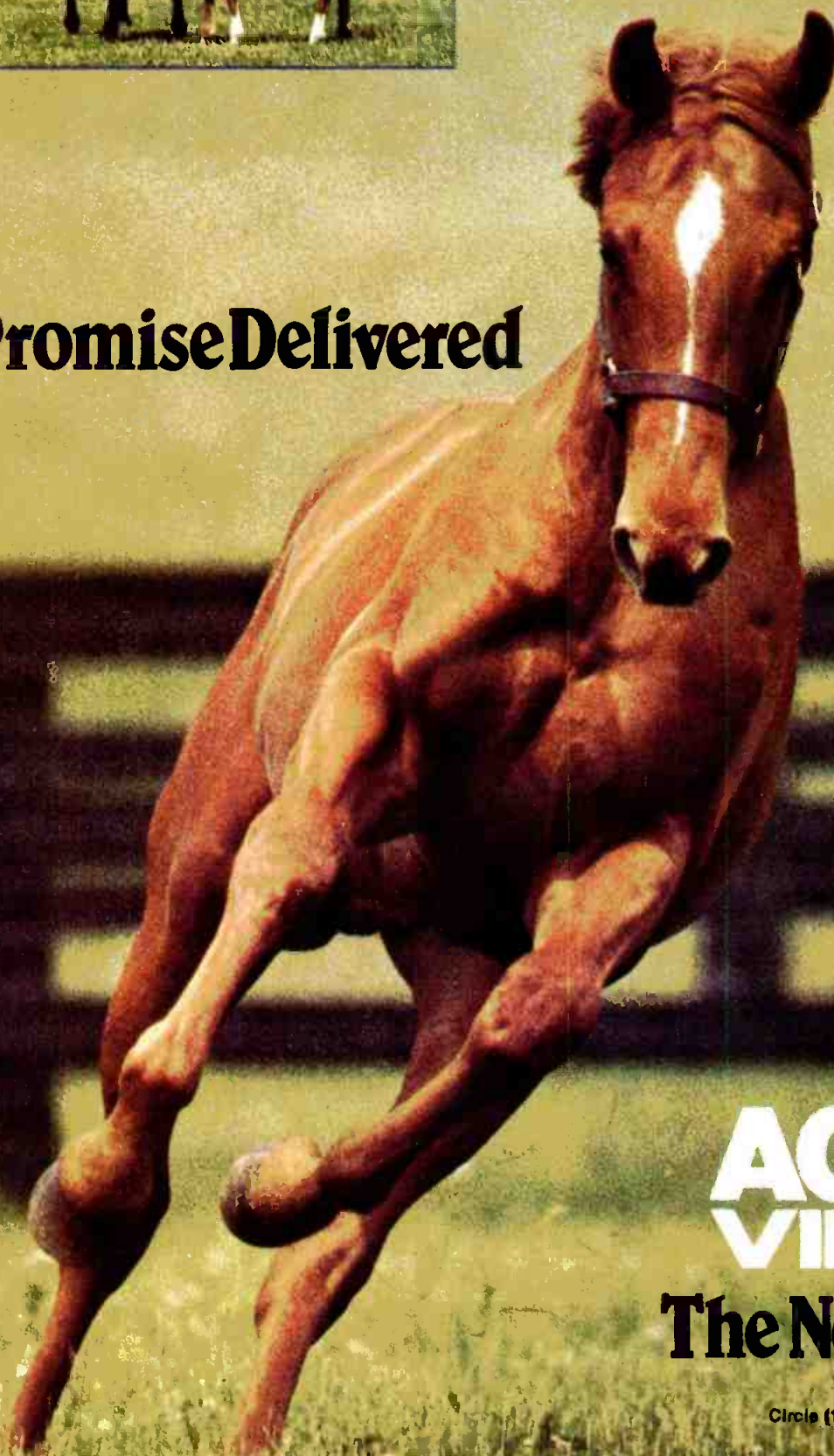
A panel of production experts will also discuss topics such as talk radio, special effects production tools, studio acoustics and the use of network control signals.





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# At A Glance: NAB '85 Engineering Conference

## Saturday, April 13

### Radio

9:30 a.m.

**AM Technical Improvement**

2 p.m.

**Radio Engineering**

5 p.m.

**Radio RF Maintenance**

### Television

9:30 a.m.

**Electronic Graphics Centers**

2 p.m.

**MTS Transmitter Conversions**

## Sunday, April 14

### Radio

10 a.m.

**Radio Studio Maintenance**

### Television

10 a.m.

**TV Maintenance Workshop**

## Monday, April 15

### Radio

8 a.m.

**AM-FM Allocations**

10 a.m.

**Radio Subcarriers**

2:30 p.m.

**Special Radio-TV Session:  
Broadcast Auxiliary**

### Television

8:30 a.m.

**Television Engineering**

2 p.m.

**TV Multichannel Sound**

4 p.m.

**Spectrum Management**

6 p.m.

**Ham Radio Reception**

## Tuesday, April 16

### Radio

8 a.m.

**Radio New Technology**

10 a.m.

**Radio Production**

12 p.m.

**Engineering Luncheon**

2:30 p.m.

**Audio Processing**

4:15 p.m.

**AM Stereo**

### Television

8 a.m.

**TV Satellite Systems**

9 a.m.

**Advanced Television Systems**

2:30 p.m.

**UHF Transmission Systems**

3 p.m.

**Special Radio-TV Session:  
Non-ionizing Radiation**

## Wednesday, April 17

8 a.m.

**Special Radio-TV Session:  
FCC Engineers Panel**

- "Audio Processing" (Tuesday at 2:30 p.m.)

With new types of audio processing comes the need to measure and control the results. This session will examine a proposed IEEE standard for the peak program meter (PPM), a method of correcting phase errors in program material and a concept for monitoring the spectral density and aural characteristics of a transmitted signal. A panel discussion will follow the formal presentations.

- "AM Stereo" (Tuesday at 4:15 p.m.)

Each year brings new developments in AM stereo transmission technology and implementation. This session will feature audio processing for AM stereo, converting studios and the new generation of AM stereo excitors.

- Annual Ham Radio Operators Reception (Monday at 6 p.m.)

Station engineers who are also ham radio operators contribute significantly to their communities and their profession. This reception is held in recognition of those contributions. With door prizes and special guests, the event has become one of the convention's most popular gatherings.

### TV sessions

- "Electronic Graphics Centers" (Saturday at 9:30 a.m.)

When considering an electronic graphics system, engineers are faced with a bewildering array of computers, terminals, storage systems and interface requirements. This session will examine how large and small TV operations have coped with the problems of assembling a graphics creation center. Special emphasis will be given to matching the available equipment with the station's needs and budget.

- "MTS Transmitter Conversions" (Saturday at 2 p.m.)

Now that multichannel TV sound receivers are available to consumers, converting the broadcast plant to multichannel operation is a top priority at many stations. This session will feature presentations from nine stations that have converted their transmitters to stereo.

Other reports will focus on how to determine if the transmitter's notch diplexer will pass a stereo signal, how translators will handle stereo and FCC type-acceptance for multichannel transmitters.

- "TV Maintenance Workshop" (Sunday at 10 a.m.)

Equipment maintenance is the cornerstone of any station's engineering



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AIR-7 is better. Simply because no other console combines better sound with reliability and value. The AIR-7 features recording studio quality electronics—the same kind of quality that goes into Harrison recording, television, and film post-production consoles.

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March 1985 **Broadcast Engineering** 23



department. This session will feature reports on proper HVAC maintenance, installation of new transmission systems and ENG battery charging. Following the formal presentations, a panel of station engineers and manufacturer representatives will discuss maintenance requirements.

- "Television Engineering" (Monday at 8:30 a.m.)

A wide range of new and important technical topics will be discussed during this all-morning session. Papers will include the design of an electronic newsroom for television, new developments in CCD cameras, digital fiber-optic transmission, diplexing aural and visual signals in high power transmitters and wideband TV antenna design. A special report on the proposed SMPTE standard for a studio component video transmission system (S-MAC) will also be presented.

- "Multichannel TV Sound Studio Techniques" (Monday at 2 p.m.)

Most television engineers have had little experience with handling stereo audio. This session will provide valuable information for those planning or building TV audio facilities for multichannel operation. Technical reports will include audio consoles for stereo production and post-production, converting 2-inch video cartridge equipment to stereo, digital audio distribution and stereo synthesis for monophonic program material.

- "TV Satellite Systems" (Tuesday at 8 a.m.)

Satellite news gathering (SNG) is the latest application of satellite technology. This session will discuss SNG, in addition to program scrambling systems, network control equipment and experiences with full-time service in the Ku-band.

- "Advanced Television Systems" (Tuesday at 9 a.m.)

Planning for the future of television is the charter of the Advanced Television Systems Committee (ATSC).

### More NAB coverage:

- Exhibitor listings, page 166
- Exhibitor map, page 171
- Product directory, page 282

## Engineering award

Carl E. Smith, president of Smith Electronics, Cleveland, has been selected to receive the NAB's 1985 Engineering Achievement Award. It will be presented at the engineering conference luncheon on Tuesday, April 16.

In a career that has spanned more than 50 years, Smith has gained recognition as an authority in electronics engineering, broadcast station antenna design and education.

Smith has been responsible for engineering scores of AM and FM broadcast stations in the United States and abroad. Research by his company into circularly polarized antennas resulted in an important scientific contribution

to broadcasting and modification of the FCC's standards of good engineering practice.

Smith founded the Cleveland Institute of Electronics, and has authored a major portion of the original advanced engineering courses.

Smith holds patents on the spiral antenna, 3-slot cylindrical antenna, elliptical polarization electromagnetic energy radiation system, electromechanical antenna calculator and low loss antenna system. He received a B.S.E.E. degree from Iowa State College, and an M.S.E.E. and professional degree in electronic engineering from Ohio State University.

This session will feature reports from each of the three technical subgroups of the ATSC on new developments taking shape in the industry. Topics will include improvement of the current NTSC system, how new transmission formats can be used and how standards for HDTV are being developed in the United States and abroad.

- "UHF Transmission Systems" (Tuesday at 2:30 p.m.)

As more UHF stations go on the air and others turn to higher power to better serve their audiences, the demand grows for improved UHF transmitters. This session will report on developmental work on the multiple depressed collector Klystron, higher efficiency convention Klystrons, new tube designs and transmitters designed for higher efficiency.

### Related sessions

- "Broadcast Auxiliary" (Monday at 2:30 p.m.)

The broadcast auxiliary service has become a critical link in the chain of operation for many radio and TV stations. This session will address the concerns of broadcast auxiliary users with reports on a spectrum-efficient digital audio transmission system for aural and video STL systems, the development of a microwave ENG receiver with wide dynamic range, the use of LORAN-C for automatic microwave antenna pointing and the status of developmental work on 40GHz broadcast auxiliary equipment.

- "Spectrum Management" (Monday at 4:30 p.m.)

Efficient management of the electromagnetic spectrum has never been more important than it is today. With

every other service looking for spectrum in which to expand, the need to maintain existing broadcast spectrum becomes ever more important. This session will feature a panel of FCC representatives and broadcast engineers to discuss major spectrum management problems.

Reports are also scheduled on the activities of the FCC's Field Operations Bureau, the status of the FM/FAA dispute and pending spectrum reallocation dockets.

- "Non-ionizing Radiation" (Tuesday at 3 p.m.)

With various governmental entities proposing regulations limiting public exposure to electromagnetic energy (non-ionizing radiation), broadcasters must become informed on the subject and prepare for the battles that may lie ahead. Federal regulations on electromagnetic energy are expected to be adopted this year. The results could have serious consequences for broadcast stations.

This session will feature reports on how RF energy is measured, the equipment used for the measurements and interpreting measurements.

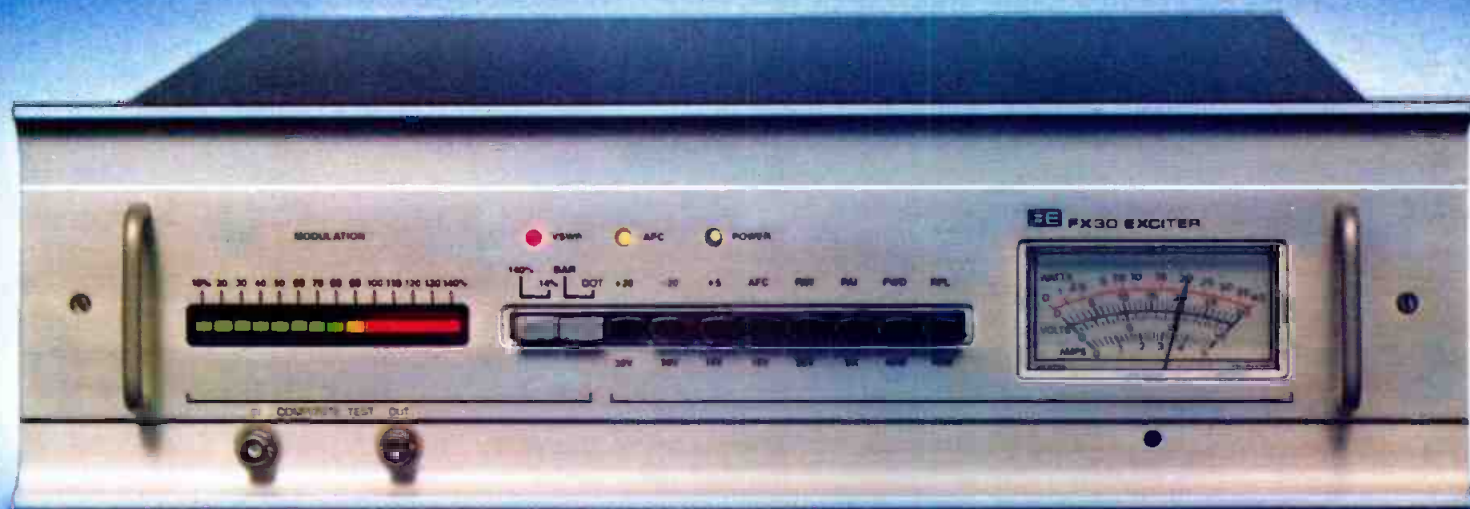
- "FCC Engineers Forum" (Wednesday, April 17, at 8 a.m.)

This is the session that every broadcast engineer looks forward to each year. The chance to meet and question FCC engineers on specific problems and rules. Included on the FCC panel will be James McKinney, mass media bureau chief, Ralph Haller, policy and rules chief, and Bill Zears, field operations bureau engineer. One of the FCC's field measuring vans will also be on display and available for inspection.

[:?>)))



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# What satellite recovery means to broadcasters

As the industry's dependence on satellite-based audio and video transmission systems increases, retrieving and repairing damaged satellites becomes more important.

By John Kinik, satellite correspondent

The recovery of two satellites from earth orbit by Space Shuttle mission 51-A in November was a dramatic accomplishment that will have a far-reaching impact on satellite users. The effort also provides a much-needed boost for the satellite communications industry.

The double satellite failure in February 1984—after initial launch from the shuttle—cast a pall over the industry. To make matters worse, a third satellite, belonging to Intelsat, was lost in June when its conventional rocket malfunctioned.

The total losses absorbed by insurance underwriters were more than \$280 million, and resulted in a sharp increase in launch insurance costs. Instead of insurance rates in the range from 5% to 10% of the payload value—which had been the typical figure—rates are now as high as 20%.

The recovery of the Westar VI and Palapa B-2 satellites by the shuttle restored the industry's shaken confidence and brought favorable publicity to the space industry. It also allowed recovery of some of the financial loss sustained by insurance underwriters, who will sell the refurbished satellites to the highest bidders.

The recovery and refurbishment of the satellites also creates a better climate in the business community, which must have confidence in all aspects of satellite technology to fuel the vigorous growth expected in the next five years.

Satellite communications, having

Astronaut Dale Gardner (left) hangs onto an adapter for securing the Palapa B-2 satellite in the Space Shuttle Discovery's cargo bay. Joseph Allen can be seen in the background at the cargo bay work station.

Photo courtesy of NASA



weathered difficult times, is now ready to enter into a period of rapid expansion, bringing with it a number of benefits to the broadcast industry.

### Orbital maneuvers

The actual retrieval mission was preceded by months of detailed engineering work and complex orbital maneuvers to match the two satellites' orbits with the planned shuttle orbit. As described in February's "Satellite Update," this engineering effort provided solid evidence of the advanced state of development of satellite technology.

Hughes Aircraft, manufacturer of the two lost satellites, charged its orbital operations and analysis team with the task of conducting the maneuvers, which were performed in three separate phases during a 6-month period.

In May, after two months of analysis and preparation, the first phase of maneuvers equalized the satellites' orbital planes, raised their orbital altitude and used up the apogee kick motor (AKM) fuel.

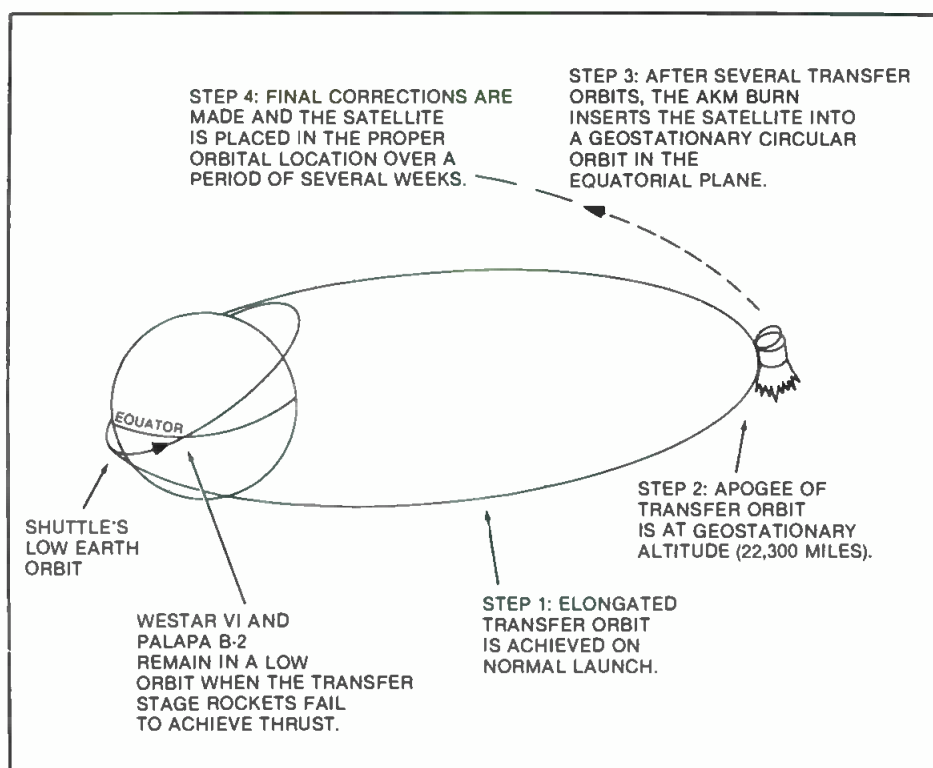
As shown in Figure 1, the AKM is normally fired after several elongated transfer orbits around the earth by command from ground control at the apogee of the orbit, which is the geostationary orbital altitude of approximately 22,300 miles.

When a conventional rocket is used to launch a satellite, it is positioned directly into the transfer orbit by the rocket's final stage. In a shuttle launch, however, a booster rocket stage is required on the satellite to achieve the transfer orbit from the shuttle's low earth orbit.

It was the booster rocket—called a *payload assist module*—that failed almost identically on both satellites. Because the satellites' AKM was intact, the volatile rocket fuel had to be burned up.

The first phase of maneuvers accomplished this goal and at the same time placed the satellites in storage orbits for the next two months. Westar VI was placed in a 600nm altitude orbit and Palapa B-2 was boosted to an altitude of 650nm, with both orbits circular and in the same plane.

The second phase of maneuvers,



**Figure 1.** The normal launch sequence used to place a satellite in geostationary orbit.

performed in August for one week, brought the satellites closer together in a 560nm orbit whose planematched the shuttle's planned orbital plane.

The final phase, performed in the last five weeks before the shuttle launch, lowered the orbits of the satellites to the 195nm altitude of the shuttle. A total of 331 maneuvers were performed during the three phases.

Each maneuver was conducted during the satellite's orbital pass over an appropriate ground control station. The maneuvers consisted of combination firings of hydrazine gas thrusters on board the satellites. These thrusters are normally used during the orbit life of the satellite to perform periodic corrections in attitude and orbital position.

Satellite attitude must be precisely controlled to ensure that it is properly pointed toward the earth, with the exact position in orbit maintained to an accuracy of 0.1°. This requires periodic corrections to offset the effects of gravitational forces on the satellite that causes it to drift out of a true geostationary orbit.

The final pre-recovery maneuver (spin-stabilizing) slowed the spin rate of the satellites from 50rpm to 2rpm, so they could be retrieved.

### Retrieval and refurbishment

The shuttle's cargo bay was set up to hold two satellites for launch (Figure 2). The two satellites, Anik D-2 and Syncom IV-1, were launched on the second and third days of the mission. Palapa B-2 was retrieved on the fifth

## Satellite communications in the year 2000

A study by NASA's Lewis Research Center in Cleveland forecasts the demand for satellite-based domestic communications services to increase six-fold by 2000.

Three telecommunications assessment studies, recently completed for NASA by Western Union and U.S. Telephone and Telegraph, provide forecasts of the total U.S. domestic demand from 1980 to 2000 for voice, data and video services.

An analysis of the studies shows the potential satellite demand will grow by a factor of six, from 400 to 2400 equivalent 36MHz satellite transponders. About 80% of the demand will be best served by trunking (publicly owned) systems and about 20% by customer premises service (privately owned) systems.

The study is part of a continuing effort by NASA to provide guidance for developing communications satellite technologies to satisfy demand in the next 20 years.

day and Westar VI on the seventh.

Each retrieval used different methods to get the satellites safely into the shuttle cargo bay. Neither one went exactly according to plan, and the crew's ingenuity came into play when unforeseen obstacles arose.

The retrieval of Palapa B-2 took six hours, much longer than expected.



MANIPULATOR FOOT RESTRAINT

WESTAR VI RETRIEVAL PALLET

PALAPA B-2 RETRIEVAL PALLET

ANIK D-2 SATELLITE

SYNCOM IV-1 SATELLITE



The Westar VI retrieval went more smoothly as the crew gained experience in using the equipment.

Once back on earth, the satellites were transported to Hughes Aircraft in El Segundo, CA, where they were inspected for damage, repaired and tested for proper performance. A number of potential customers have apparently surfaced, attracted by the possibility of a bargain price for the satellites.

The concept of satellite retrieval and repair is now firmly established in the public consciousness as a result of the shuttle mission. The next step in the application of this technology is the servicing or retrieval of satellites in geostationary orbit.

The most immediate impact of the recovery mission on the satellite communications industry is its psychological boost. This year, 10 satellites are scheduled for launch, anticipating a rapid increase in demand for business communications networks.

Some industry experts are predicting a large and undesirable surplus of transponders in orbit, partly because the installation of fiber-optic links is increasing the transmission capacity all over the country.

Other experts think that although a temporary surplus will exist, the situation will actually stimulate more growth in satellite networks because lower transponder costs to users will result in greater demand.

The latter view is probably more accurate, not only because of the law of supply and demand, but also because other segments of the satellite communications industry are only now reaching a point of maturity.

The new satellites to be launched this year are predominantly medium-power Ku-band types, which are ideally suited to business communications networks. They are also well suited to broadcast applications.

A new generation of earth terminal hardware is also being introduced by manufacturers, featuring small antennas and more compact and reliable electronics.

With 10 years of solid progress based on C-band technology, the satellite industry is now ready to begin a second phase of growth, based on medium-power Ku-band technology.

The broadcast industry will move increasingly to satellite systems for video and audio program transmission because of the economic and operational benefits that a satellite-based network can provide. The success of the space shuttle recovery mission will help speed this conversion process.



Hugh Fallis, VP Engineering,  
Radio Free Europe, Munich, stands  
beside CE 100 kW HF transmitter  
using EIMAC 4CV100,000C tube.



# EIMAC tubes provide long life for Radio Free Europe Service.

Radio Free Europe transmitters in Biblis and Lamperthelm, West Germany, use EIMAC 4CV100,000C power tubes in 12 Continental Electronics 100 kW HF transmitters.

The station logbook shows most tubes have over 50,000 hours of service, and many tubes logged over 60,000 hours! And EIMAC tubes are still running strong—that's long life!

These figures are representative of the long life EIMAC tubes log in a variety of high power broadcast applications.

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SITE: Biblis

TYPE	IN SERVICE		SPARES		REMARKS
	Serial	Hours	Serial	Hours	
4CV10000	A6N-413	62660			
	A6N-415	68879			
	E6G-265	61829			
	E6G-270	59636			
	E6M-597	62456			
	G6R-896	59246			
	H6E-283	55892			
	H6J-368	64300			
	H6T-890	59472			
	P6Q-624	64066			
	G5D-155	62554			
	H6J-367	55907			
	H6J-371	59991			
	J6A-2	57805			
	D6V-817	42279			
	F3Q-730	59386			
	D6V-815	41416			
	E6G-273	47349			
	J6A-7	59067			
	E6G-266	57026			
	F6W-1297	57865			
	H6C-161	26683			
	J6A-6	31752			
		49355			

MONTHS: \_\_\_\_\_





# Digital technology: Radio's key to the future

By Joe DeAngelo, radio product marketing manager, Harris, Quincy, IL

Digital technology will revolutionize radio stations in the next five years.

If you invented a software program that could predict the future with some degree of accuracy, the world would beat a path to your door.

Although predicting the make-up of radio products for the next five years is certainly a challenge, using trend analysis can help make some accurate projections.

Throughout this look into the future, an equipment prediction will be linked with the corresponding application. Technology and applications must go hand-in-hand. A new or improved mousetrap with no user benefit can be an exercise in creativity but a failure in the real world.

The majority of equipment changes in the next five years will take place in the studio and office areas.

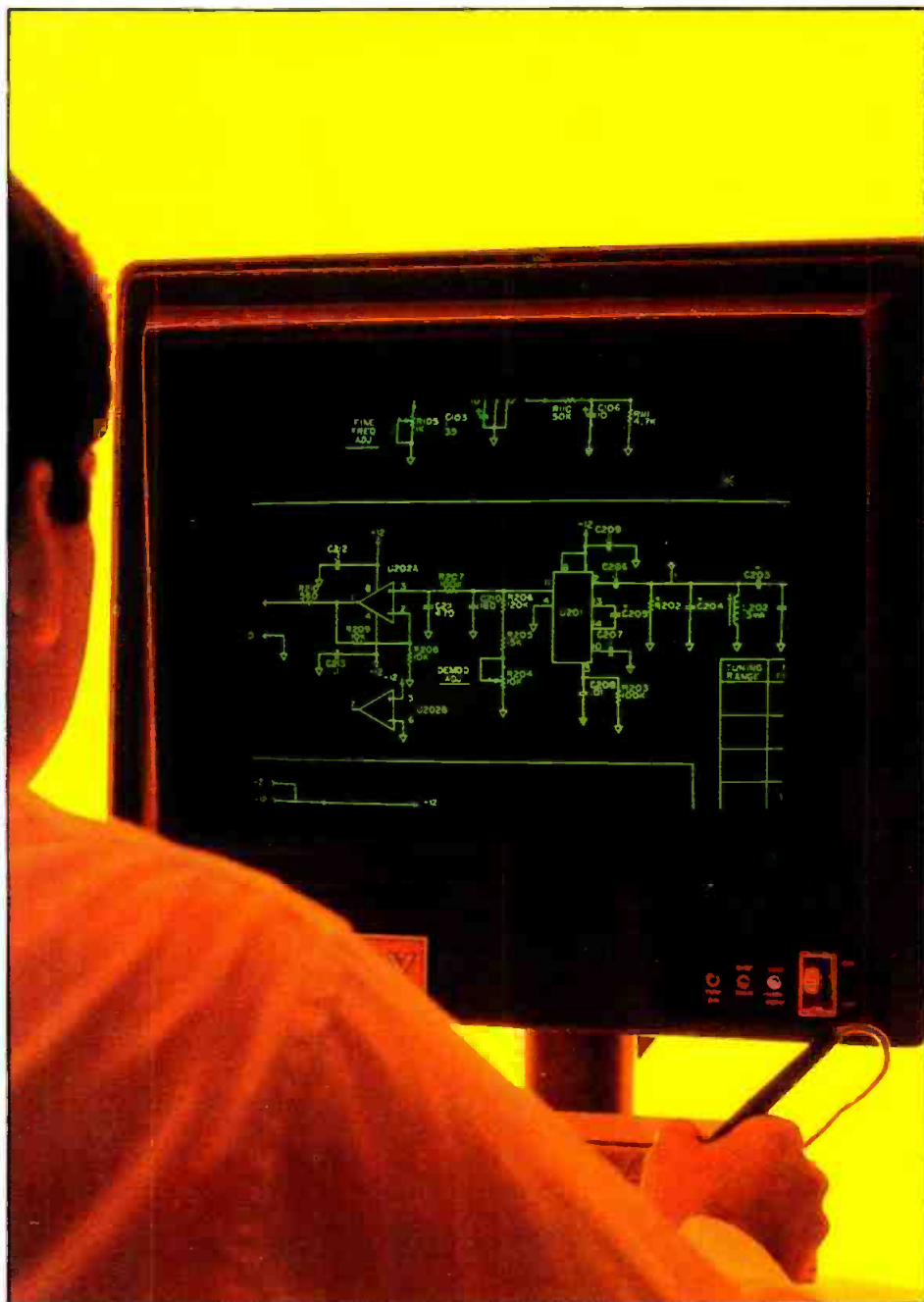
With the proliferation of personal and small business computers in the marketplace, along with creative and productive software programs, office functions will increasingly be assisted by a mini- or microcomputer system. Stations are already benefiting from increased employee productivity and information accuracy provided by automated business systems that handle all traffic, billing and assorted accounting functions.

Additional stations will opt for automated business systems as hardware prices continue to drop and creative, practical software programs continue to be developed.

## The newsroom

In the early-to-mid 1970s, major city newspapers examined the methods by which a newspaper was composed. Various technological printing advances had occurred over the years—such as photocomposition—but the whole system, from copywriting to final page layout to offset plate production, had yet to be tied together.

Newspapers wanted to link the entire system to increase productivity. Their desire was achieved by technology that offered a comprehensive word processing/text processing



Broadcast technology is changing at an ever increasing rate. This pace is being set by demand on the part of broadcasters for equipment that is more efficient, versatile and reliable. The production of new technology equipment requires new manufacturing tools, as illustrated by this computer-aided design station.

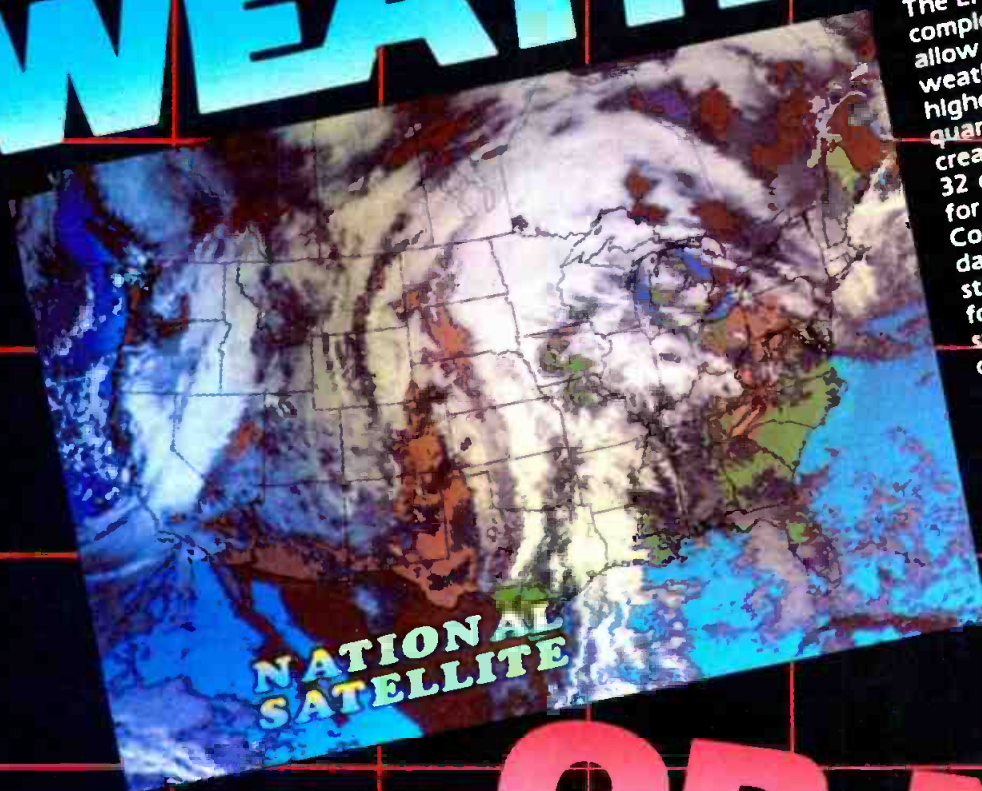
system that interfaced with electronic photocomposition equipment.

Adaptation of newsroom text processing has now been accomplished in the broadcast environment, where it is used by all-news stations in many major markets. The copywriting and

editing process remains the same as for newspapers, but instead of sending text to the photocomposition room, it is routed to the anchor's CRT. News copy/text processing will increase in popularity at stations regardless of format, or even size of



# WEATHER



The LiveLine IV provides a complete set of tools that allow you to create and air a weathercast composed of the highest quality graphics. A quarter of a million colors create anti-aliased maps and 32 gray level cloud depiction for realistic satellite images. Compatibility with weather data and graphics services is standard. A complete set of fonts, including weather symbols and the ability to create your own! Complete in-system sequencing for direct-to-air operation. Program animation, frame-to-frame transitions, and live radar directly into your show sequence. You can even "zoom" into your region, live, on-the-air! Optional RRWDS dial-up color radar, Collins Doppler Radar interface, and the FLASH lightning display software round out the ColorGraphics weather repertoire.

Now our production graphics system will provide you with high quality illustrations and many types of animation for a reasonable, cost-effective investment. The ArtStar features are many. Among them are 256 displayable colors with over a quarter million possible choices, an unlimited number of brushes, gleams and glows, anti-aliasing, font editor, cut-and-paste, assorted animation, optional full color digitizer, world map data base, in-system sequencing with assorted wipes, system networking, total system archive capabilities to back up all images, interface to hard copy output devices and an optional still-store system. Contact us for more information or a demonstration tape.

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market. Again, this can be attributed to the decrease in hardware costs.

With more sophisticated hardware entering the newsroom environment, the traditional 1-way dedicated news wire will probably disappear and be replaced with an *interactive line*. A station's news terminal would call into a news service data bank on a scheduled basis and collect the stories it

subscribes to (national, regional, weather, etc.) or special stories or information it may request (similar to current teletext systems).

Wire services now offer terminals that print only the information to which a particular station subscribes. The futuristic interactive newsroom terminal is simply an application of available technology.

### Production and on-air studios

Digital-based equipment will continue to make strong advances into the studio environment. Leading the way will be the incorporation of compact disc-based source equipment into radio station control rooms. The growth of CD equipment will be made possible by increased consumer popularity, which will bring forth an expanded number of titles.

Consumer acceptance of the compact disc is increasing in the United States and is contributing to the demise of the LP record. Interestingly enough, however, the CD is not the major factor in decreased popularity of the LP disc. The cause is, instead, the cassette tape.

Fifty-two percent of the prerecorded material sold last year in the United States was on cassette, and sales figures indicate that more than half of the consumers purchasing recorded music consider cassette quality satisfactory. As further evidence of cassette popularity, more than 60% of new cars have factory-equipped cassette players. Not wanting to leave the compact disc at home, major consumer electronics firms displayed auto CD players at the recent spring and fall editions of the Consumer Electronics Show.

Radio stations should welcome the introduction of CD technology for the improved audio reproduction quality it offers, compared with the standard vinyl LP. The increased air time and promotion that CD selections are receiving from stations attest to this.

The introduction of the compact disc will replace the station's LP/phono cartridge system, which has long been the forgotten link in the broadcast audio chain.

One individual made the analogy that the introduction of CD audio into broadcasting was like cleaning dirty windows only to see that you have trash in the front yard. The quantum leap in audio performance that a CD offers over the standard LP often reveals other elements in the audio chain that need improvement.

### Digital vs. analog

In professional audio circles, there is much discussion of whether current CD performance is, indeed, any better from a pure listening standpoint, compared with mastered discs. There are, no doubt, valid points on both sides of the issue. However, looking at the broadcast application, master disc LPs are the exception.

The quality of the vinyl used in standard disc LPs commonly found in broadcast stations is decreasing. When comparing today's CD quality

## Training for the future

Although high-tech broadcast equipment is giving radio stations a degree of sophistication and versatility that was a dream just a few years ago, the march of new technology is not without its missteps.

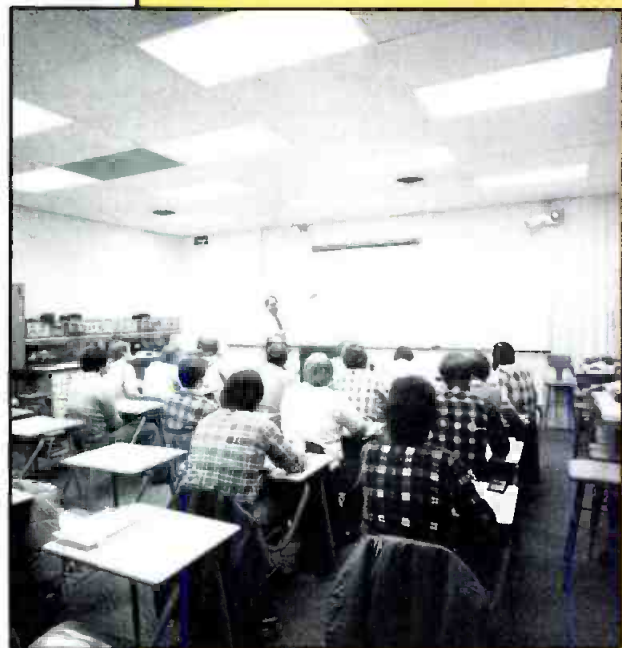
To maintenance engineers, the biggest concern when a new piece of sophisticated electronic equipment arrives at the station is often the unit's servability. The old saying, "This thing is great, when it works," illustrates a serious problem within the industry.

The training of maintenance engineers on how to service new high-tech hardware is an important aspect of any facility updating project. Many manufacturers, seeing this need, have established factory training schools to provide instruction on the operation and maintenance of their equipment.

The next five years should bring an increase in the number of service training classes sponsored by broadcast equipment manufacturers. A lack of proper training of maintenance personnel could have an adverse impact on the introduction of new products into broadcast stations.

Built-in diagnostic features will aid engineers in maintaining the new equipment to come, but these test routines have their limits. It is virtually impossible to create a diagnostic program that will identify any possible problem with a particular piece of equipment. The human element is vital to any successful troubleshooting effort.

Modular construction is aiding maintenance engineers in keeping complex pieces of equipment operating properly. With many types of hardware, troubleshooting has been simplified to a level of module replacement. Some designs have also incorporated a *soft failure* feature, where a fault in any one section of the system may impair performance, but will not cause the entire unit to go down.



Students undergo training at the Broadcast Instruction Center of Harris Corporation in Quincy, IL. Classes cover a broad range of topics from satellite system operation and maintenance to radio and TV transmitter theory and troubleshooting.



# "...performs accurately under any RF situation."

John Bortowski, chief engineer for radio station WLAK in Chicago, had a problem.

Will a frequency counter work under his adverse conditions? Here is what he told us.

"To give you some background, WLAK is located on the 90th

floor of Sears Tower. Studios and service area are located a mere 30 feet from an antenna farm transmitting frequencies from 150MHz to 800MHz. Atop the building are two VHF, two 5 megawatt UHF and five FM stations.

"We have just completed testing the Sencore FC-71 frequency counter in this environment. The only care taken was keeping the test leads as short as possible to minimize stray pickup. Otherwise the unit performed brilliantly under these conditions.

"I'm confident the FC-71 will perform accurately under any RF situation."

TAKE THE 71 CHALLENGE. RF immunity is only one reason you'll like the FC-71. Take the 71 Challenge and see for yourself. Try a new FC-71 on any job site in any RF field for a month. If in 30 days you don't believe the FC-71 is the best buy on the market, we'll buy your FC-71 back for every penny you paid including freight both ways.



**John Bortowski**  
Chief Engineer, WLAK-FM  
Chicago, IL.



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## **Sencore FC-71, portable, 1 GHz FCC accurate Frequency Counter**

- ☐ FCC accurate (.5 ppm) — even at 1 GHz
- ☐ Exclusive 9.5 hour battery operation
- ☐ Super sensitivity: 5 mV average
- ☐ .01 Hz resolution in one second
- ☐ Completely RF immune — we guarantee!
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**\$995**



# SENCORE

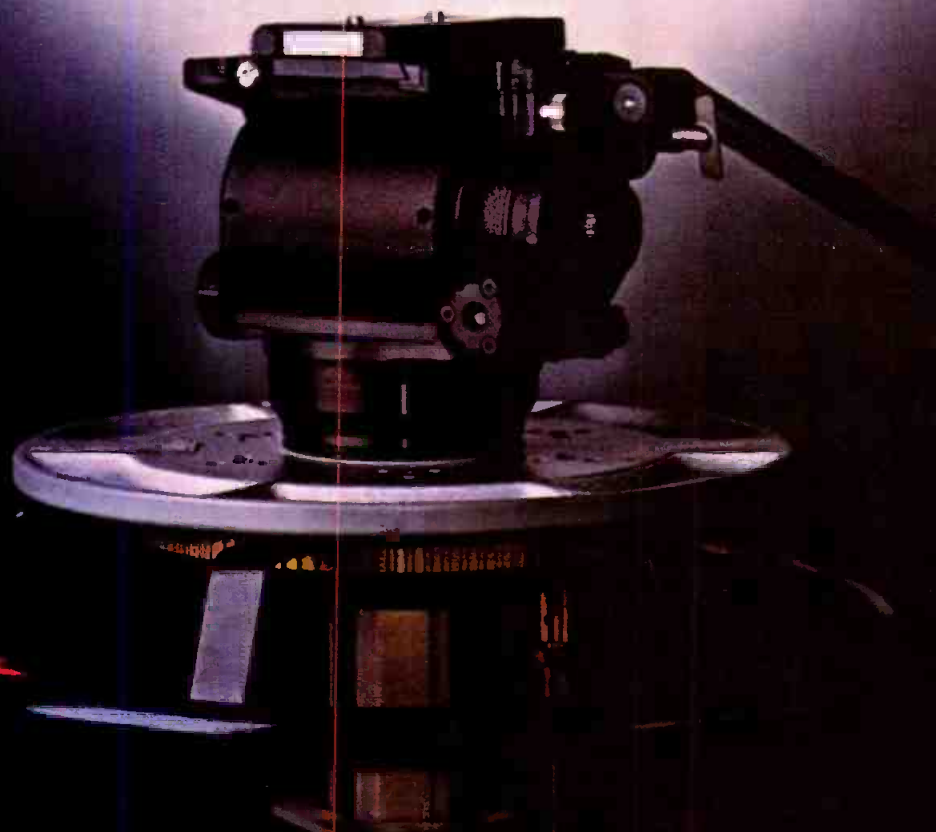
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**INTRODUCING THE  
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THE REMARKABLE  
BECOMES AVAILABLE.**

When we previewed this camera at NAB, the response was tremendous. Which, considering Sony's considerable reputation for high performance broadcast portables, wouldn't normally seem so surprising. Except for one detail.

The BVP-360 isn't a broadcast portable. (Although at 50 pounds it's certainly the most portable camera in its class.)

What the BVP-360 represents, however, is the culmination of Sony's work in tube technology, in innovative mechanical design and in High Definition Video Systems. A highly sophisticated, automated camera that promises to usher in a new era in price/performance for cameras in the Field/Studio category.



Sony-developed 2/3-inch Mixed Field Saticon.<sup>™</sup>  
(Plumbicon<sup>™</sup> tubes also available.)

**THE 2/3-INCH IMAGE  
FORMAT COMES OF AGE.**

For those of you unable to get through the crowds for a close look at the BVP-360, there are two explanations for the exceptional image quality you saw on the monitors overhead.

First, the BVP-360 employs the remarkable, Sony-developed 2/3" Mixed Field\* tubes. The first real challenge to big tube performance. Because they deliver twice the registration and geometric accuracy of conventional 2/3" tubes. Plus greater depth of modulation. And thanks to the special Sony-developed FET that is built into the tube and yoke, an extraordinary signal-to-noise ratio. (MF Plumbicon<sup>™</sup> or MF Saticon<sup>™</sup> tubes are available.)

Secondly, the Sony BVP-360 is equipped with a breakthrough F1.2 prism design that single-handedly results in sensitivity and depth-of-field comparable with

25mm image formats. And vastly superior to any current 2/3" Field/Studio camera at any price.

And, naturally, when you combine these factors with the extensive signal processing technology Sony has engineered into the BVP-360, you get specs which could only be described as spectacular.

**A SUPERHUMAN FEAT  
OF HUMAN ENGINEERING.**

Many of the experts who were able to get their hands on the camera at NAB were even more impressed by how it performs from a human standpoint.

Some were moved to comment by how easy the BVP-360 is to move around. Its smoothly integrated handles. Low weight. The highly maneuverable viewfinder. And the shortest lens-front-to-viewfinder distance in the industry.

Others cited the uniquely pragmatic approach to automation. An approach that concentrates the camera's considerable microprocessor-based intelligence on the most difficult setup operations; functions such as digital registration, B/W balance, flare and gamma.

And still others referred to the BVP-360's extensive camera head memory, which can store up to sixty-four scene files, eight setup files, sixteen lens files and three reference files.

Plus the advantages of being able to choose from three remote operational panels.

**NOT JUST A CAMERA.  
A CAMERA SYSTEM.**

But perhaps the most striking aspect of the BVP-360 is its "building block" design concept. An arrangement that makes it particularly easy to customize the camera for various production situations.

It starts with a



BVP-360 Remote Control Panels: (left to right) a flexible Field unit, a highly sophisticated Creative Production panel and a simple Studio unit.

camera head able to transmit component signals via Triax or Multicore. Or function as a stand-alone camera.

Then, on the technical front, alignments are handled at the Camera Control Unit. With each camera able to be tweaked individually. Or addressed as part of up to an eight-camera chain linked to one Master Setup Unit.

And finally, on the operational front, all control during production may be directed from one of three types of Remote Control Panels—a simple Studio model, a flexible Field unit, or a highly evolved Creative panel with extensive memory and scene-painting facilities.

**ADOPT A  
WAIT-AND-SEE ATTITUDE.**

Of course, as we said at the outset, the BVP-360 isn't ready for delivery tomorrow. But that doesn't mean you have to wait until May to see it. There are units here right now for demonstrations and evaluations.

And of course, by the time you're finished testing it, raving about it and getting a budget for it (although that last part may go faster than you're used to thanks to the BVP-360's incredible price/performance), it won't be tomorrow. It'll be closer to May 1.

**SONY<sup>®</sup>**  
Broadcast



\*Sony Mixed Field tubes use electrostatic deflection and magnetic focus. ©1984 Sony Corp. of America. Sony is a registered trademark of Sony Corp. Sony Broadcast Products Company, 1600 Queen Anne Rd., Teaneck, NJ 07666.



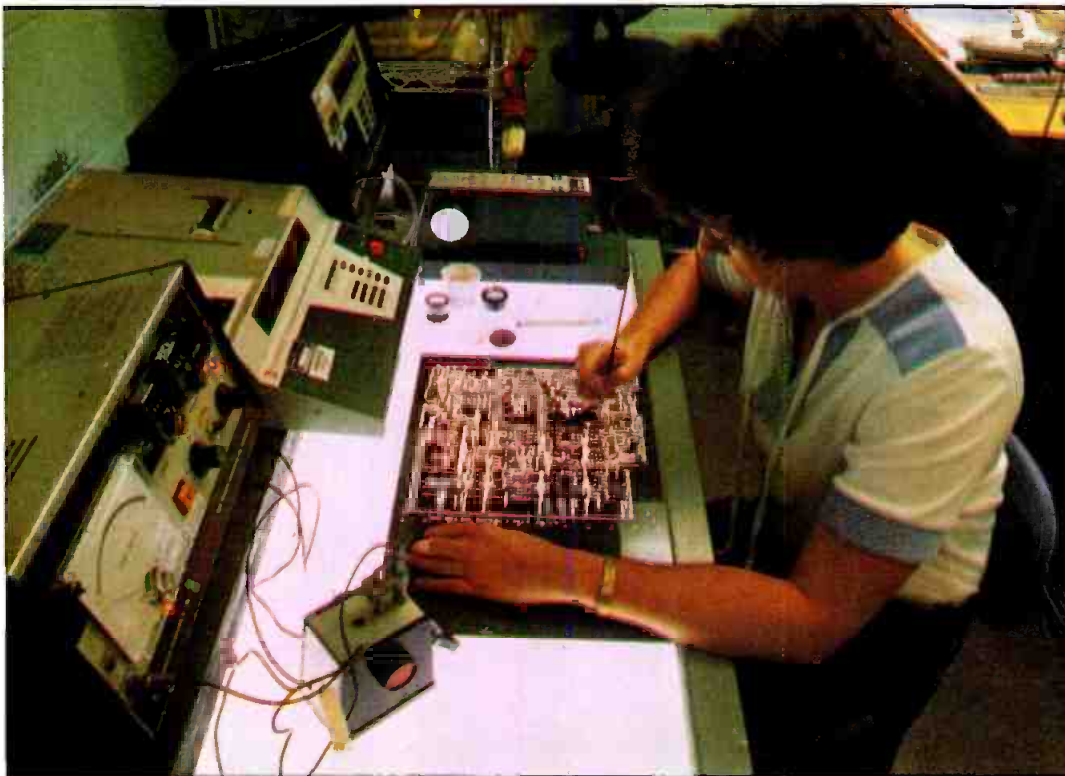


Photo courtesy of Harris

A technician checks a printed circuit board layout, prepared using a CAD system, for adherence to specifications.

against a standard disc—especially after extensive plays—CD emerges as the winner hands down, from the standpoint of both technical specifications and subjective listening quality.

CD recording technology is still in its infancy. Professional and consumer manufacturers are just starting to refine its electronics and transport mechanics. Significant advances are expected in A/D and D/A converters, which will improve CD performance.

#### Digital tape recorders

Digital multitrack reel-to-reel tape recorders have already made their entry into the professional recording studio. However, they have not been seriously considered for standard broadcast use. A few companies are now marketing production digital recorders, with other electronic firms showing prototype equipment designed for broadcasters.

Broadcasters probably will not want digital tape recorders' improved audio performance until CD players are well integrated into the station's studio equipment line up. At that time, it will be advantageous to improve the audio performance of production and on-air reel-to-reel sources.

#### New storage mediums

In polling a number of knowledgeable people—both in manufacturing and hands-on broadcasting—there seems to be a majority who feel that

current source equipment (such as reel-to-reel and cartridge tape machines) are low on the list of items needing improved performance. These opinions are based on the fact that major evolutionary improvements have recently been introduced into both tape machines and the tape itself.

They think that current equipment being offered by manufacturers will fill the needs of broadcasters for several years to come. Broadcasters will, instead, want to spend equipment dollars in other technical areas.

Despite the forecast that new source equipment may not be high on the broadcaster's priority list, technology will certainly be ready when the market determines there is a real need to make major performance improvements in source equipment. It is conceivable that magnetic tape—as we know it today—will disappear, being replaced with discs or other new storage mediums.

#### Mixing consoles

Using the pure digital audio console for radio broadcast probably will not occur in the next five years. The single largest reason is that a pure digital mixing console today essentially performs the same as state-of-the-art analog consoles. This concerns only audio mixing performance, and not audio effects, which will be discussed next. Digital technology

is used in broadcast consoles now on the market, but the applications have been limited to source commands and sequence programming.

Although a pure digital mixing console for radio may not be in the forecast during the next five years, this technology is being developed and will be ready for broadcast application. Several companies have already introduced digital audio mixers for the recording industry, which tie in with the increasing availability of digital recording systems.

#### Audio effects

Audio effects is a better term than audio processing, because audio effects broadens the scope of future equipment developments.

With the cost of digital audio components decreasing and their performance increasing, more companies will be introducing sophisticated audio effects devices. Already on the market and gaining broad acceptance are digital time delays, audio phase correctors (also known as audio time base correctors), flangers, harmonizers and even some custom-built digitally controlled audio processors.

But these devices are most likely only the first wave of new, sophisticated audio effects systems. Harmonizers, synthesizers and other effects units, which have been used in the music and recording industries for years, are finding new, creative roles in the radio production rooms of some major-market stations and radio production houses. This equipment addresses the needs of the radio industry for creative tools with which to practice the trade. With hardware cost decreasing, more stations will incorporate these new effects boxes into their studios.

The digital audio evolution will also make its mark on audio processors. Sophisticated analysis of program content will be made by a control system, resulting in programmed correction or audio coloration.

For example, attack and release time parameters and compression and AGC slopes could all be made continuously variable, with the processor making the optimum choice, based upon preprogrammed instructions.

Audio effects equipment will likely undergo the same revolutionary changes as video equipment.

#### Studio transmission links

Whether they use telephone audio lines or RF studio-to-transmitter links (STLs), broadcasters are finding it increasingly difficult to get programming from one point to another. In



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**MITSUBISHI**  
DIGITAL AUDIO SYSTEMS

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many major markets, not only are all the aural STL frequencies committed, but often broadcasters find they can't even get a Telco audio pair out of the downtown studio, regardless of the destination.

Just a few years ago, most phone companies maintained reserved cable pairs specifically for broadcasters. During the last five years, however, phone companies in many markets have been besieged with data line service orders that have consumed all available intercity cable capacity.

Progressive telephone companies today are implementing fiber-optic transmission technology to gain the additional capacity desperately needed. Many phone companies are planning their optical cable routes for the next five years, looking at various factors such as current system capacity and projected business expansion.

In many major cities, broadcasters are going to the phone company (and the phone company is even going to the broadcaster) to determine projected future requirements and ways to work together to meet those needs.

Additional Telco loop capacity should be gained in some markets as phone companies implement new fiber-optic services. Unfortunately, the outlook for additional RF spectrum for audio STLs is not as encouraging. Regional frequency coordinating groups, such as the one established in Los Angeles, painfully recognize that the RF spectrum is a

finite resource and must be managed as such.

Although additional RF spectrum for radio STL use may not be available in the foreseeable future, obtaining program channel capacity from existing frequency allocations may. Radio common carriers (phone companies) have faced a similar problem—the need for additional channel capacity within the limited spectrum available—with their short- and long-haul microwave systems.

Solutions they have found include extensive channel multiplexing and companding techniques. These methods have provided additional channel capacity, while simultaneously maintaining reasonable quality.

How does this apply to a broadcast environment? Many major markets, where spectrum space is at a premium (or non-existent), find FM broadcasters sharing clustered transmitter sites. For example, in Los Angeles, it is Mt. Wilson; San Francisco, Mt. Sutro or Mt. San Bruno; New York City, the Empire State Building; and Houston, the Senior Road Community FM Tower site.

Broadcasters have shown they can work together. Many find it desirable to piggyback (multiplex) their program feeds on single STL carriers. The STL transmitter is located centrally, with stations providing a local Telco loop to the transmission point. After reception at the centralized transmitter location, local high quality

short haul loops distribute the program service as needed. It is a complicated system, but when faced with the alternative of no STL at all, it is a reasonable solution to the problem.

#### New transmitter technology

The transmitter has the function of converting audio information into a modulated carrier. The ideal transmitter would perform this task at the highest efficiency and add unmeasurable distortion to the audio information in the modulation and amplification process. Control of the ideal transmitter would be quite simple—either on or off. Transmitters today are closer to ideal than those available just five years ago. Five years from now, they will be even closer to the ideal.

Semiconductor technology will continue to replace vacuum tubes in power amplifiers in both AM and FM transmitters. With the current decline in the cost-per-unit of power semiconductor devices, a solid state 50kW AM transmitter will probably be available in the next three years.

FM transmitters will also benefit from advancements in power semiconductor technology. Currently, there are prototype 5kW and 10kW solid-state FM transmitters on the market. A 100% solid-state 20kW to 30kW FM transmitter will be feasible in five years.

However, the question remains

*Continued on page 44*

## Digital audio mixing

The audio industry has made spectacular progress in recent years in the field of digital signal processing and recording. The net result of developments such as digital delay, digital reverberation and digital recording has been the creation of digital islands in an ocean of analog hardware.

Recent developments in semiconductor technology, however, have made possible a totally digital audio system, from the microphone preamp to the audio mixer output buss. The figure on page 40 shows the concept.

Remote control microphone amplifiers and companion A/D converters are in the studio, allowing the audio signals to be translated into a digital form at the earliest possible opportunity. Signal transmission from the studio to the control room is made using a fiber-optic cable.

Digital signal processing al-

lows, for the first time, the signal handling circuits of a comprehensive audio mixing system to be fully remote control. The control console can be a compact unit situated in the control room, connected by fiber-optic cables to the digital signal processing racks, which provide both digital outputs and analog outputs (via D/A converters).

A digital mixing system offers what has now become established as a new *standard* in the recording industry. A digital system is free from common analog problems, such as crosstalk and frequency response variations. And, perhaps more importantly, a digital mixing system provides a direct, distortion-free interface to digital tape recorders.

Digital recording, in itself, is a virtually degradation-free process. Some distortion and noise do occur, however, in analog audio con-

versions. Although these degradations are relatively small, multiple conversions can lead to a perceptible signal change. Intermediate conversions are rendered unnecessary with a digital mixing console.

Digital mixing also provides benefits to the user in terms of the layout of a complicated audio control desk. All program path control settings, including faders, equalizers, limiters, echo sends, cue feeds and signal routing can be memorized by the system, enabling the operator to store and recall instant *snapshots* of the entire console setup.

Full mixdown automation with time code synchronization is also available on all controls, greatly expanding the power of the system for both multi-track mixdown and post-production dubbing.

Control information can be stored on a removable floppy disc and console controls can be in-



# Essential in the trench.



# Indispensable on the bench.



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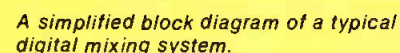
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# Put The Best To Test!

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Facilities courtesy of Editel Corp.





With a digital mixing console, it is no longer necessary for every channel to have a separate set of controls for equalization, limiting, cue, echo sends and the like. Instead, one central comprehensive control panel containing just one set of adjustments is required. In this way the operator can effectively bring the controls to his hands, instead of reaching out with some difficulty to the required knob.

Because the digital mixing desk is under software control, equipment updates can be accomplished easily. Custom features can, likewise, be incorporated into a console to meet the special needs of a particular user.

*The Neve DSP digital audio mixing desk and CRT status display.*





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David Hooge, Chief Engineer KEYC, Mankato, Minnesota

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# Building for the future

The broadcast industry's acceptance of new, high-tech equipment will depend not only upon performance and features, but upon price. To successfully compete in today's marketplace, broadcast equipment manufacturers are turning toward automation at various stages in the design and construction process.

Automation of manufacturing begins at the first step: design. Computer-aided design (CAD) systems have reduced the mechanics of new equipment development to a fraction of what it was before automation. Working from a single CAD terminal, an engineer can electronically sketch a new circuit, modify and refine it with just a few strokes of a light pen.

The same system can then be used to generate a printed circuit board layout, master parts list and camera-ready schematic diagram.

Many CAD systems can also be interfaced with automated manufacturing machines, such as PC board drilling decks, electronically controlled metal milling machines and automatic PC board component insertion units. Such automated manufacturing hardware not only produces less expensive equipment, but better

equipment as well. With automation, close tolerances can be established and held.

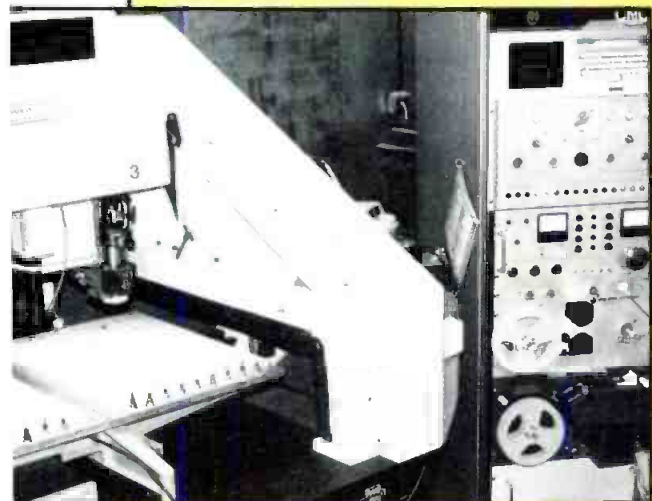
The use of automated test equipment is increasing rapidly in broadcast equipment manufacturing. Automated testing provides more accurate and repeatable measurements of the performance of a particular system or circuit board. Every test is conducted in exactly the same manner on every board. No measurements are missed, and no controls are accidentally left in the wrong position. Tests are accurate and detailed.

Automated test equipment is also finding its way into radio and TV station maintenance shops. Although less sophisticated than the hardware used by manufacturers, automated test gear gives the maintenance technician freedom of many of the time-consuming measurements that are required to accurately evaluate a piece of broadcast equipment.

The use of automated test instruments will increase during the next five years, as prices decline and performance increases. Many *smart* test instruments are on the market, and more are expected in the near future.



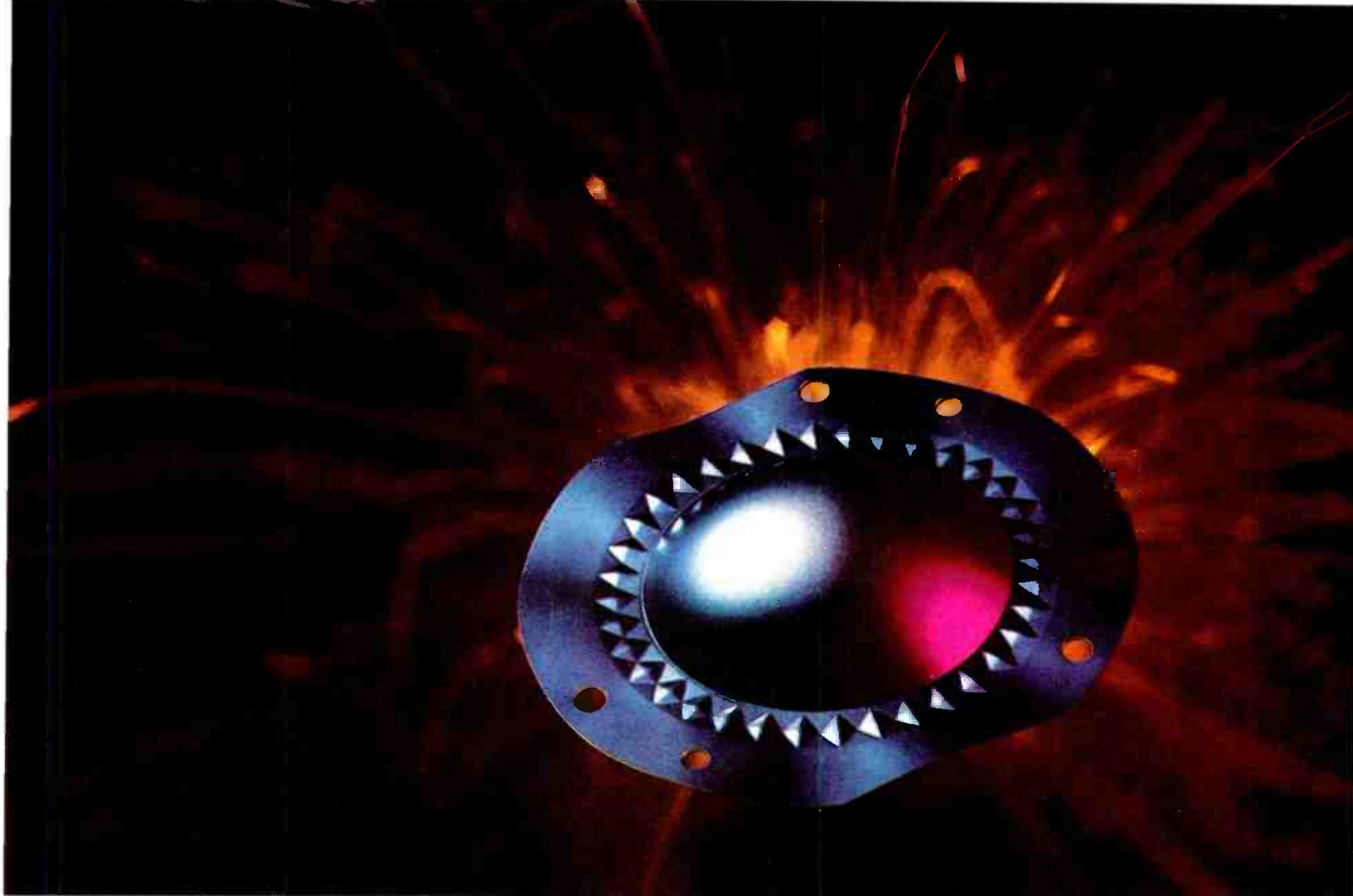
*The primary output device for a CAD system is usually a graphics plotter. This unit can draw both schematic diagrams and printed circuit board layouts.*



*This automated printed circuit board drilling deck produces PC cards with high speed and accuracy. The data that drives the deck is generated by a CAD system.*

*An automated printed circuit board test setup. The operator inserts the board to be checked in a test fixture, and the computer system measures and records the performance of the unit.*





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

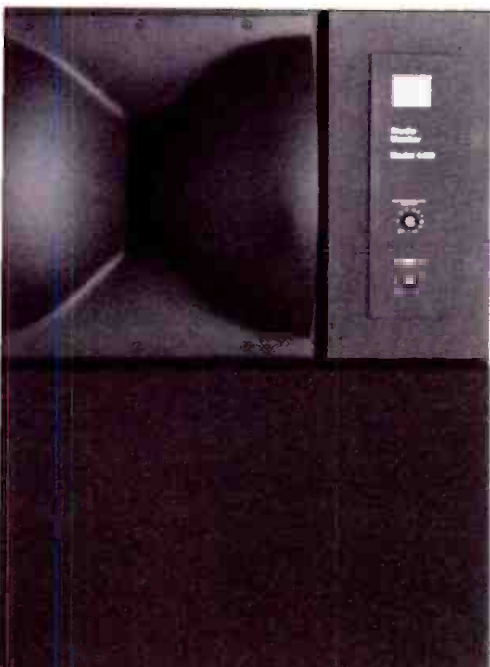
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Perfecting titanium technology is just one of innumerable ways in which JBL science is re-shaping the quality of sound. From driving your studio monitors in a demanding final production mix, to critically evaluating in detail actual on-air signal quality,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



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whether the cost-per-watt of VHF semiconductors will yield a product that is competitive with an equivalent vacuum tube transmitter. One indicator that points to a balanced cost-per-watt comparison is the continuing increase in the price of precious metals used in power grid tubes.

These increases contribute to the higher prices of tubes and their associated cost-per-watt. On the other side of the equation are advances in

power semiconductor technology, forcing the cost-per-watt ratios down.

New transmitter designs will not only usher in higher power solid-state amplifiers, but will also include design advancements in modulation and excitation techniques. These advancements will not only improve signal quality, but will simultaneously lower operating costs and improve reliability.

To achieve these goals simul-

taneously often increases the complexity of the overall transmitter design. The complexity issue raises other concerns such as maintainability and serviceability. To help in these areas, transmitter controllers will offer more capabilities in the areas of problem diagnosis and possible automatic correction.

#### Antennas

AM broadcasters will concentrate on upgrading the audio quality of their facilities, and that effort must also encompass antenna systems. Station and consulting engineers are increasingly aware of the audio quality benefits that broadband AM antenna systems offer. Consulting engineers and some phasor manufacturers have developed detailed computer programs that help convert theory into practice. Broadband antenna work will need to be done at many stations as increased bandwidth AM receivers evolve in the consumer market.

FM broadcasters are also expected to give more attention during the next five years to their antenna systems and the resulting radiated signal. Improvements in FM antenna performance will be on the priority list of both antenna manufacturers and broadcasters. Much of this effort will concentrate on replacing some of the marginal antenna systems installed during the explosive FM growth during the 1960s and 1970s.

Many of these antenna systems, such as side-mounted antennas on large faced towers, were installed with little regard to the resulting horizontal and vertical pattern distortion. With the FM audience now king, its tolerance for poor quality reception, especially auto reception, has become a major concern to broadcast management.

As one FM station manager recently emphasized, "It doesn't matter what format the station is running if you cannot deliver a signal to your targeted audience."

#### Moving on

Radio broadcasters continue to find new and innovative ways of entertaining and informing listeners, while equipment manufacturers continue to provide new tools for the trade. Broadcast equipment technology is growing at an exponential rate, promising an exciting future.

Related articles were written by Jerry Whitaker and Barry Roche, president of Rupert Neve, Bethel, CT.

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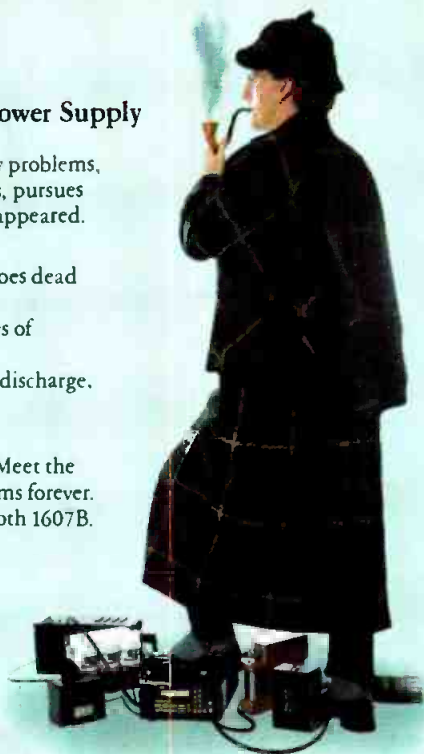
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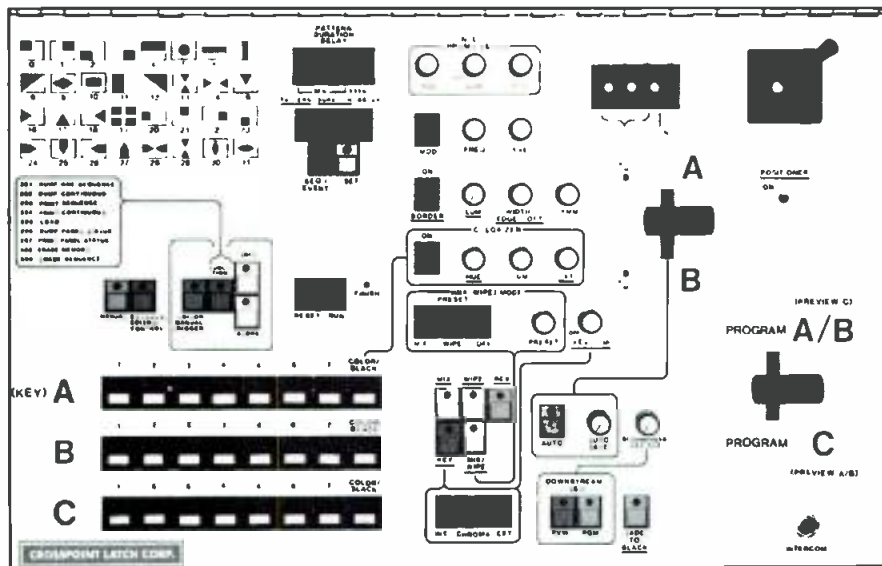
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\* SMOOTH PROGRAMMABLE CONTROL OF ALL FUNCTIONS SIMULTANEOUSLY FROM ANY SETTING TO ANY OTHER SETTING.

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\* DURATION OF TRANSITIONS CAN BE SET OR CHANGED EASILY AT ANY TIME (UP TO 999 FRAMES EACH).

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- \* EVENT REGISTERS CAN BE RECALLED RANDOMLY BY THE EDITOR, AS STATIC SWITCHER SETTINGS.
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Crosspoint Latch Controllers, such as the 7209, are by far the easiest ones, in the industry, to program. The procedure is simple—set up the switcher panel to the required configuration and depress the STORE button. The switcher is automatically readied for the next event.

## EXAMPLE OF A SEQUENCE

A SEQUENCE is a group of EVENT REGISTERS. Consider the following sequence. A bordered circle opens up to surround a model's face, stays constant for a few seconds, then closes in with the border changing color while it wipes the face off; this is followed by a diamond pattern which moves diagonally to a different point of the screen, opening up and changing the color of the border as it does so, until the pattern ends up surrounding a picture of the product being advertised.

This sort of sequence can be stored in the switcher, recalled by the Editor and then triggered by it at the correct instant.

The DURATION time for each of the above transitional movements can be programmed up to 999 frames, and can be reviewed and altered at any time. In addition to this a delay of up to 999 frames can be introduced between each of the transitions. (This permits a transition followed by a pause to be programmed in each EVENT).

The basic 7209 stores one SEQUENCE consisting of four EVENTS. The 99 SEQUENCE option stores an additional 396 EVENTS. Any one of the 400 Events can be recalled individually as a stationary panel configuration, or any SEQUENCE can be recalled and "run".

## "EDIT" FUNCTION ONLY AVAILABLE IN CROSSPOINT LATCH CONTROLLERS

To make changes to stored EVENT REGISTERS, in other switchers, the entire control panel must be set up to the new configuration. A Crosspoint Latch controller is unique. It allows a change to be made even to a single function, WITHOUT AFFECTING ANYTHING ELSE. More importantly, only CHANGES in the switcher controls (not their current status) are reflected to the picture on the screen. For instance, MOVEMENTS in the "joystick" are reflected as equivalent MOVEMENTS of the pattern on the screen (the pattern does not jump to the current position of the "joystick"). This technique is of particular significance when small changes have to be made, without disturbing the rest of the details in the EVENT.

## STANDARDIZATION IN PROTOCOL

Crosspoint Latch uses the same editor (or computer) protocol for all its switchers. The protocol is the simplest and the fastest one to implement, and is the ideal one for computer control of a switcher. Crosspoint Latch has interfaces with almost all current Editors.

### AUDIO FOLLOW, WITH THE MODEL 6800 AUDIO MIXER

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# Higher fidelity FM?

## A look toward the future

By John Kean, senior engineer, National Public Radio, Washington, DC



New technologies may soon open the door to new opportunities for FM stations.

While the public in general may think of FM broadcasting as a high fidelity medium, broadcasters and audiophile listeners know there is room for improvement.

The performance of FM transmitters and receivers has, however, significantly advanced during the last decade.

Typical distortion specifications for transmitters and receivers only 10 years ago was in the range of 0.5% to 1.0% at each end of the system (when measuring baseband harmonics or intermodulation distortion at full modulation). Today, these values are commonly around 0.1% for the exciter and transmitter and less than 0.5% for most receivers.

Although bandwidth and distortion are interrelated (and somewhat mutually opposed), the modulation bandwidth of transmission equipment has improved significantly along with reduced distortion. The modulation bandwidth is the range of frequencies that may modulate the carrier.

While transmitter specifications for modulation bandwidth remained at 75kHz (the baseband necessary for stereo plus one SCA), the capability of transmitters to operate linearly over greater ranges has continually improved. Bandwidth is now frequently being specified by transmitter manufacturers at 100kHz to qualify for multiple SCA operation.

The broadcast industry rightly put



The 1764-foot transmitting tower of WFOX-FM, Atlanta, GA.

A workman secures a section of the WFOX tower.

Related articles were written by Jerry Whitaker and Barry Hufken, production director, KWMU, St. Louis.



# Can the Panasonic® AK-30 stand head to head with the bestselling broadcast camera in the world?



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the horse before the cart by improving transmission equipment before the FCC approved rules permitting stations to take advantage of the new capabilities.

A third and equally important performance improvement is that of S/N ratio. This has been especially beneficial for main channel programming, where transmitters are now capable of providing stereo S/N ratios of more than 70dB. Improvements in receiver technology have lowered noise levels to a remarkable -80dB in laboratory conditions.

Quite apart from the opportunities that these improvements have created, the changes seem to have come from within the technical ranks, with little outside influence. It is notable that the relentless pursuit of excellence by broadcast engineers has given the industry some unforeseen advantages.

#### Problems in the field

Despite continued work to upgrade the technical performance of transmitting and receiving equipment, stereo FM quality is still limited by noise under field receiving conditions. Natural and manmade noise, cross-modulation in the tuner and co- and adjacent-channel interference contribute to the background noise level in receivers.

Compare the dynamic range (or peak S/N ratio) of some consumer equipment: Cassette tape decks using Dolby A or dbx noise reduction can deliver at least 70dB to 90dB of dynamic range; BETA and VHS hi-fi claim to deliver around 80dB; and digital audio recorders and digital audio discs are capable of 85dB to 95dB signal-to-quantization noise ratios. Clearly, FM has to work hard to match these kinds of performances

#### Companded L-R

A system to improve the S/N ratio of stereo FM has been developed by Emil Torrick of the CBS Technology Center and Tom Keller of the NAB Office of Science and Technology. It can be shown that demodulated stereo FM suffers approximately a 23dB increase in noise over monophonic FM.

This is due mostly to the noise contribution of the left and right difference (L-R) subcarrier, which occupies 30kHz of bandwidth above the L + R baseband.

In the CBSTC/NAB system, a compandor is used in conjunction with a special L-R subcarrier to greatly reduce the noise component before being matrixed back into separate left and right channels.

Figure 1 shows a block diagram of the concept. The special L-R subcar-

Continued on page 54

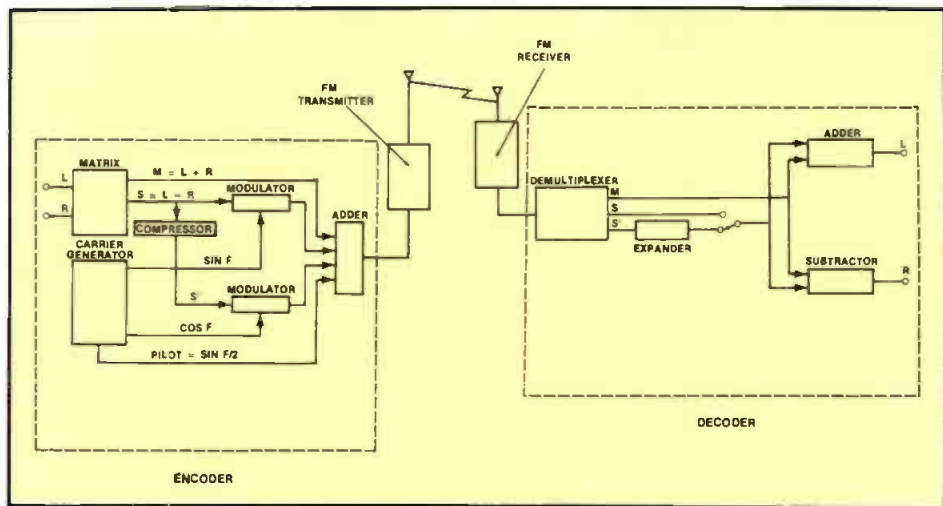


Figure 1. The quadrature companded L-R CBS Technology Center-NAB transmission system. Because the quadrature signal is not recovered by conventional stereo FM receivers, the system is compatible with existing radios.

## Ambisonics: Something new for FM

Ambisonics is a *surround sound* recording and broadcasting system that circles the listener in 360° of sound. Invented in Great Britain about 10 years ago, ambisonics reproduces the original soundfield in all three spatial dimensions—left-right, front-back and up-down.

The ambisonic signal can be stored on a 4-track tape recorder in what is known as the *B Format*, which allows direct manipulation of the spatial elements after the recording has been made. Alternatively, the signal can be *trans-coded* (converted) into another format, such as *2-channel UHJ*.

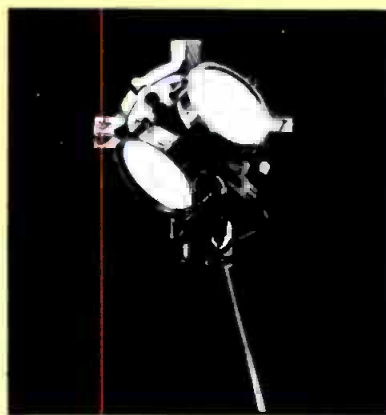
The encoded 2-channel UHJ signal is heard as normal stereo unless it is converted back into surround sound ambisonics by the listener using a decoder, a second stereo amplifier and a second pair of speakers.



The decoder and extra amplifier and speakers are only superficial resemblances to quadraphonic technology. Unlike quad, ambisonics is patterned after the mechanics of human hearing, taking both level and phase differences into consideration in the reproduction of the sound field. The system images well between the front and rear speakers and is compatible in all its forms with conventional reception and reproduction equipment.

An ambisonic recording can be made using a special microphone and associated electronics. The adjacent photo shows a microphone assembly designed specifically for this application. The device contains four separate sound detecting diaphragms. The microphone assembly samples the soundfield and conveys amplitude and phase information to the control unit, which processes the signals for recording or transmission.

KWMU-FM has now begun regular broadcasts using the ambisonic 2-channel UHJ format for live and live-on-tape concerts of classical and jazz music. Last year, the St. Louis station became the first station in the country to air an ambisonic program. Listener response to the project has been favorable.



The Calrec Mark 4 Soundfield Microphone with cover removed (top) and the microphone control unit, which processes the output of the device for recording or transmission.



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For total flexibility, the AU-220 includes a built-in

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*dead issue.*

simultaneously. So in the unlikely event that your "on air" transport fails, the MVP-100 can be programmed to switch to the protection copy maintaining broadcast continuity.

What's more, the MVP-100 also eliminates "custom mechanics." Since each removable transport operates independently of each other, individual repairs or maintenance can be done without putting the entire system out of commission.

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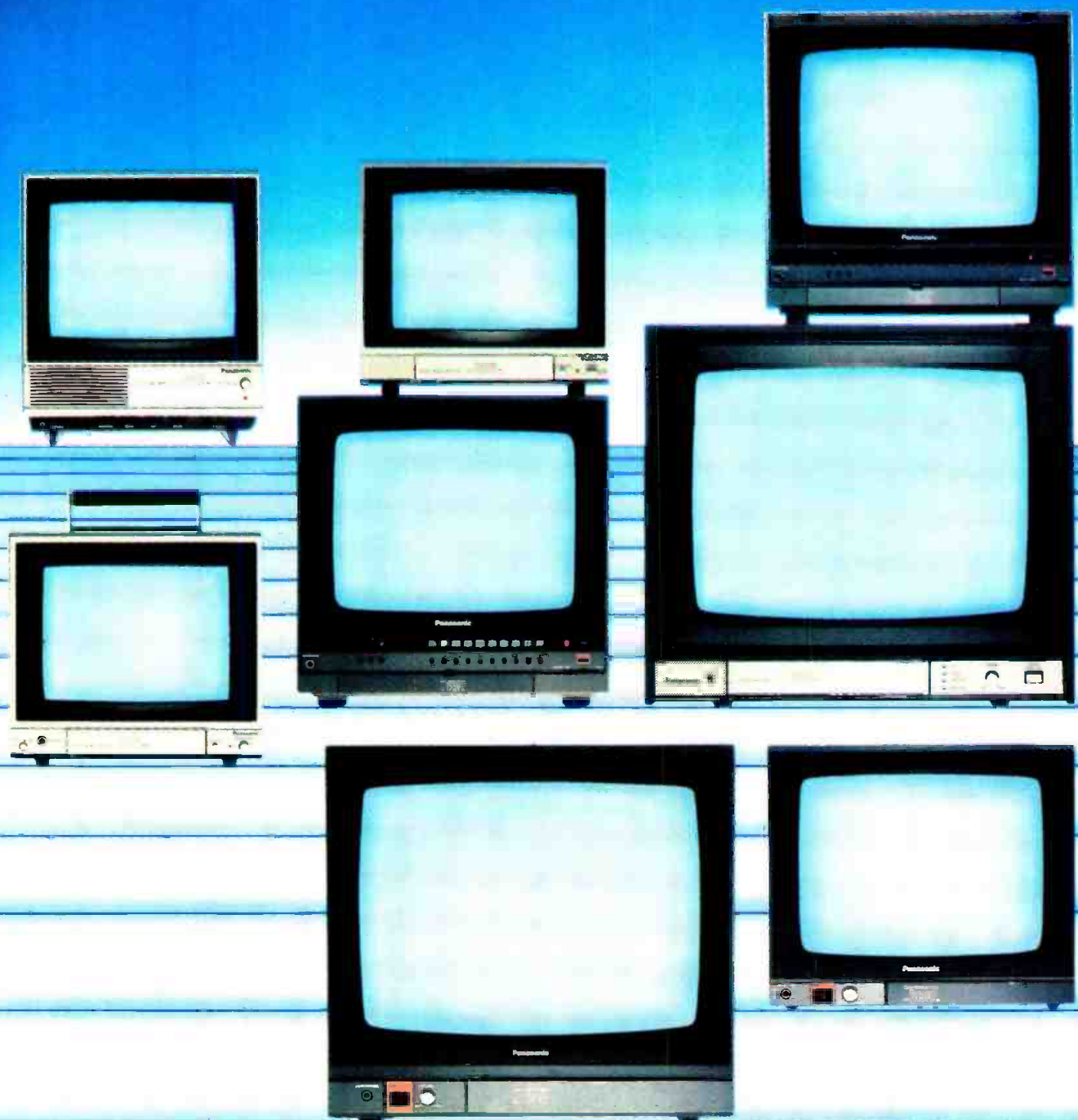
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When you look at the BT-S1900N 19" monitor (all screen sizes measured diagonally), you'll see one of our most brilliant and best defined color pictures ever. One reason is our CompuFocus™ picture tube with OverLapping Field Lens gun. Another is

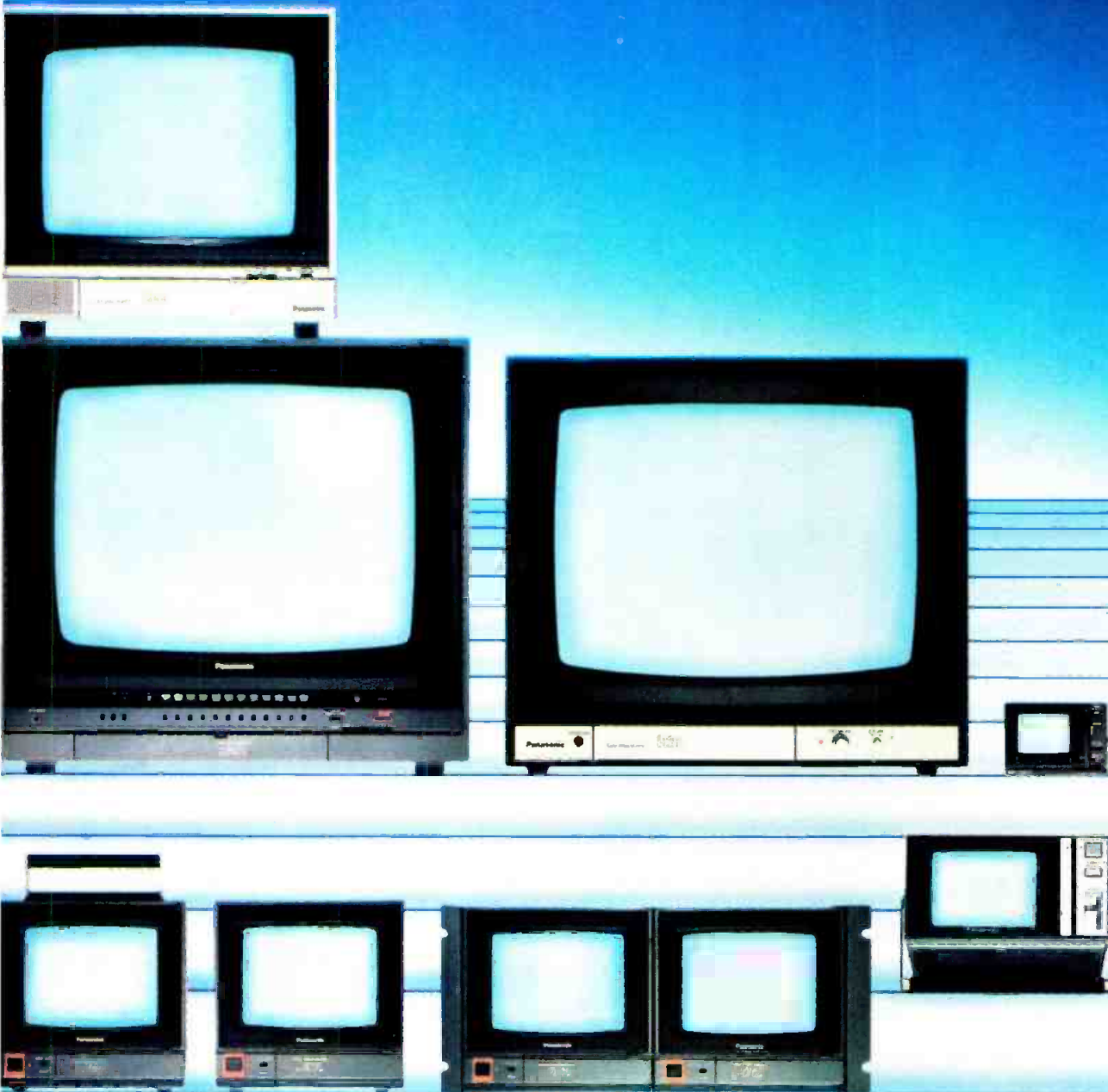
a switchable comb filter which increases definition for easy detection of signal flaws. Behind its push-open door lies a full array of operating controls. Like a normal/underscan switch, pulse cross, horizontal/vertical centering controls and blue-only for easy adjustment of chrominance and hue.

The 13" BT-S1300N has the same great picture,

controls and inputs. And our 7" BT-S700N is ideal for mobile units and outdoor production because it operates on AC or DC. It also features controls for normal/underscan, pulse cross, blue-only and much more.

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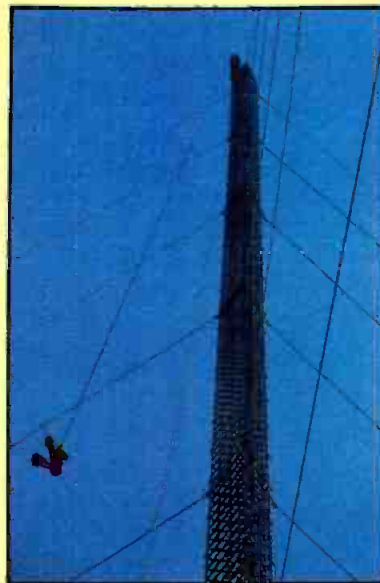


## Tower of power

New technology and tougher-than-ever competition are causing station managers and engineers to look closely at their technical plants for ways to improve their coverage areas. This concern, coupled with the FCC's 80-90 decision, has led many stations to head for higher ground.

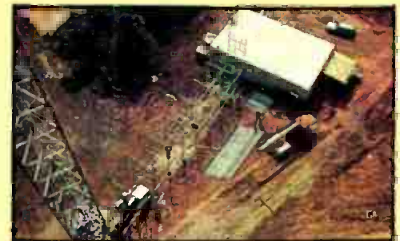
In Docket 80-90, the commission established minimum antenna height and power requirements for the various station classes. FM broadcasters have, in the past, had the option of beginning operation with transmitting facilities below the minimum effective radiated power (ERP) and antenna height allowed by FCC rules and—when economics permitted or needs demanded—improving their plants to the maximum level allowed by the station's particular classification.

Docket 80-90, however, places a time limit on updating facilities for stations operating below the minimum specified ERP and antenna height. Failure to meet these requirements will result in classification of the station at a lower level. The situation can best be summed up by the phrase, "Use it or lose it."

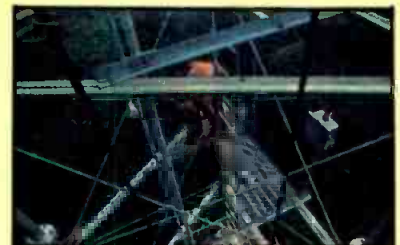


One station that has decided to "use it" is WFOX in Atlanta. The station recently completed a new transmitting tower that is the tallest manmade structure in Georgia—2624 feet above sea level. From this point, the station transmits its 100kW class C signal.

The tower itself is 1764 feet tall,



The 1764-foot WFOX-FM transmitting tower under construction near Atlanta.



weighs more than 703,000 pounds and uses nearly six miles of guy wires. The project took about a year to complete.

The predicted coverage area of the station from the new tower is more than 8700 square miles.

WFOX has also constructed a new transmitting facility to feed its tower of power.

rier is generated in quadrature to the pilot and the normal L-R subcarrier. A synchronous AM demodulator, operating in quadrature to the pilot, is used to recover this special L-R channel.

The quadrature subcarrier is not heard on standard stereo receivers, because regular stereo decoders are phase-synchronized to the pilot. The proposed system maintains compatibility with standard stereo FM.

When implemented at both the transmitting and receiving ends of the FM transmission path, the quadrature system allows stereo FM reception with almost no noise penalty over monophonic FM.

### Audio processing

FM broadcasting still suffers in comparison with state-of-the-art consumer audio systems because of the need to compress and peak-limit program audio for broadcast.

Such processing is needed for a variety of purposes, including: restricting dynamic range to overcome noise in reception; restricting dynamic range to improve intelligibility in portable and mobile listening environments; competing in commercial loudness races; and complying with both maximum and minimum FCC modulation limits.

### Compatible processing?

This issue is raised as a question because it has not been proved (to my knowledge) that audio originated in the studio of an FM station can ever be recovered after the processing techniques employed by most broadcasters today. Certainly, compatible processing would be appreciated by audiophile listeners who wish to hear the true music without the mashed wall-of-sound usually broadcast.

Compatible processing might even add some commercial advantage to those stations that offer an alternative to single-ended processing. The concept, however, seems to be getting no attention from broadcasters. But, then, how much attention was given SCAs a few years ago?

It might be easier to look at the problem from the standpoint of audio processing using a method that may be recovered, rather than finding a way to recover the original dynamics from audio processing techniques.

### Hi-fi SCA?

Using a subcarrier for audio programming yields a service that is generally far from high fidelity. However, the addition of a noise reduction system to the SCA channel can greatly improve the sound quality.

Problems such as background hiss,

hum and crosstalk can be significantly reduced—or even eliminated—by a compandor, or double-ended noise reduction system. At present, only a few stations have tried this technique using professional compressors and expanders.

The cost of a high-quality compandor system can easily exceed the cost of the FM SCA receiver, which is acceptable if only a limited number of receivers require a high-quality signal. It is not acceptable for applications using a large number of receiving points.

It is curious that companding has not been used more widely for audio SCAs, as this technology has been available for a number of years.

### Developing fidelity

FM broadcasting is a fertile medium for new services. The 200kHz channel provided for wideband frequency modulation, combined with the high performance of current FM transmitting and receiving equipment, offers many avenues for further research and development.

#### Editor's note:

This article was adapted from a paper delivered to the 4th annual WOSU Broadcast Engineering Conference, sponsored jointly by the WOSU stations and BE.

||:~::~)))||



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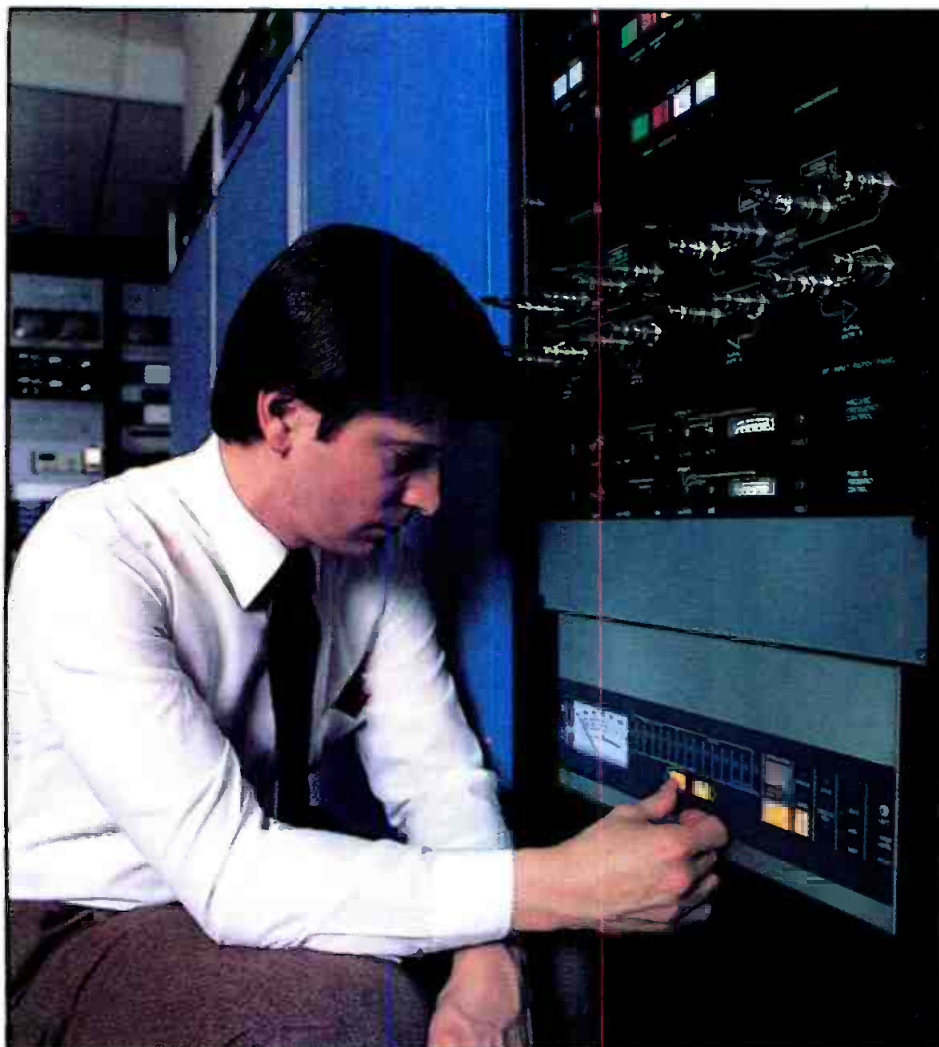
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March 1985 *Broadcast Engineering* 55



# Is your transmitter stereo-ready?

By Eric Small, vice president of engineering, Modulation Sciences, Brooklyn, NY



One of the most talked-about TV changes is multichannel TV sound. Implementing this new technology may present fewer problems than some engineers had feared.

"We want to begin stereo operation, but will my TV transmitter handle an MTS signal?"

That question is being asked by many TV engineers. To accurately answer the question, you need to take a close look at your transmission system.

This article will examine implementation of only the stereo portion of the MTS signal. A discussion of second audio program (SAP) and professional (Pro) channel performance could fill another article.

## Direct FM exciter?

It seems that only a *direct FM* type exciter will work with TV stereo. *Indirect* or *Serrasoid* FM aural exciters will not provide acceptable stereo performance. The RCA "F" and "G" series VHF transmitters employ direct FM aural exciters. The Harris TV-30 transmitters are also direct FM designs.

If you are unsure of what type of aural exciter you have in your transmitter, look at a block diagram of the unit. If the basic oscillator (not the AFC), operates at a low frequency and is followed by a series of multipliers to bring the signal up to the carrier frequency, the exciter is not direct FM.

If, on the other hand, the oscillator is an LC-type circuit operating at the carrier frequency or an intermediate frequency and is directly modulated by varactor diodes, it is a direct FM design.

When checking the block diagram, do not be confused by the AFC system of a direct FM exciter. It may employ a low frequency crystal oscillator, but the oscillator drives a phase comparator whose other input comes from a divider chain that is driven by the modulated carrier.

As far as I know, no direct FM TV aural exciter was ever made that employed vacuum tubes. A Collins

A number of stations are now on the air with stereo TV programming, including WFSB in Hartford, CT. Engineering manager Stevan Vigneaux checks the operation of the station's Modulation Sciences TV stereo generator.

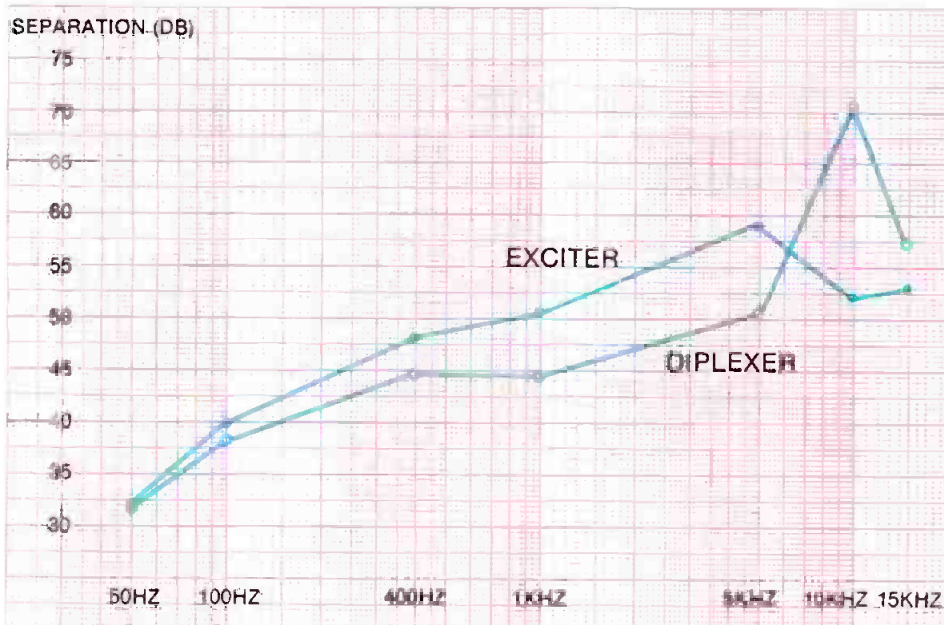


Figure 1. Measured stereo separation of an RCA TT25H transmitter at the output of the exciter and after the diplexer.



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direct FM broadcast exciter was, however, manufactured in the 1960s that was a hybrid of tubes and solid-state.

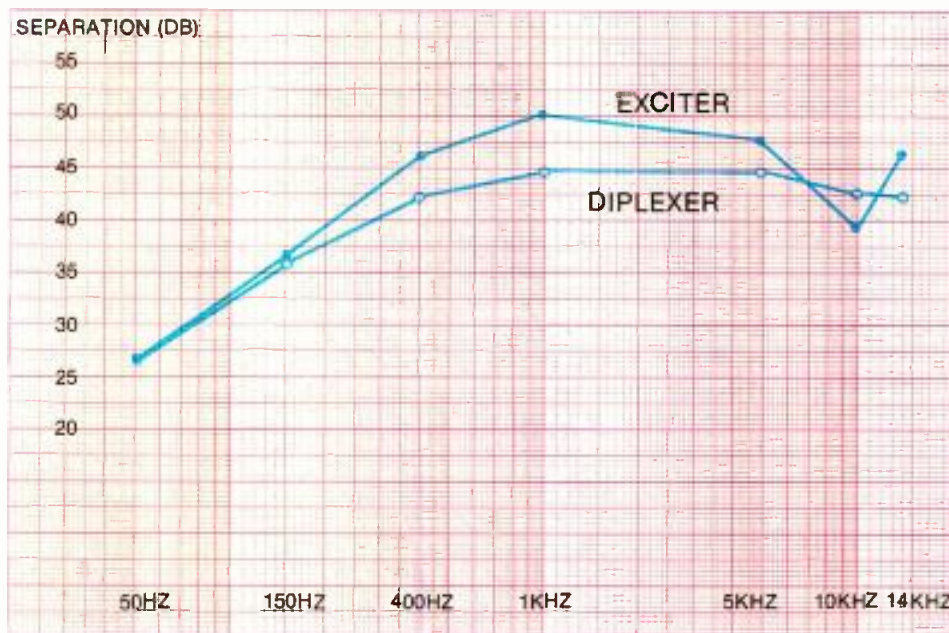
If you have an indirect FM exciter in your transmitter, don't panic. Several companies have a retrofit direct FM aural system for most TV transmitters. It should be noted that

many indirect exciters will work with SAP, but not stereo.

If you are fortunate enough to have a transmitter with a direct FM exciter, the next step is to measure the unit's performance.

### ICPM

Inter-carrier phase modulation



**Figure 2.** Measured stereo separation of a Harris TV-30L transmitter at the output of the exciter and after the diplexer.

(ICPM) is a parameter that has only recently received the attention it deserves. ICPM is the synchronous FM that occurs when the visual signal is amplitude modulated. Because the intercarrier detection method is used in virtually all TV receivers, any stray FM of the visual carrier will be detected by the aural demodulator as though it were intentional information.

For acceptable stereo operation, the measured ICPM must be below 3°. For best stereophonic performance, a reading below 1° is desirable. If you have an ICPM problem, discuss it with your transmitter manufacturer. Many retrofit techniques are available for ICPM reduction. If your transmitter manufacturer cannot help, speak to an independent supplier of TV exciters. A retrofit visual exciter with ICPM cancellation often will solve the problem.

### Diplexers

There has been a great deal of confusion regarding the effects that the notched aural-visual diplexer may have on stereo TV performance. The main problem is the lack of field experience regarding the relationship of diplexer parameters—such as RF amplitude response, group delay and symmetry—to stereo performance.

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Experience with stereo FM broadcast systems indicates that it takes a lot less bandwidth to transmit good stereo than most people estimate. Given the number of parameters needed to describe the RF transmission channel and the complexity of the modulating waveform, it is difficult to conceive of a good analytical

solution to the problem of quantifying the characteristics required of a notch diplexer for good stereo television performance.

With the failure of any known theoretical approach to assess the impact of the notch diplexer, direct measurements were undertaken. Six different transmitters—VHF and UHF—were

tested. Performance was measured before and after the diplexer.

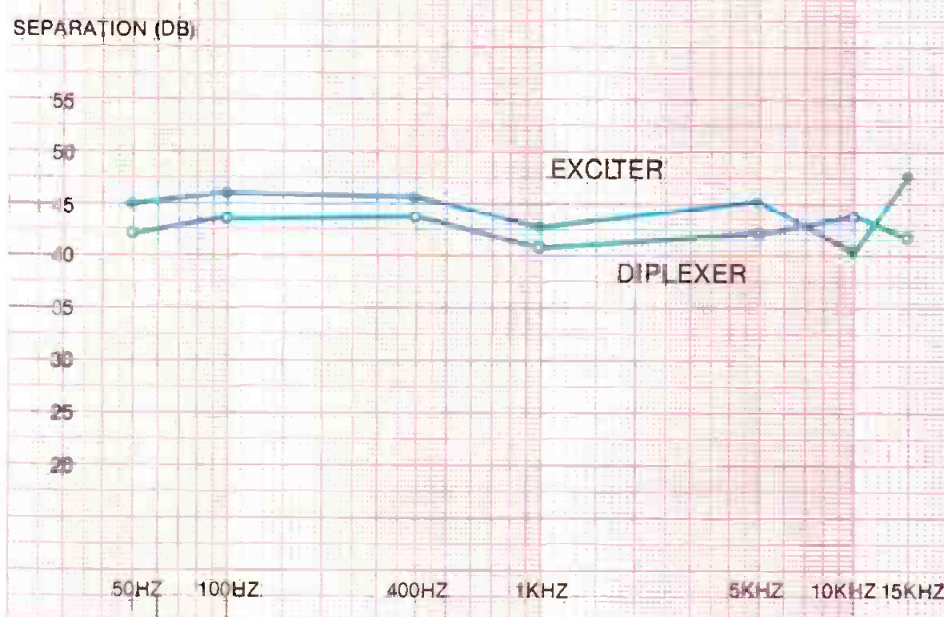
In no case did the diplexer significantly degrade the separation of the stereo signal. (In some cases, effects were noted that might have an effect on SAP and Pro channel performance, but is beyond this article's scope.)

Channel separation is probably the best single parameter that can be used to characterize the performance of a stereophonic TV transmission system. Figures 1-3 show separation measurements for three types of transmitters in actual installations before and after the notch diplexer.

It can be seen that the diplexer did not have any significant detrimental effects on stereo performance for the units tested (an RCA TT25H, Harris TV-30L and PVE TVT).

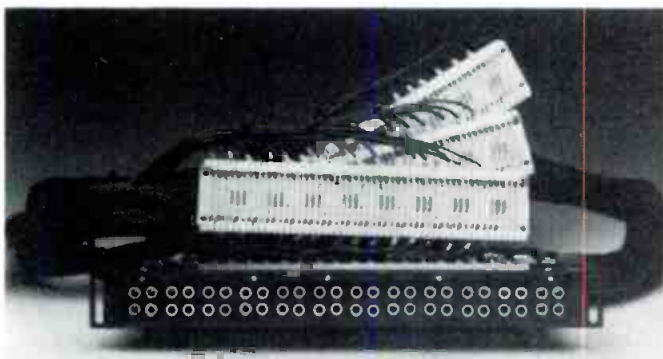
The most striking feature of the separation graphs shown in Figures 1 and 2 (the RCA and Harris transmitters) is the rapid rolloff of separation at frequencies below 400Hz. This is caused by interaction between the modulating signal and the AFC.

The AFC is—in effect—attempting to "correct" the modulation at low frequencies. Remember that the exciter was designed to function with typical modulation at  $\pm 25\text{kHz}$  deviation.



**Figure 3.** Measured stereo separation of a PYE-TV transmitter at the output of the exciter and after the diplexer.

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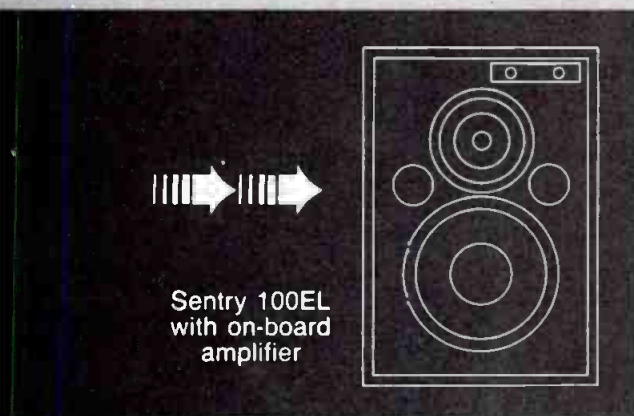
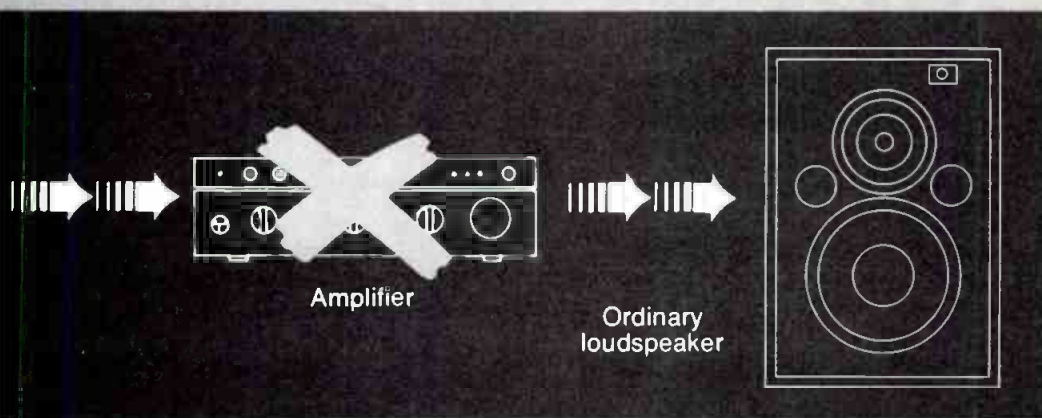
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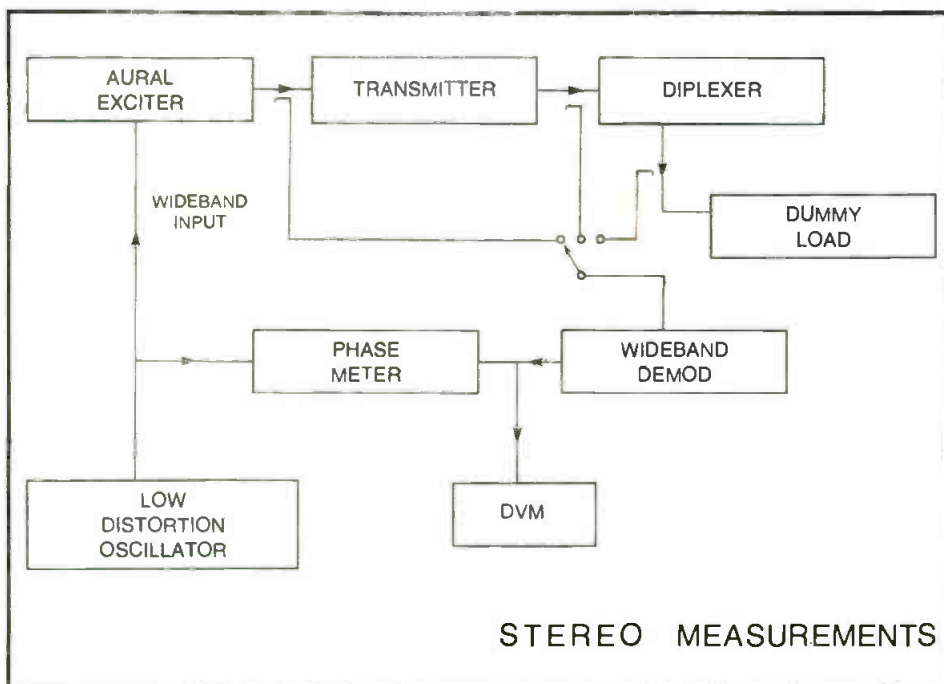
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The stereo generator for WFSB-TV, installed in the transmitter equipment rack (bottom panel).



When required to deviate  $\pm 50\text{kHz}$  and  $\pm 75\text{kHz}$  with complex MTS signals, the AFC has trouble differentiating between desired modulation and undesired carrier frequency shifts.

Fortunately, the solution to this problem is straightforward—improve the AFC loop filter by lengthening its time constant.

The PYE-TVT transmitter does not exhibit this problem. Its exciter was designed for use in West Germany with the IRT stereo system, which has a main channel deviation of  $\pm 50\text{kHz}$ .

#### Modifying the exciter

Most TV direct FM aural exciters do not have a wideband input port suitable for stereo. Fortunately, creating one is not difficult. However, because the exciter is part of an FCC type-accepted system, any modifications must comply with applicable commission rules.

The input circuit should provide  $75\Omega$  termination to the input signal and provide sufficient attenuation so that a 2.5V to 3V P-P signal will deviate the transmitter  $\pm 73\text{kHz}$ . A dc blocking capacitor (minimum value  $500\mu\text{F}$ ) should be installed between the attenuator and the modulator diodes. The polarity of the capacitor should be such that the bias voltage correctly polarizes the capacitor. The existing audio circuitry should be disconnected for this modification.

If the varactor diode is used for both program modulation and AFC loop control, be careful not to disturb the AFC circuitry when disconnecting the normal modulation signal path.

After completing installation of the new wideband port, run a performance test by sweeping the exciter from 50Hz to 50kHz. Response must be flat to within a few tenths of a dB for good stereo performance.

#### Testing the aural transmitter

The most direct way to judge how well a particular transmitter will work in stereo is to get a TV stereo generator and stereo demodulator and measure system performance through the transmitter. A few problems arise, however.

One is that production of TV stereo generators is still limited. Most are sold as fast as they can be produced. In addition, an accurate stereo demodulator is required to conduct the measurements, and is difficult to find.

Making separation measurements of more than 40dB requires precise test equipment and a test setup that is

Figure 4. Test setup for stereo performance measurements on an aural transmission system.

Photo by Charles Koteen



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difficult to debug. Few FM broadcast stereo generator/demodulator combinations can achieve 40dB separation across the audio band.

Even if a sufficiently accurate generator and demodulator could be obtained, the data produced would only provide a go/no go indication, with no insight into the nature of the limitations.

A TV station could obtain a standard FM broadcast stereo generator and demodulator and—after the needed frequency shift modifications—use the pair to measure the performance of the TV aural exciter and transmitter.

This approach has merit, especially if the FM broadcast equipment is easily obtainable. If the measured TV system channel separation is acceptable (more than 40dB) with an FM broadcast system that has baseband frequency components out to 53kHz, then it is reasonable to assume that performance will be at least as good with the MTS TV stereo system, which has energy out to only 46.468kHz.

This method, however, still has the drawbacks for the TV generator/demodulator system. Achieving performance of more than 40dB from the chosen test gear is often difficult, and

the data obtained from such tests provide no insight into the causes of poor results.

For these reasons, Modulation Sciences developed a computer simulation program of a perfect TV stereo generator/demodulator, freeing the results from the limitations of real world hardware. By making accurate gain and phase measurements of the transmission channel, the effects of the transmission system by itself can be measured.

And, by zeroing the gain and phase measurements one at a time, the contributions of each toward reducing the separation of the stereophonic signal can be examined. This information would be difficult to obtain in a real world test setup.

The only drawback to this approach is the need to make exceedingly accurate gain and phase measurements. The gain measurements can be made with a commonly available pocket DVM. The phase measurements, however, demand a less common and more expensive precision phase meter.

Figure 4 shows the test setup used to measure the performance of an aural TV transmission system using the computer simulation program.

#### Measuring stereo performance

The key to deriving useful separation figures from the amplitude/phase response data is computer simulation of a perfect stereo modulator-demodulator system. The program was originally written for HP-41CV and HP-97 calculators, but was moved to a Digital Equipment PDP-11 under the RT-11 operating system, BASIC V2.5.

The program has also been run on a variety of personal computers. Every effort has been made to create a transportable program, and all of the machine-dependent functions have been noted. The program has also been translated into Pascal (OMSI 1, V1.2) for ease of modification.\*

If you are not familiar with the particular dialect of BASIC that your computer understands, have someone who knows the language look over the program first. Just to be sure, always run the test case provided in the comments at the program's beginning.

To complete the computer program measurements—which provide readings for the expected transmission system stereo channel separation—phase and amplitude readings must be taken at several modulating frequencies. When the required infor-

Continued on page 69



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\* Because of the length of the stereo performance simulation program, it will not be presented here. A copy of the program and recommendations on test equipment for the measurements is available from the author by circling (1001) on the Reader Service Card.



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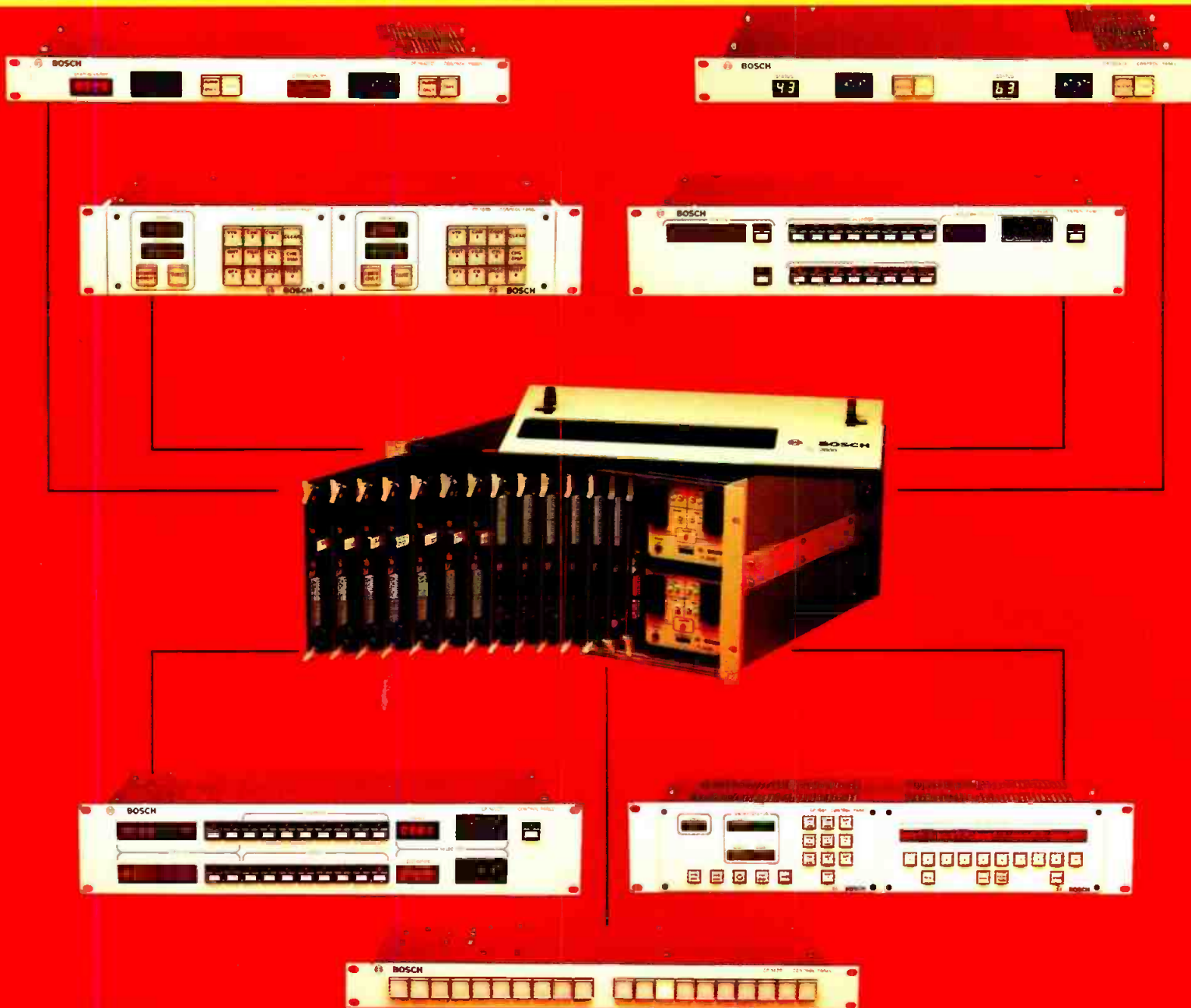
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mation is plugged into the program, the predicted separation figure will be calculated.

Aural frequency deviation for the tests should be  $\pm 50\text{kHz}$ , or 200% on a conventional modulation monitor.

A word of warning is in order about conventional aural modulation monitors: To the best of my knowledge, none are characterized above 15kHz modulating frequency and  $\pm 25\text{kHz}$  deviation.

To set 200% modulation, measure the signal level at the aural exciter input with the oscillator set to modulate the transmitter 100% as indicated by the modulation monitor. This represents  $\pm 25\text{kHz}$  deviation. Increase the oscillator level until the exciter input voltage exactly doubles (+6dB) and the system should produce the desired 200% modulation for the tests.

### Required test equipment

The test instrument that will probably present the greatest problem in locating will be the wideband aural demodulator. Several manufacturers are working on new TV stereo modulator monitors or modification kits that may be used to make existing monitors stereo-capable.

Alternatives to these test approaches include:

- Renting a laboratory-type modulation analyzer to make the measurements. This is probably the easiest approach. However, these instruments can be expensive to rent, even for a short period of time.

- Modifying a standard FM modulation monitor to operate on the aural channel frequency (only a wideband monaural demodulator is needed).

Depending on the channel, the monitor can usually be changed to the required frequency by either adjusting (or modifying) the unit's local oscillator, or using a balanced mixer and a stable low-noise oscillator to heterodyne the aural carrier to the monitor's frequency.

- Using the heterodyne technique described previously for a standard FM monitor in conjunction with a consumer-type FM tuner. This idea works well as long as the performance of the tuner is verified using an FM exciter of known quality. Consumer tuners can vary tremendously in quality, and price is not always a good indicator of performance.

Most consumer tuners have a high impedance composite output that is not suitable for driving test equipment with a high degree of accuracy. The buffer amplifier shown in Figure 5 can be installed in the tuner or attached with a few inches of coax to provide a low impedance output for the test measurements.

It is important to remember that any RF bandwidth restrictions in the demodulator will degrade the measured data when large deviations are employed with high modulating frequencies. This should not be a problem with laboratory demodulators, nor should it be a problem with FM broadcast modulation monitors, as long as the RF wideband input is used.

An FM tuner, however, will generally show an increase in distortion with greater deviations at high modulating frequencies, making it imperative that the performance of any tuner—regardless of how expensive it is or how good the specifications may appear—be verified using a modern, high-quality FM exciter.

Four other pieces of test gear are required to conduct the computer simulation stereo performance measurements:

- A low-distortion audio oscillator (less than 0.1% THD).
- An accurate frequency counter (to measure the exact frequency of the audio oscillator).
- A digital ac voltmeter, flat to at least 100kHz with built-in dB conversion (relative scaling is desirable).
- A phase meter with accuracy of at least  $\pm 0.03^\circ$  and resolution of  $\pm 0.01^\circ$  from 50Hz to 50kHz. Such an instrument can be rented from an equipment leasing company.

It may be most economical to first assemble all of the required test instruments, except for the phase meter. The amplitude tests can then be run on the aural transmission system, assuming zero phase delay. If the amplitude response does not produce acceptable results, then the addition of phase data will only further degrade separation.

### Other measurements

To give the user a complete picture of the performance possible from the aural transmission system, two additional measurements should be taken: modulation sensitivity and distortion.

Modulation sensitivity of the aural exciter should be checked several times for two or three weeks to determine the amount of drift. Any change in sensitivity will reduce stereo separation. A total system change (transmitter as well as receiver) greater than 3% from the value at setup will reduce separation to below 25dB.

For best performance, the error contributed by the transmission system should be held to 1%.

The modulation sensitivity measurements are simple to make using the Bessel null procedure. The transmitter is modulated with a low distortion sine wave of exactly 10,396Hz. The signal's amplitude is monitored from one test to the next using the ac digital voltmeter referred to earlier.

The aural carrier (either at IF or on-channel) is observed using a spectrum analyzer or a narrowband communications receiver. When the oscillator amplitude is adjusted for a complete carrier null, the transmitter is deviating exactly  $\pm 25\text{kHz}$ . Record the exact modulating voltage and compare it with previous readings.

Another important test is distortion. Equipment needed is a low distortion oscillator, a baseband spectrum analyzer and an aural demodulator. It is important to use a low-frequency spectrum analyzer because you must identify each harmonic component separately.

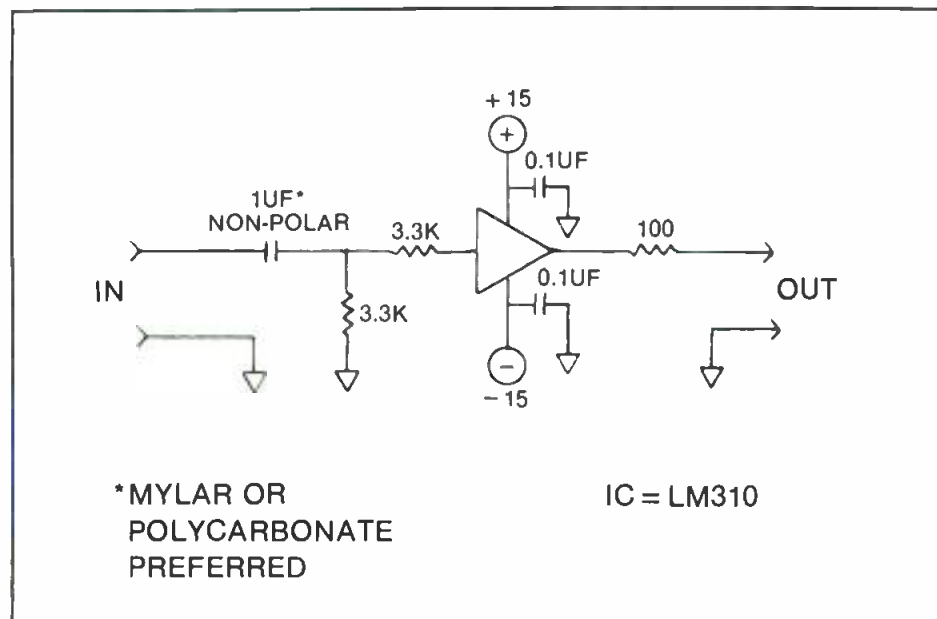


Figure 5. A buffer amplifier circuit that can be used to drive test instruments from the composite output of a commercial FM receiver.



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A conventional total harmonic distortion analyzer is of no use. If a low-frequency spectrum analyzer is not available, a wave analyzer (selective voltmeter) may be used.

Distortion should be measured at modulating frequencies of 5kHz to 110kHz in 5kHz steps at  $\pm 25$ ,  $\pm 50$ ,  $\pm 75$  and  $\pm 100$ kHz deviation. Of particular interest are the second and third harmonic signals. The distortion components should be mostly third harmonic, and below 0.5% (-46dB). If second harmonic distortion predominates, the varactor frequency modulator is probably being driven into non-linearity.

If distortion is greater than 0.5% at  $\pm 50$ kHz deviation, stereo performance may be degraded. If it is greater than 0.5% at  $\pm 75$ kHz deviation, simultaneous use of SAP and stereo may be adversely affected.

Adding a variable reverse dc bias to the varactor diode and adjusting for minimum distortion may help in marginal situations. This is not possible, however, if the same diode is used for AFC and modulation.

If the major distortion components are third harmonic, check the input stages preceding the modulator diodes for non-linear operation or slew-rate limiting. The simplest solution may be to bypass any input circuitry and drive the varactor diodes directly.

Significant third harmonic distortion can also be caused by symmetrical non-linearity of the varactor diodes. This condition, however, is more often a cause of second harmonic problems than third harmonic. If symmetrical non-linearity proves to be your problem, try replacing the existing varactors with a more linear type.

As mentioned, consult all applicable FCC rules and the transmitter manufacturer before attempting to modify your exciter.

Another cause of significant third harmonic distortion can be excessively narrow bandwidth through the exciter, transmitter or diplexer. However, having measured several complete transmitters—including diplexers—we have not seen any bandwidth problems that would result in poor stereo performance.

### Easing conversion fears

Generally speaking, the problems with transmitter conversion are neither as serious nor as expensive as many station engineers have feared. It is hoped that the tests will enable engineers to replace speculation and generalizations with hard facts when planning to upgrade their facilities.

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# Are you ready for surface-mount components?

New technology may make leaded components obsolete

By Christopher H. Fenton, consultant,  
Western Reserve Tool and Machine Company

Surface mounting, a radically new method of attaching electronic components to printed circuit boards, is expected to have long lasting effects on broadcast product design, manufacture and service. Surface mounting could render most standard leaded components obsolete within the foreseeable future.

Surface-mount component packages have either short winged leads or no through-hole leads at all. A conventional resistor, capacitor or IC component package contains wire leads that are pushed through plated holes in the

circuit board assembly and then soldered to copper foils on the opposite side.

Some experts predict these types of devices will go the way of the vacuum tube with the current rise of surface-mount technology.

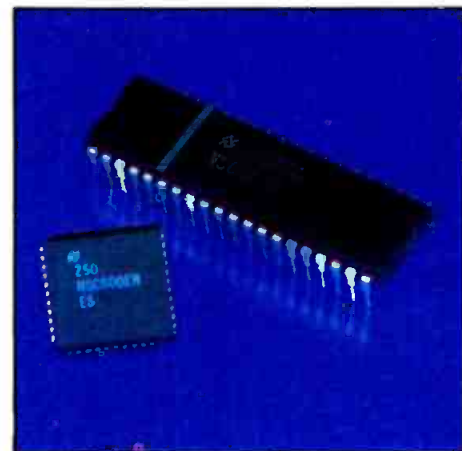
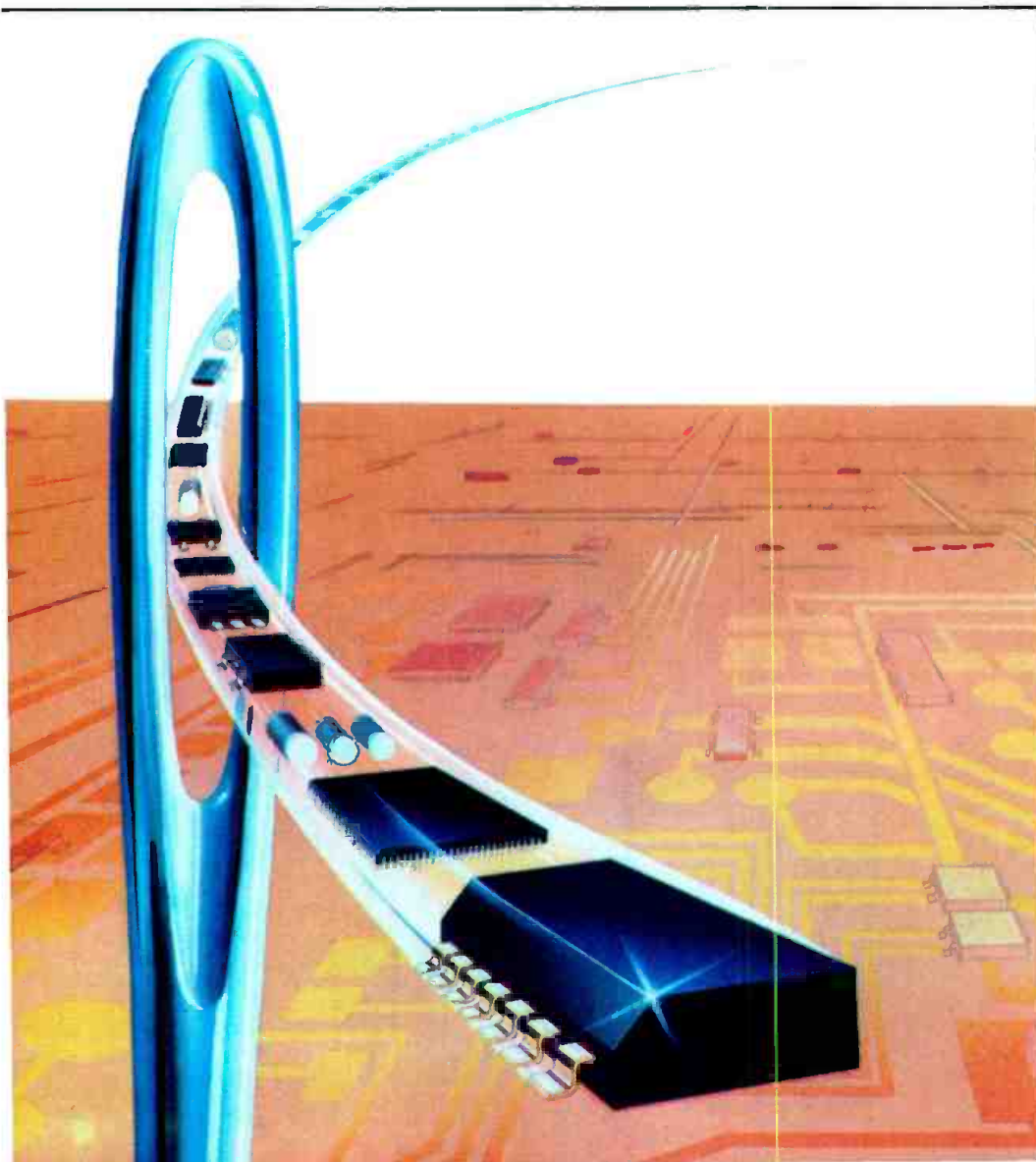
It probably won't be long before broadcast electronics manufacturers adopt this technology on a large scale. Not long after that, maintenance engineers will be facing the problem of learning how to most effectively remove and replace surface-mount components when they fail.

Surface-mount packages can house the same chips or components that leaded packages do, but in much smaller spaces. Surface-mount devices are soldered onto foil patterns on printed circuit boards in a way much different from the standard construction techniques used in conventional board assembly. Surface-mount PC boards do not need holes for component leads. As a direct result, device packages can be spaced much more closely, and the circuit board need not go through a hole drilling operation.

## Technology background

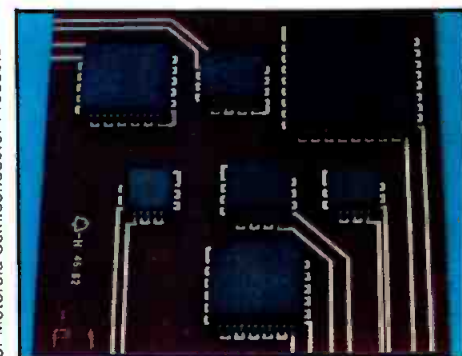
In some of the early applications of surface-mounting, devices were used where cost considerations were secondary to reliability and size. Discrete surface-mount components were initially attached to ceramic substrates as part of mixed-composition devices. This same concept was later used with less expensive board materials, such as glass/epoxy.

As size reduction becomes more of a factor in many non-military applications, such as computers and advanced audio and video products, the demand for surface-mount parts is increasing. As a result, surface-mount components are being produced in large



Courtesy of National Semiconductor

A standard IC chip (top) and its surface-mount small outline (SO) equivalent (bottom). Note the reduction in circuit board space requirements with the SO device.

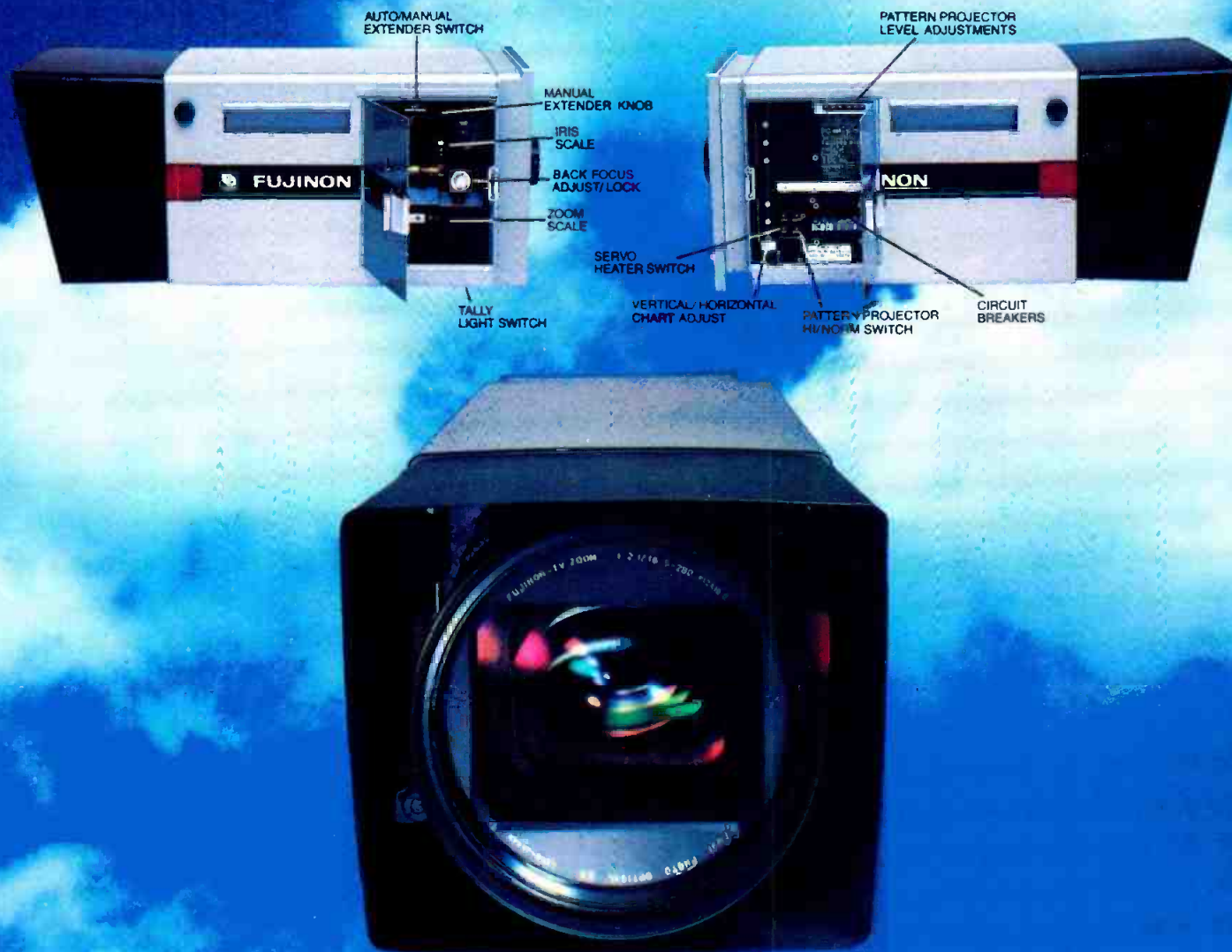


Courtesy of Siliconix

A multilayer PC board using surface-mount integrated circuit components.



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A 1/2- to 1/3-size reduction compared with conventional circuit board space requirements is possible with surface-mount devices.

There are several major reasons for using surface-mount components in designs using existing technology.

Also, surface mounting the components reduces stray capacitance and lead inductance. High-speed digital systems and high-frequency communications equipment are two applications where surface-mount com-

## Current products

Surface-mount devices are available in many different package styles. The most common are the chip configurations for passive devices, small-outline packages for semiconductors and ICs and plastic chip carriers for ICs with high pin counts.

Most discrete components are available in surface-mount packages. The chip packages, for the most part, house resistors, capacitors and inductors. Small-outline (SO) packages generally house transistors and other discrete semiconductors. The SO packages have electrically conductive, tinned surfaces at either end of the component for solder attachment.

Analog circuits and logic families such as TTL and CMOS are produced in *small-outlined integrated circuit* packages (SOIC). The SOIC devices are generally available in 8- to 24-pin configurations. Computer memories, microprocessors and other devices with 40 to 68 pins are available in plastic chip carriers (PCCs).

A PCC, also known as a *quad-pack*, is square and contains leads on all four sides. The pins of the quad-pack are *j-shaped* and curl under the package.

Surface-mount component leads are spaced much closer than those of conventional components. As a result, PC board layout is more critical. As density requirements increase, foil width and spacing will decrease to about three to five mils. This change is expected to occur by the end of the decade.

Tool costs for equipment manufacturers are two-to-five times higher for surface-mount boards than for conventional packages. Price parity has, however, already occurred with some discrete components.

Even with the current cost penalties, the use of surface-mount technology can reduce overall costs. Reduction in board size as a result of surface-mount devices can lead to lower material costs.

Some observers think that surface-mounting will be the dominant force in board assembly technology by the end of the decade. Faster and more flexible automatic assembly machines are needed for placing components on circuit boards.

The key reason tooling costs are so high is, in part, because of the lack of a standard component package, primarily in the 20- to 40-pin range. Surface-mount component prices are expected to drop to the level of conventional parts during 1986. [7:2:111]

Most manufacturing techniques for building circuit boards with surface-mount components have evolved from standard *insertion-mount* methods. A fundamental difference exists between the two processes, however.

The lead-forming stage is not used in the surface-mount process. *Pickup and place machines* replace automatic component insertion equipment in surface-mount board assembly. A typical pickup and place machine is computer controlled and positions parts with servo-driven heads.

Although surface-mount components are soldered to the circuit board, attachment and soldering procedures differ from those used in conventional through-hole PC board construction.

Conventional boards are automatically stuffed with components on one side of the board. Excess wire lengths are then trimmed and the boards are wave-soldered.

Surface-mount boards, on the other hand, are first screened with solder paste on all component soldering points. Placement machines then position the surface-mount devices in the solder paste. Manual placement is impractical

because of the small size of the parts and their tight placement in relation to other components on the board

The cured solder paste holds the components in place until soldering. Large surface-mount devices may also require adhesive mounting.

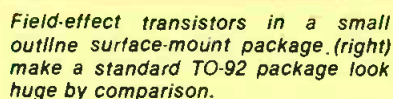
Wave soldering with some modifications can be used on surface-mount devices. Wave soldering, however, is difficult to control because it may cause solder bridging on devices with high pin counts. Plastic chip carriers are particularly difficult to wave solder because they have closely spaced leads on all four sides.

Other solutions include using alternative solder techniques to avoid solder bridges. One method, called *solder reflow*, seems to have the greatest potential for resolving the problem of solder bridging.

With solder reflow, a solder paste is screened onto the circuit board before component placement. The paste holds the parts to the board and the assembly is then heated to 210°C. The solder paste melts—or *reflows*—to form the solder joints. Surface tension of the solder holds the components in place.

Another surface-mount attachment technique uses electrically conductive epoxy instead of solder. This concept has been used for years to produce hybrid circuits on ceramic substrates. Proposed surface-mount applications will use standard glass/epoxy boards.

The attachment process begins with the screening of electrically conductive epoxy at all component placement points. Drops of non-conductive epoxy hold larger components in place until they can be cured. Placement machines are used to position components on the board. Convection, infrared or vapor-phase heating then cures the epoxy.





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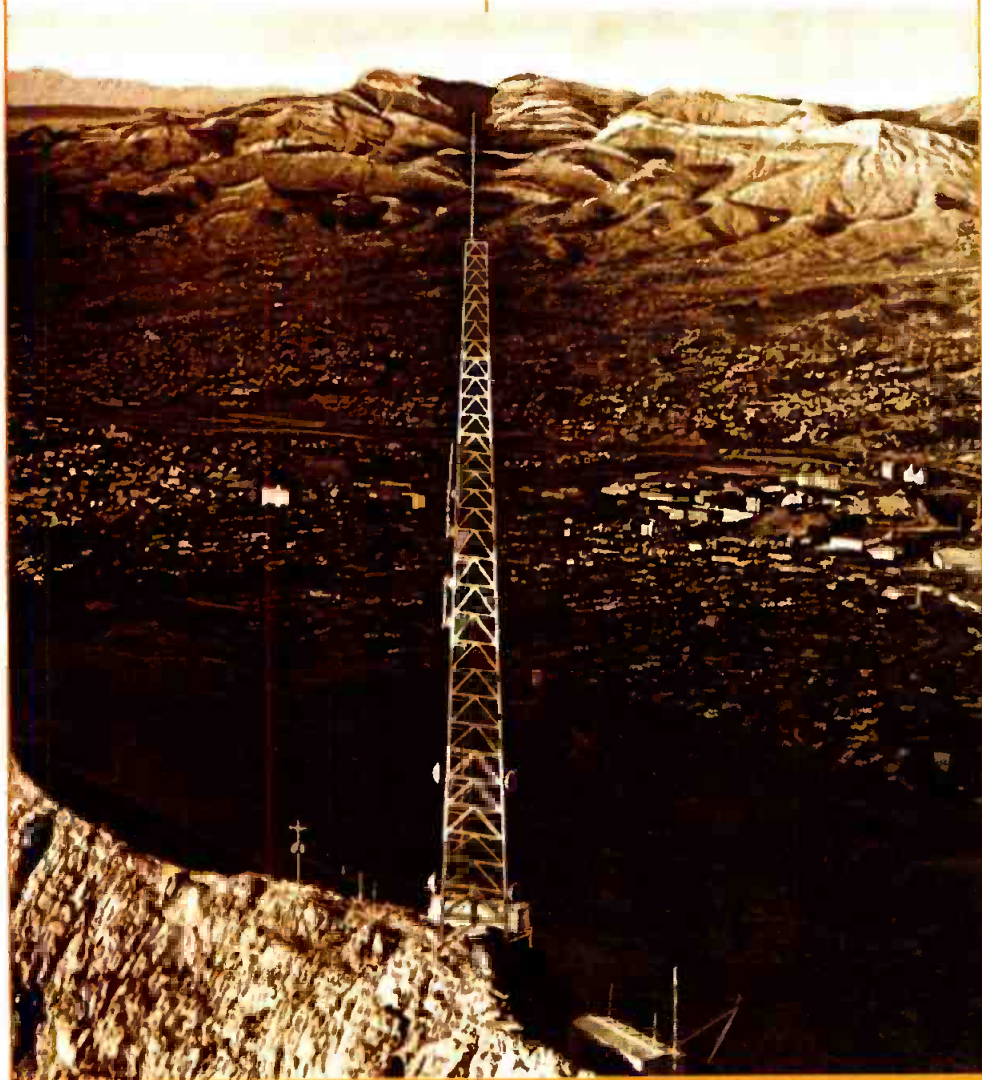
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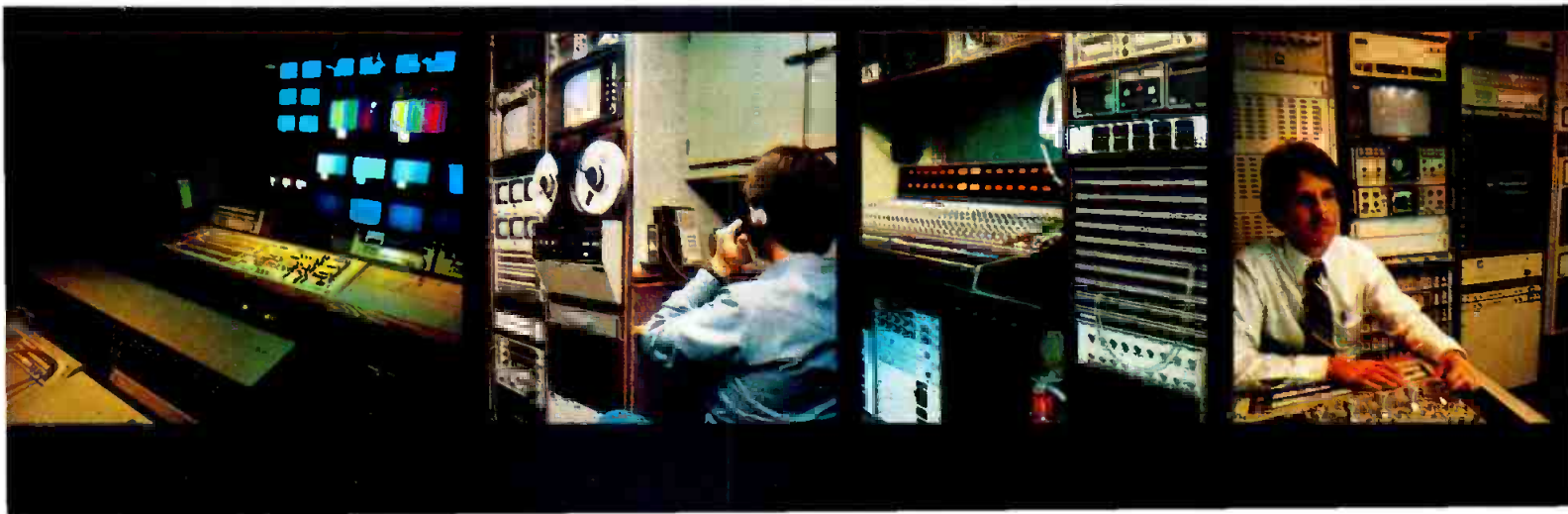
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# Fiber-optic communications systems

By Martin Pyykkonen, AT&T Technologies, Burlington, MA

The transmission of information using fiber-optic systems has brought about a major technological advancement in information transfer. Since the initial technology of basic voice transmission on hair-thin optical fibers in the mid-to-late 1970s, advances have pushed the state-of-the-art to data and video transmission in a variety of communications networks.

The natural benefits of fiber-optic technology for the transmission of information include low signal attenuation, wide information bandwidth, negligible crosstalk, immunity to electromagnetic interference and security against unauthorized tapping of the optical signal.

Fiber-optic technology involves essentially three elements.

- the optical fiber medium;
- optical source and detector devices; and
- optical line rates of transmission.

## Fiber medium

The optical fiber medium consists of thin glass strands, each having a diameter less than the thickness of a

human hair. Current telecommunications technology can transmit 6000 simultaneous voice conversations over a pair of fibers. (A pair is re-

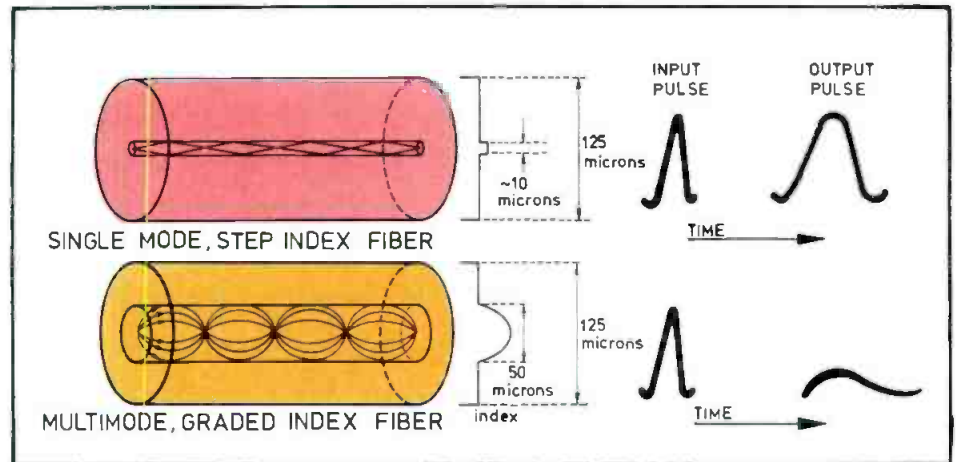


Figure 1. A comparison of single-mode and multimode fiber-optic transmission.

## Installing fiber-optic cables

Fiber-optic cables are often lighter but stronger than metal cables of the same size. This is because materials built into the cables absorb tensile forces with a minimum of stretching. There are two families into which fiber-optic cables can be categorized:

- **Loose-tube or channel.** Loose-tube construction provides a fixed space for each fiber, within which the fiber may adjust its position without incurring significant stress. Loose-tube cables are preferred for most fixed installations, difficult installations and severe environments. They also present the least risk to fibers during manufacture.

- **Tight-buffer.** If fibers are in continuous contact with other cable

materials, the cable is said to be of tight-buffer construction. Tight-buffer cables are more compact and flexible. They are used for portable, temporary applications where easy reeling and unreeling is an important requirement.

Tight-buffer cables may be made resistant to crushing and bending by using soft, resilient jackets. Tight-buffer cables are generally not recommended for long, crowded pulls. The manufacturing risk is higher and temperature stability more difficult to achieve.

Although installation methods

for fiber-optic and electronic cables are similar, there are two important rules that should be observed when handling fiber-optic lines: Do not pull on the fiber, and do not allow tight loops, kinks, knots or bends in the cable.

To comply with these rules, it is necessary to identify *strength material* and *fiber location* within the cable, and to use the method of attachment that pulls most

directly on the strength material.

By observing pulling strength limits, minimum bending radius limits and avoiding scraping of the cable at sharp edges, damage to the cable structure and fibers will be avoided.

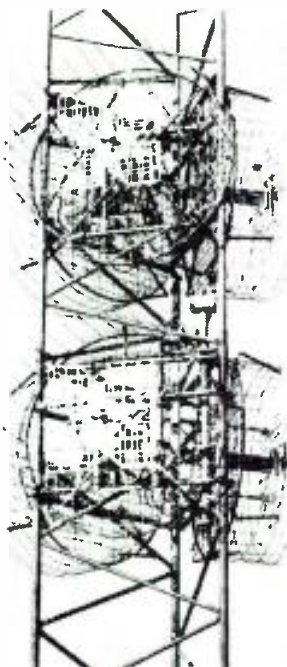
A 6-fiber loose-tube optic cable with an epoxy fiberglass central member.





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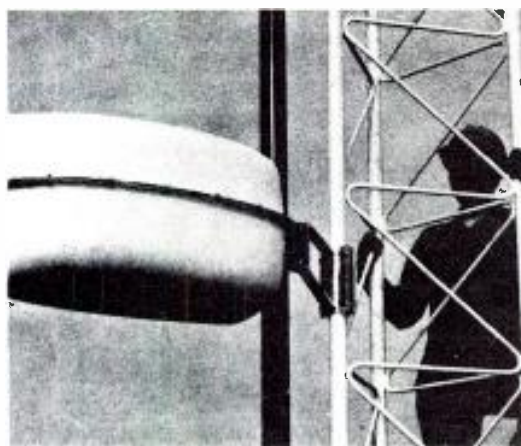
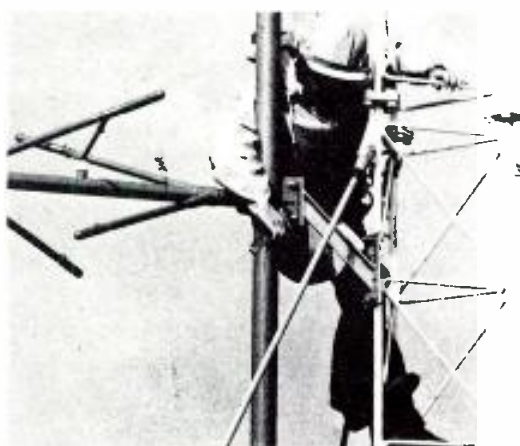


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### Preparing the cable

The preferred way of pulling a fiber-optic cable is by *direct attachment* to strength members. This way you will not pull on the fibers.

For direct attachment, cut back cables slightly, taking care not to weaken the strength material be-

ing uncovered. Conventional cable tools may be used. If the strength material is flexible and may be formed into a knot without weakening, it can be tied directly to pulling eyes, loops and swivels.

Kevlar strands and steel wires are suitable for direct attachment. Loose fiberglass threads or braids may not be knotted without breaking. They are, therefore, unsuitable for direct attachment. Fiberglass/epoxy rods are too rigid to knot. Pulling eyes that use screw pressure to attach to rigid strength members are not widely available.

A *Kellems grip*, which grasps the cable by the jacket, is an example of *indirect attachment*. If the strength material is directly beneath the cable jacket, indirect attachment is safe and may be preferred, especially for larger cables.

Prestretching and taping a Kellems grip to a small cable helps assure even pulling. Griping less than  $\frac{1}{4}$  inch, however, is not recommended.

Indirect attachment is less desirable when fibers are in the path of forces transmitted to strength members. In such a case, only a fraction of maximum pulling strength may be used. This applies when the strength member is centrally located and the fiber cables are placed around it.

When connectors are attached to a fiber-optic cable, it becomes more likely that the first installation rule will be broken. The best advice is to install without connectors and apply them afterward.

If a pull is made entirely in one direction, connectors may be preinstalled on one end, leaving the other end free for pulling. If the cable must be installed with connectors attached, every practical means must be taken to protect the connectors from physical damage. Solid, taped and cushioned enclosures should be used to protect connectors during pulling.

Courtesy of Belden

A technician pulls a vertical run of fiber-optic cable on the 1500-foot transmitting tower of KOVR-TV, Sacramento/Stockton, CA.

This photomicrograph shows the layers found in a fiber-optic lightguide that can transmit 450 telephone calls simultaneously. The lightguide measures 5/1000 of an inch in diameter.

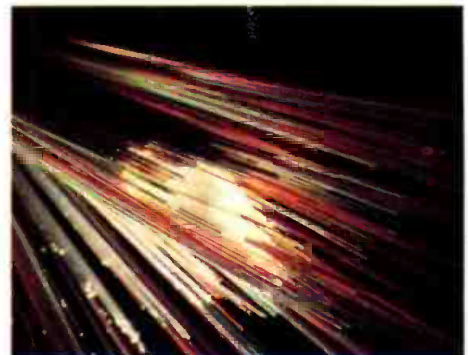
quired, one to transmit and one to receive the signal.)

Pairs of optical fibers are bundled into a cable designed to provide external protection in a typical installation. A common type of cable containing up to 144 fibers has a  $\frac{1}{2}$ -inch diameter and can carry more than 400,000 voice-grade audio circuits.

Photo by Leo Derlak, courtesy of AT&T Technologies

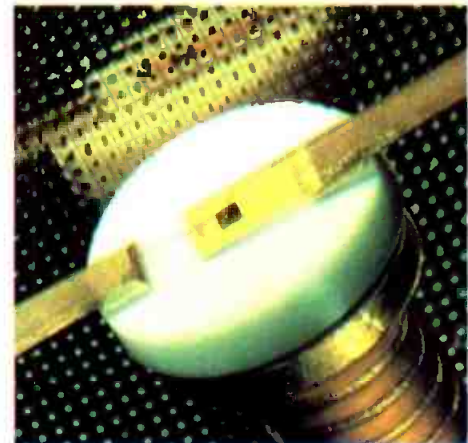


Courtesy of Siemens



Courtesy of Siemens

Fiber optic conductors can be bundled together to form cables of any size needed. There is no crosstalk between adjacent optical conductors.



Courtesy of Siemens

A high-radiance LED is shown in front of a semiconductor wafer, which contains the integral lens used to control focus.

Optical fiber technology provides two basic modes of propagation:

- **multimode:** multiple modes of light propagated along the optical fiber for multiple distance paths at various angles within the fiber;
- **single-mode:** a highly concentrated light path that propagates along the fiber in a single, straight line.



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Initial optical fiber development was confined to multimode technology. However, commercial single-mode systems are being developed and installed.

Single-mode is superior to multimode technology because it provides more concentrated power, allowing longer distances before the optical signal must be regenerated.

The optical fiber medium only provides the path over which information is transmitted. Needed is a light source at one end and a light detector at the other.

Peripheral to the purely optical operation, additional processing of the audio, video or data information is required. This is done electronically by digitizing the signals.

### Optical devices

Optical source devices consist of

either *lasers* or *LEDs*. Both of these can operate in either the short wavelength spectrum (approximately 0.825 microns) or long wavelength spectrum (approximately 1.3 microns). Early developments were confined to devices in the short wavelength region.

Because the optical fiber exhibits a natural minimum signal attenuation at about 1.3 and 1.5 microns, recent development has focused on laser and LED operation within those areas.

Technological breakthroughs in source devices have been highly dependent on materials, particularly the use of indium and gallium arsenide. Taking advantage of lower optical signal attenuation in the fiber has led to lengthening of signal regenerator spacing, from six miles in 1981 to more than 30 miles today.

The development of detector de-

vices during the past few years has roughly paralleled that of sources, although at a less dramatic pace. Early detectors consisted of simple avalanche photo diodes (APDs), although recent developments have resulted in the more sensitive and more complex PINFET (P-intrinsic-N Field Effect Transistor) design.

High optical power laser sources, sensitive PINFET detectors and optical fiber optimized at the 1.3-micron wavelength are the current state-of-the-art. Technological breakthroughs will soon, however, allow production of devices and fibers that operate in the 1.5-micron region.

### Information transmission

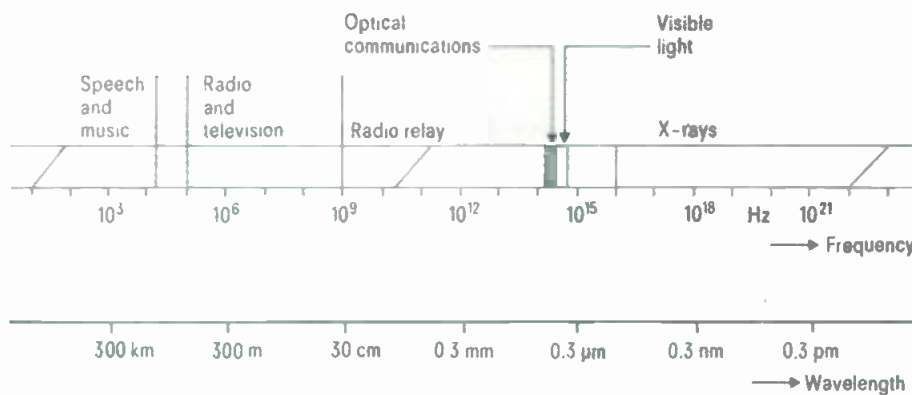
Another major element of fiber-optics technology is the rate at which information is transmitted, commonly known as the system bit rate. This element is primarily limited by the source and detector devices. Because the optical transmission is digital, bits of information are represented by either the presence or absence of a pulse of light.

To transmit more bits of information for a certain period of time, a source device must be able to turn on and off more often, and a detector at the other end of the system must be able to recognize it. The fiber medium itself is not the limiting factor here because it is essentially an optical pipe providing information transfer.

The earliest fiber-optics systems developed from 1977 to 1979 were limited to the transmission of about 6 million bits per second (Mbps). Advances in laser modulation have led to today's capability of more than 400Mbps.

### Related technologies

Optical fiber technology is also composed of a subtechnology related to



**Figure 2.** The electromagnetic spectrum, showing the bands used for optical communications.

## Making optical connections

Connecting an installed fiber-optic cable system requires new assembly methods. Optical connectors support and position fibers at cable ends to admit or deliver light to the user's equipment. Precise positioning of optically clear fiber end surfaces is the objective of connector installation.

Connector style may be dictated by chosen terminal equipment. Standardization of cables and connectors has not yet occurred, and so there are no generic end devices. SMA connectors made by several manufacturers provide some degree of interchangeability. It may be

necessary to acquire tools unique to a particular manufacturer's system. Connectorizing kit prices start at about \$400.

### Glue and polish connectors

These connectors are the workhorse of the industry and are produced by many manufacturers. The fiber is glued, usually by epoxy compounds, into a close fitting hole in a *ferrule*. The connector assembly usually provides for attachment to the main cable for strain relief.

After gluing, the connector is held in a polishing fixture for hand or machine polishing of the fiber and ferrule end surfaces. Training

for simple glue and polish connectors takes about one hour.

Typical glue and polish connectors cost from \$4 to \$25. Most attach by threaded nuts, although a few *snap on*. Bayonet-type attachments are also available.

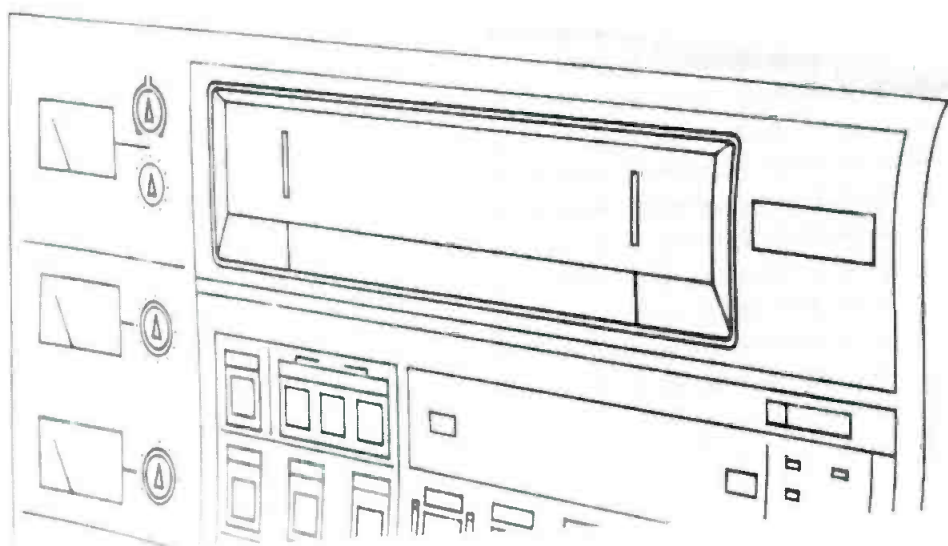
### Crimp and polish connectors

Epoxy glues can harden in 20 minutes to 24 hours. There are new connectors that eliminate epoxy glues. The fiber is grasped by compressing a close-fitting ferrule or a *tapered collet* around the fiber and then polished as normal.

Typical polishing procedures use coarse grinding to remove excess fiber and epoxy from the fer-



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**Crimp and cleave connectors**  
Crimp and cleave connectors eliminate polishing. After the fiber is fastened within the connector, a precision tool lightly scribes or scores the fiber at the ferrule surface. A controlled pull breaks the fiber flush with the ferrule surface.

### High efficiency connectors

Connectors that merely intercept light at fiber end surfaces do not have the best optical efficiency. Some light is reflected or scattered rather than transmitted. Light that falls outside the fiber core area is lost, while dirt and dust on the ends of the cable block light.

Optical efficiency may be improved by using *light-index match-*

This image shows two fiber optic cables with yellow protective sleeves and metal connectors. The cable on the left has a broken fiber tip, while the cable on the right has a sharp, intact fiber tip.

*Single-fiber loose-tube cables before insertion into a connector. The buffer coating seen on the larger fiber must be removed before installation.*

Fig. 1

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the splicing of fiber ends. Splicing fibers involves the proper alignment and bonding together of two fibers to provide a continuous optical path. In practice, this technique has undergone significant evolution. Array and bonded splicing have greatly enhanced the technical and economic feasibility of fiber-optics systems.

Device technology (sources and detectors) consists of subtechnologies primarily related to materials and fabrication techniques. This is similar to the work being done in other integrated circuit applications.

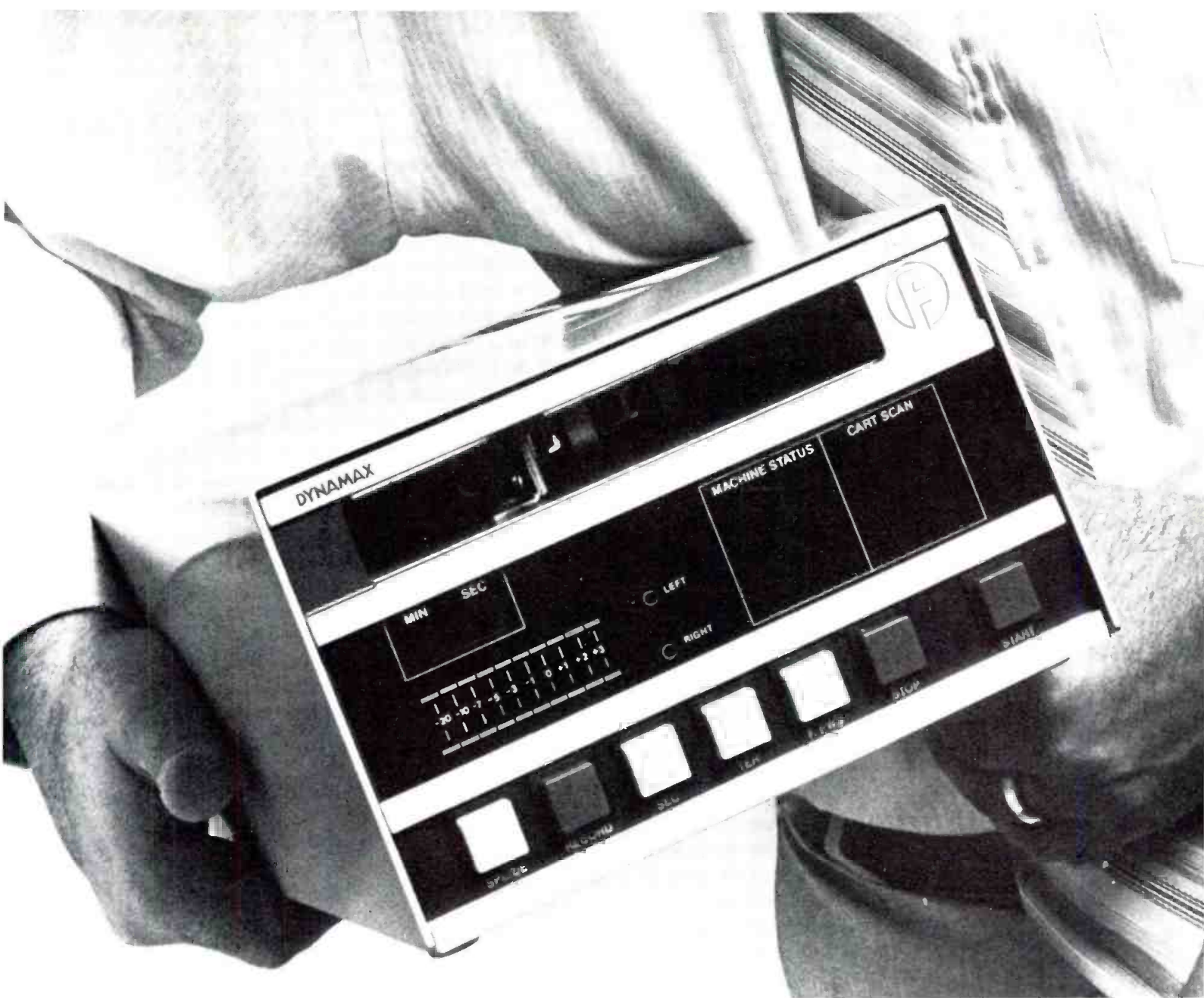
Sources typically consist of a laser or LED and supporting integrated circuits for control and electrical interface. Detectors consist of either a PINFET or ADP receiver and the necessary support circuitry. The primary limiting subtechnology within the devices category has historically been laser development.

The fiber-optics industry is expected to see rapid technological change for at least the next several years. New developments on the horizon and reduced systems costs will bring increased applications for radio and TV broadcasters.

Related articles were written by Stewart Cudworth, sales/service manager for the fiber-optic department of Belden, Geneva, IL.

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IMAGE FROM DUBNER COMPUTER



# Studio acoustics

By Eric Neil Angevine, P.E., broadcast acoustics consultant



Once upon a time, not so long ago, broadcast studios with good acoustics came about by accident.

Occasionally, the broadcaster or the architect had a Fairy Godmother who could turn pumpkins into studios and mice into engineers. But for the most part, studios with the best acoustics just happened.

Fortunately, in those days the typical construction materials lent themselves to good sound control. Unfortunately, many of those materials have been replaced in modern construction techniques by lighter, less expensive materials which do not work as well for acoustical control.

But it is no longer necessary to have a Fairy Godmother or to trust in luck in order to build a studio with good acoustics. Good acoustics can be designed into any broadcasting facility by paying attention to an acoustical consultant and following some simple rules.

## Basic points

Sound has two basic properties that can and will vary independently and continuously: amplitude (measured in dB) and frequency (measured in Hz). The human ear does not respond to all frequencies equally. A number of factors affect the amount of variation, including the age of the listener. Generally, human sensitivity to sound decreases steadily at frequencies below 100Hz and above 10kHz.

It is desirable throughout the realm of acoustics to relay information with single-figure metrics that encompass all frequencies. An almost endless list of single-figure rating systems have been created for sound level alone, and all of them suffer from the same fault: Information about what happens at different frequencies is lost.

One of the best and most common of the single-figure sound level metrics is the A-weighting curve. As shown in Figure 1, the A-weighting curve

weights against (reduces) low frequency sounds and high frequency sounds.

A sound level meter equipped with an A-weighting network will produce an indication similar to the ear's sensation of loudness for all frequencies. However, the meter cannot differentiate between a pure 1kHz tone at 80dB and a broadband spectrum sound at 80dB.

## Units of measurement

The decibel is a logarithmic unit defined as 10 times the logarithm of the ratio of sound intensity to a reference intensity. Sound intensity cannot be measured with a simple sound level meter. Intensity is proportional to the square of the sound pressure, which gives rise to the equation:

$$dB = 10 \log_{10} \frac{p^2}{p_{ref}^2} = 20 \log_{10} \frac{p}{p_{ref}}$$

where  $p$  is the sound pressure and  $p_{ref}$  is a reference pressure of  $20\mu Pa$ .

From the arbitrary selection of the reference pressure, 0dB occurs when the sound pressure is equal to  $20\mu Pa$ .

Because the decibel is logarithmic, we find that a doubling of sound power (intensity) produces only a 3dB increase in measured sound level. Unfortunately, the human ear does not respond to increases in amplitude in a purely logarithmic way. A doubling of loudness, as perceived by the listener, is typically equated to an increase of 10dB in measured sound level.

Perhaps the most important aspect that is overlooked when dealing with sound is its size. We tend to forget that sound waves have a physical size, because we cannot see them.

Sound travels at a fairly constant speed in air and it is, therefore, possible to compute the wavelength of sound at any frequency using the equation:

$$c = \lambda f$$

where  $c$  equals the speed of sound in air,  $\lambda$  the wavelength and  $f$  the frequency (Hz).

The speed of sound in air at room temperature is about 1125ft/s. This means that a sound with a frequency of 1125Hz has a wavelength of one foot. A sound with a frequency of 100Hz has a wavelength of 11¼ feet, and so forth.

Now, consider how sound is created by musical instruments. A stringed instrument, such as a guitar or violin, produces sounds only at frequencies that correspond to the diameter, length and tension of the string.

An organ pipe will produce sounds whose wavelength corresponds to the length of the pipe. (Actually, a pipe open at one end has a fundamental frequency whose quarter-wavelength is equal to the length of the pipe.) Similar phenomena occur in rooms.

## Resonances

Rooms have particular resonances at which sounds will be naturally sustained, corresponding to geometric properties of the room. The lowest resonant frequency will have a half wavelength equal to the largest room dimension. This causes few problems in large rooms, but will limit the resonances present in small rooms.

Rooms whose largest dimensions is about eight feet (typical ceiling height) cannot sustain sounds with wavelengths longer than 16 feet. This means that the lowest resonant frequency will be about 70Hz.

It is desirable to have a wide range of room resonances to sustain all sounds evenly. At high frequencies this is not a problem, because there will be many harmonics present. At low frequencies, however, only the fundamental frequencies associated with room dimensions may exist.

To maximize the number of low frequency room resonances, room dimensions should not be identical. Rooms with two or more identical dimensions, or dimensions that are even multiples of a common value, will sustain sounds whose wavelengths are related to this dimension more than other sounds. To avoid these repeated resonances, room dimensions should not be integer multiples of one another.

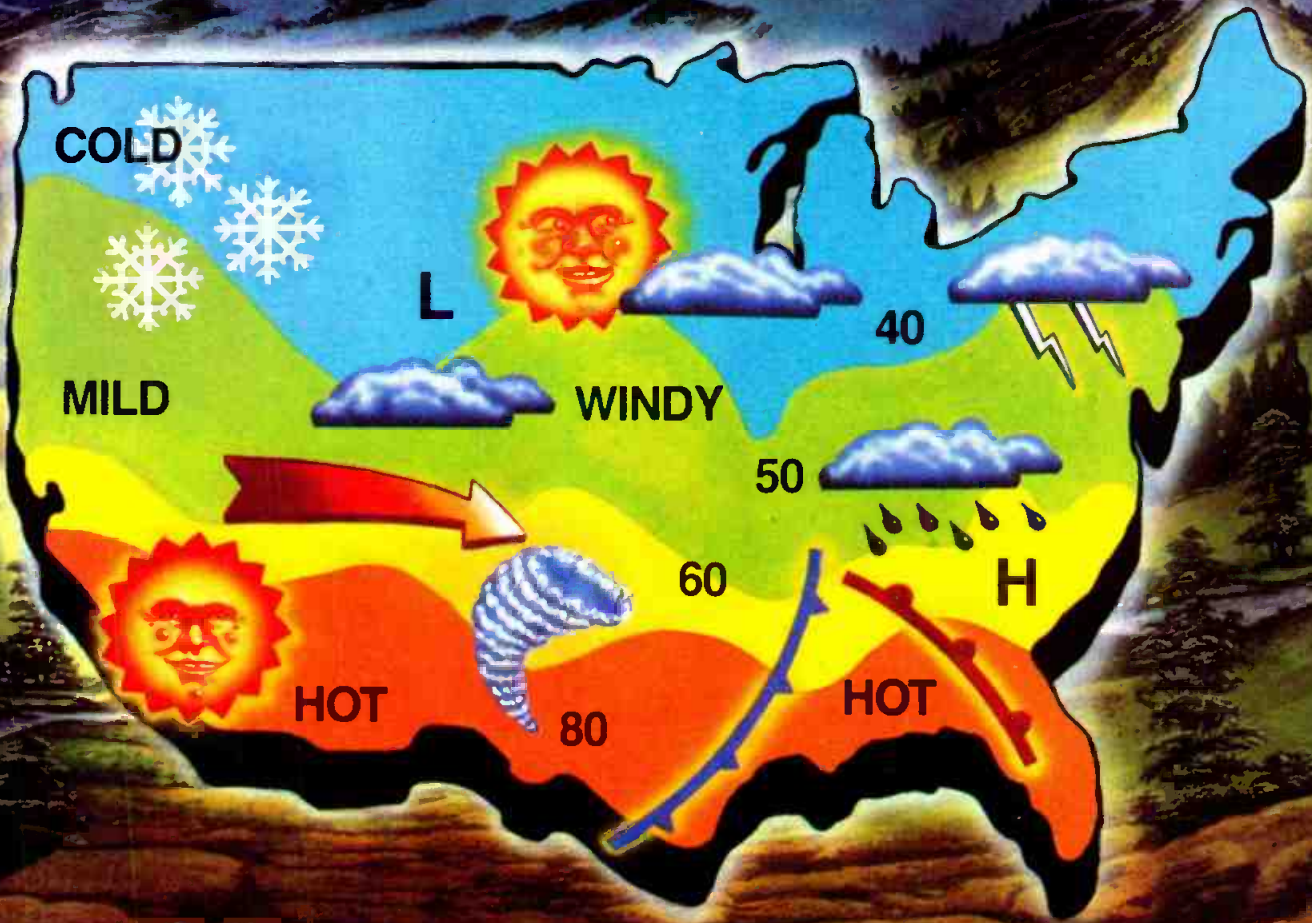
The ideal proportions for a room have been found to be the powers of the cube root of 2. These are 1:1.26:1.59. Just as good are proportions that include integer multiples of one or more of these values. For example, 1:2.52:1.59, or 1:1.26:3.18, or 1:2.52:3.18. Exact adherence to these ratios is not critical, but integer ratios (1:1, 1:2, 1:3) should be avoided.

Rooms with non-parallel walls can be used to increase the number of fundamental room resonances, because the major dimensions of the rooms are no longer constant. Trapezoidal rooms and rooms with five or six walls tend to have good acoustics.

However, rooms that are regular polygons and circular rooms have serious problems and should be avoided. Another technique for avoiding parallel walls is to slope the wall into the space or out of the space



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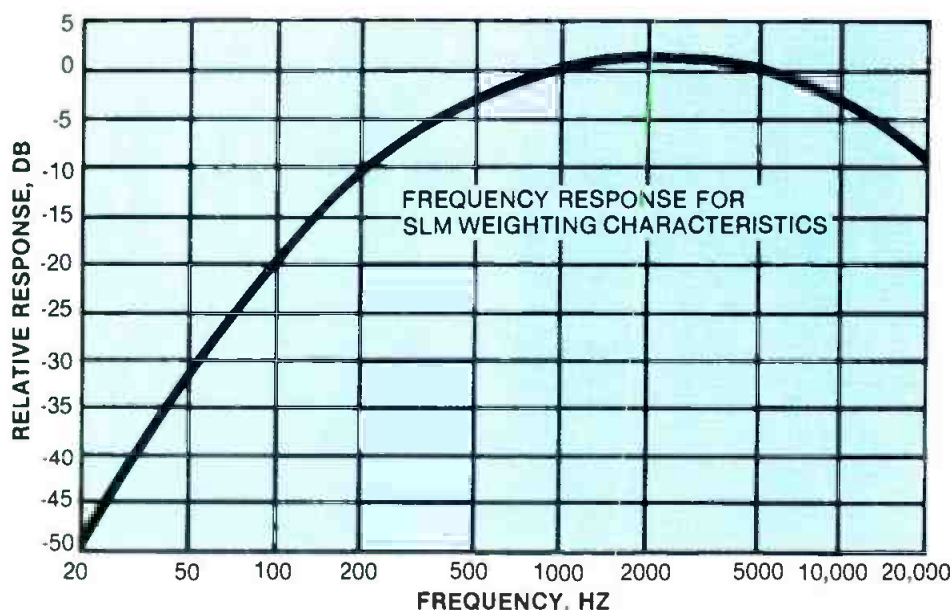


Figure 1. The A-weighting curve, commonly used to measure sound levels.

at the top. The construction of *out-of-plumb* walls is difficult, but only the interior surface has to be sloping.

#### Live or dead?

Historically, a basic rule of thumb was to make all broadcast studios as dead as possible by applying acoustic absorption material to all of the walls and the ceiling. Most of us have seen old studios with walls of peg board

over fiberglass or mineral wool batts.

In days gone by, dead studios were required for technical reasons, especially when boom microphones were used. It is important that the mic not pick up stray sounds, including those which may have been reflected off the walls or ceiling. Modern lavalier microphones prevent this problem, but the preference for dead studios over live ones still exists.

The technical reason for this preference is that most engineers prefer to use a clean, dry signal and add any desired reverberation electronically. This is particularly true of recording studios, which should be made as dead as money will allow. (An exception to this rule is the live end-dead end studio, which would require a separate article.)

A second, not so obvious reason to keep studios acoustically dead is that a broadcast or recorded signal will ultimately be received or played back in a space that has acoustical properties of its own. The reverberation of the listening space will add to the reverberation of the studio inherent in the signal.

#### Acoustical materials

Products that are acoustically absorptive are generally either fibrous, porous or both. Non-porous foams such as styrofoam and rigid urethane foams are not sound absorptive. Contrary to common thought, cork is not a highly absorptive material.

Some materials that appear hard can provide a fair amount of sound absorption. Unpainted concrete block will provide a moderate amount of sound absorption, but care must be taken to ensure that it is never painted. Painting will fill the pores in

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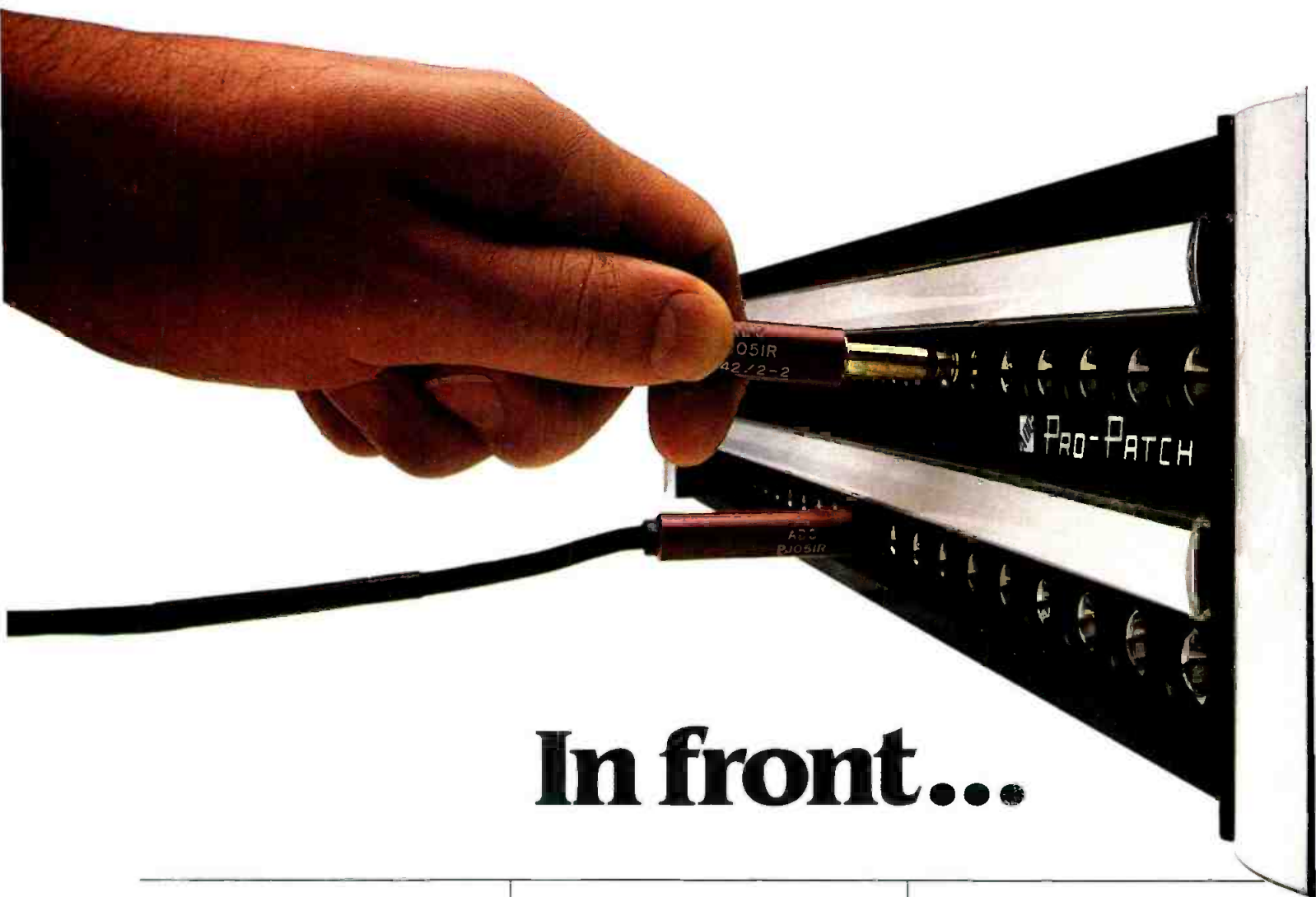
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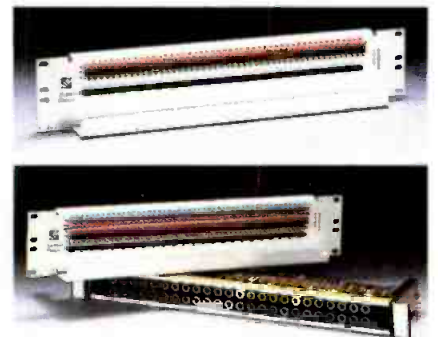


*Pro-Patch jackfields and Ultra-Patch panels cut installation time from hours to minutes and allow circuit or normalling configuration changes in seconds.*

almost as easy as plugging into the front. Just a push on a special hand tool bares a wire, locks it into a split-cylinder contact inside an insulated

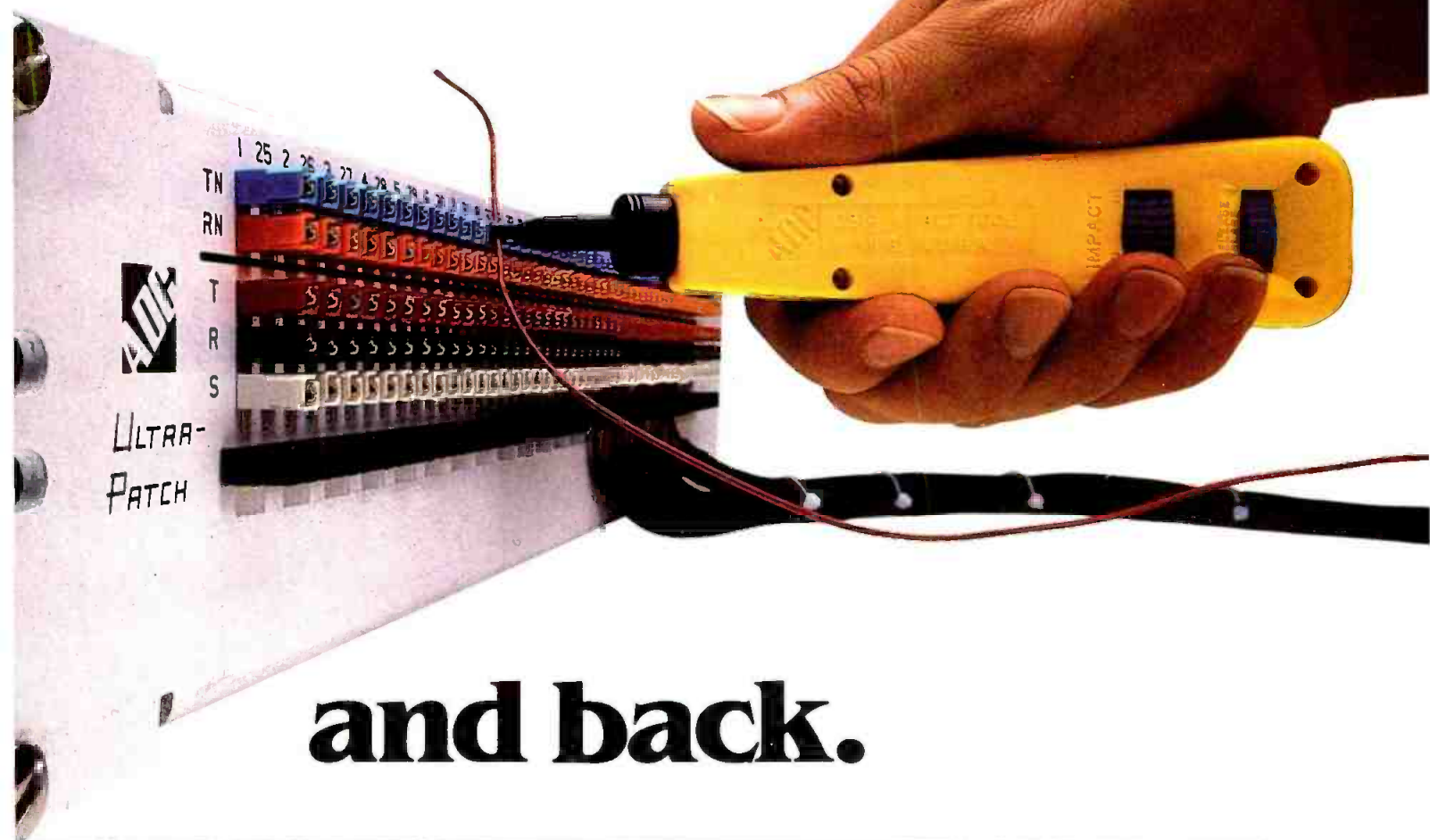
housing and trims off excess length.

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

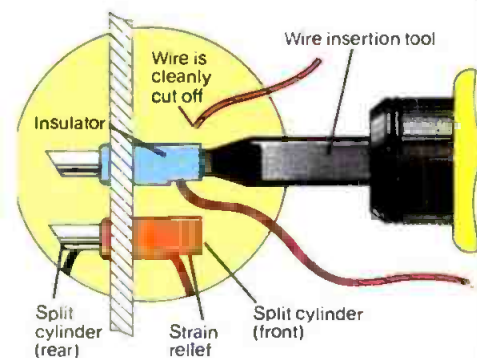




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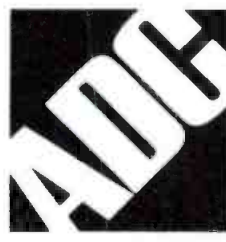
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## SOUND ABSORPTION COEFFICIENTS OF TYPICAL CEILING MATERIALS

Product	Type of mounting	Sound Absorption Coefficients						NRC
		125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	
¾-in. mineral fiber	cemented	.03	.27	.83	.99	.82	.71	.75
1-in. fiberglass	hard backing	.06	.25	.68	.97	.99	.91	.70
¾-in. mineral fiber	suspended	.68	.67	.65	.84	.87	.74	.75
1-in. fiberglass	suspended	.69	.95	.74	.98	.99	.99	.90

the block and destroy its acoustical properties.

All sound absorptive products are not created equal. Sound absorption is a volume phenomenon, and a construction element must have a certain amount of thickness to be an effective sound absorber. Thick materials tend to be more absorptive than thin ones. It is usually possible to improve the sound absorption coefficients of a material by making it thicker. Thin wall coverings are never highly sound absorptive, no matter how soft they look or feel.

Similarly, carpet is usually not an effective product for good sound ab-

**Table 1.** The sound absorption coefficients and Noise Reduction Coefficient (NRC) of two common types of ceiling materials mounted using various methods.

sorption. Although almost any carpet will afford more sound absorption than a hard wall or floor, it does not have the high sound absorption coefficients that good wall panels have.

Carpet should be used on studio floors. Not only will it provide more sound absorption than tile, wood or painted concrete, but it will also reduce the sound of footsteps. Thick carpet, used over a good pad, can be a

significant source of absorption.

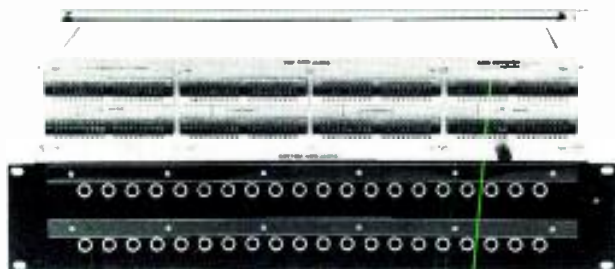
Rough surfaces are not necessarily more absorptive than smooth ones. Contoured open-cell foams are available, which do not offer significantly more sound absorption than flat foams of equal thickness. The depth of any irregularities must be similar in size to a quarter wavelength of the sound to improve the material's acoustic properties. Even 3-inch irregularities will be effective only at frequencies above 1100Hz.

### Noise reduction coefficient

It should come as no surprise that the sound absorption of any product varies with frequency. Most products are more absorptive at high frequencies than at low ones. The sound absorption of a product is measured in six octave bands with center frequencies from 125Hz to 4kHz. The resulting sound absorption coefficients are decimal ratios indicating the proportion of incident sound that is absorbed in each octave band.

Because most people want a single-figure representation of a product's sound absorptive properties, the noise reduction coefficient (NRC) was created. The NRC is the average of the sound absorption coefficients for the 250, 500, 1000, and 2000Hz octave bands, rounded off to the nearest 0.05.

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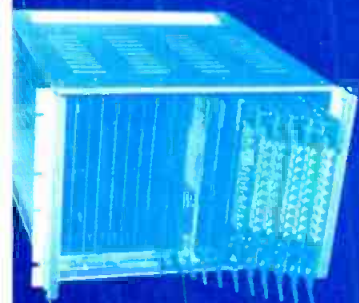


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Table 1 shows the sound absorption coefficients for two typical acoustic ceiling products in different mounting configurations. Observe that the mineral fiber panel has the same NRC for each mounting configuration, although the individual sound absorption coefficients are significantly different. Despite this drawback, the NRC is a fair indicator of a product's average sound absorptive properties.

Because low-frequency sounds have long wavelengths, it is more difficult to absorb them using a relatively thin product. It is possible to increase the low-frequency absorption of almost any product by providing an airspace behind it. Observe the dramatic increase in low-frequency absorption of the two products listed in Table 1 when they are suspended, rather than applied over a hard backing.

Low-frequency absorption can be increased in wall constructions if an airspace is provided behind the absorptive material. Furred or splayed wall treatments will provide better low-frequency absorption than the same treatments applied directly to the wall. The greater the depth of the contained airspace, the greater the increase in low-frequency absorption. A low-frequency absorber (bass trap) can even be constructed by enclosing an airspace with a thin panel of wood.

High-frequency absorption may be reduced by the application of even a thin film facing. This is seldom a problem, however, as most materials are more absorptive at high frequencies. This principal can be used to help balance the sound absorption at all frequencies, while making a product which is more easily cleaned.

Keep in mind that sound which is not absorbed is reflected back into the space. A material that has a sound absorption coefficient of .60 is both 60% absorptive and 40% reflective. This helps explain why a carpet with an NRC of .35, while more absorptive than a plaster wall whose NRC is .05, is not a particularly good wall treatment if high sound absorption is desired.

The amount of sound absorption provided by any treatment is approximately equal to the product of the NRC of the material and the area of treatment. For example, the ceiling of 10' x 12' room with the suspended fiberglass ceiling tile shown in Table 1 would provide approximately 108 sabins of absorption ( $10 \times 12 \times .9 = 108$ ). A sabin is the unit of absorption and is equal to one square foot of 100% absorption.

Although this procedure is fairly accurate and is good for comparing different methods of adding absorption to a space, remember that the information regarding sound absorption at various frequencies was lost in the

derivation of the NRC. Before making a final selection, review the sound test data to be sure that the product will provide adequate sound absorption at all frequencies.

Fiberglass and open-cell foam tend to be more absorptive than mineral fiber products. They also may be more expensive. However, a quick comparison may show that the more expensive product supplies more absorption for your money.



The master control room of WKBW radio in Buffalo, NY. The room shape is an irregular pentagon with extensive acoustic absorption material applied to all surfaces.

### Applying the concepts

Every studio space requires an acoustic ceiling. As mentioned previously, suspended ceilings are usually preferred to ceilings applied over a hard backing. Keep in mind that a suspended acoustic ceiling will not provide a good sound barrier, and a solid ceiling may be required above it if the walls do not extend to the underside of the floor or roof deck above.

In addition to ceiling treatment, some absorptive wall treatments are also required. The amount of wall treatment necessary is a function of both the use of the space and the size of the space. Large television studios should have at least 20% of the wall area treated with a construction having an NRC of .70 or more.

A larger quantity of a material with a lower NRC can also be used. If the walls are constructed of unpainted concrete masonry, no other wall treatment is necessary.

Wall treatment should be distributed fairly evenly around the room, but should not be used where it will be

shielded by furnishings or scenery. Note that absorption may be placed behind thin curtains, but will be ineffective if located behind a hard cyclorama.

In rooms where it becomes impossible to apply treatment to all of the walls, it is always better to treat two adjacent walls than two opposing walls.

Although unfaced fiberglass may be used as acoustic treatment, it is usually desirable to apply a facing for mechanical protection and to prevent the shedding of loose fibers. Where the risk of physical damage is slight, an open-weave fabric may provide this facing.

For more substantial protection from damage, wood battens, grilles and perforated metal can be used. The common practice of using peg board as a facing is not recommended, because it tends to concentrate the absorption at a particular frequency.

Smaller spaces require proportionately more wall treatment. This is because the ceiling of a small room is a smaller fraction of the total surface area. Small news booths and announce booths should have maximum treatment. Absorptive materials should be applied to all available surfaces.

After subtracting the area of doors, windows and areas shielded by furnishings, this is seldom more than one-half the wall area. Because furring or splaying of wall treatment is seldom possible, it is important to use a suspended ceiling to provide the needed low-frequency absorption.

Recording studios should have maximum treatment of all exposed wall areas. As discussed, most engineers would prefer to add any needed reverberation electronically. The minimum treatment would be furred or splayed absorption on two adjacent walls, but some treatment of the remaining walls is also recommended. For flexibility, some absorptive panels can be removable to increase reverberation for special circumstances.

Radio studios used mostly for recorded program material need only a full acoustic ceiling, but some treatment of the walls is still recommended. On-air studios and production studios should be treated the same as recording studios.

### Preventing disasters

Strict adherence to these guidelines will not guarantee the construction of an ideal studio. Any new studio design or major renovation should be reviewed by a competent acoustical consultant to prevent an acoustical disaster. The cost of the consultant's fee may be but a small fraction of the cost of correcting a problem.

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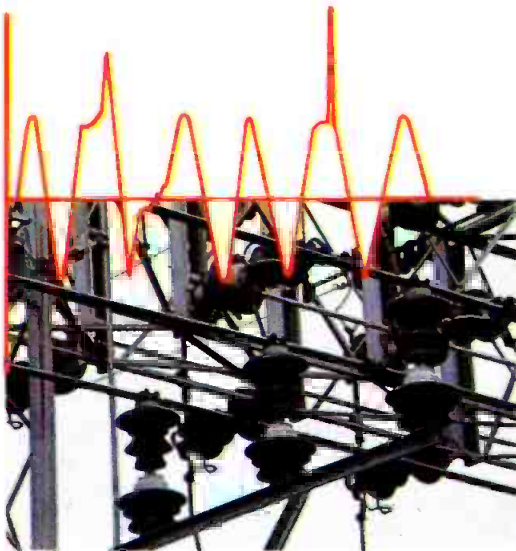
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# The effects of ac line disturbances

Part 6

Our series concludes with an examination of the importance of proper grounding.

By Jerry Whitaker, editor

An important component in transient protection for any broadcast plant is a well-planned, heavy-duty ground system. Discrete spike protectors placed at various points in a system are of little use if the ground to which they are connected has a high resistance to earth, or is inadequate to carry the expected transient-suppression current.

## Ground system considerations

The use of multiple ground rods is probably the most popular method of lowering the resistance to earth of a facility ground system. Rods, generally eight feet in length and  $\frac{3}{8}$ -inch in diameter, are driven into the earth about eight feet apart.

Recent research has shown that greater spacing, such as 20 feet, may be more effective. You should be careful, however, if you plan substantial spacing of ground rods because of increased resistance (and voltage drop) that may occur in the ground system interconnecting cables during high-surge currents.

Alternatives to the ground rod include radials buried in the earth in a manner similar to—but simpler than—an AM antenna ground system. Such measures are generally only taken in areas that experience heavy lightning.

Studies have shown that, in many instances, installation of long ground rods (75 meters in length) results in an extremely low resistance to earth. Obvious installation problems are present with this grounding method and an on-site study of the soil structure is recommended before you attempt such a project.

To improve the effectiveness of a ground system in poor soils, the area around the ground rods can be treated with sodium chloride, calcium chloride or sodium nitrate. This not only lowers the soil resistivity, but also effectively increases the ground rod (or radial) diameter. Such salting is rarely used in broadcast applications, however, because it must be repeated from time to time and tends to eat away the ground conductor.

## An example

Figure 1 shows a recommended grounding arrangement for a typical broadcast facility. Construct the building ground system using heavy gauge copper wire (No. 4 or larger) if the studio is not located in an RF field, or a wide copper ground strap (3-inch minimum) if the facility is near an RF energy source.

Run the strap or cable from the out-

side ground system to a main station ground point. Branch out from the main ground point to each major piece of equipment and to the various studio/equipment rooms. Establish a local ground point in each room or group of racks, as shown in Figure 2. Use a separate ground cable for each piece of equipment (No. 14 gauge or larger).

The ac line ground connection for a particular piece of equipment can often present a built-in problem. If the equipment is grounded through the chassis to the equipment room ground point, once it is plugged in (if it has a 3-prong plug) a ground loop will be created.

One solution to this problem is to use a ground adapter plug (3-to-2 prong) and separately ground the equipment—with a wire that is at least as heavy as the cable used for the ac power cord—to the ground point of

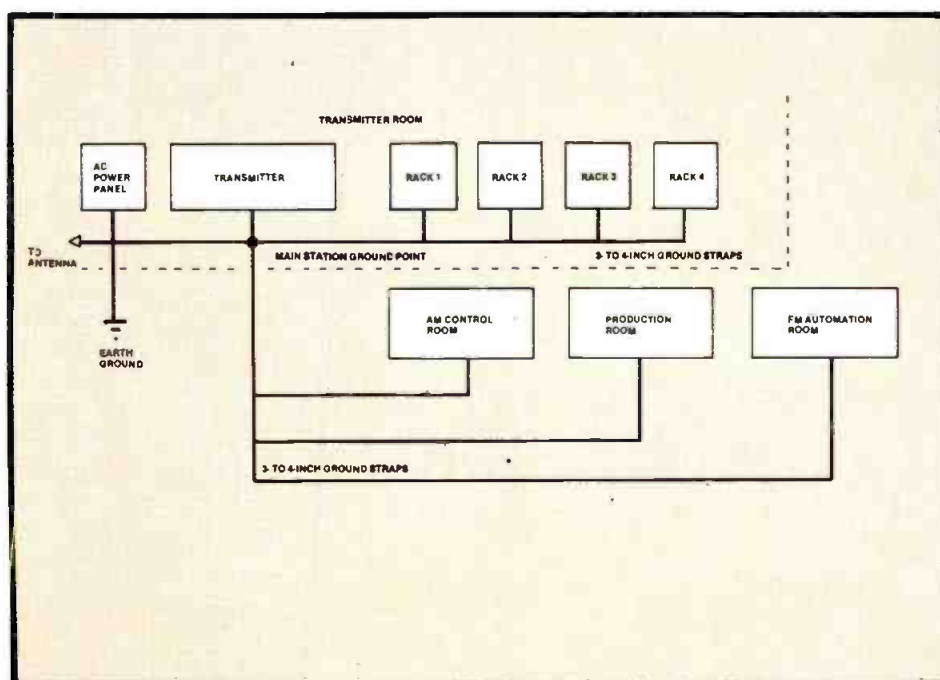


Figure 1. A typical grounding arrangement for a broadcast facility with a local transmitter. The *main station ground point* is the reference from which all grounding is done at the facility.





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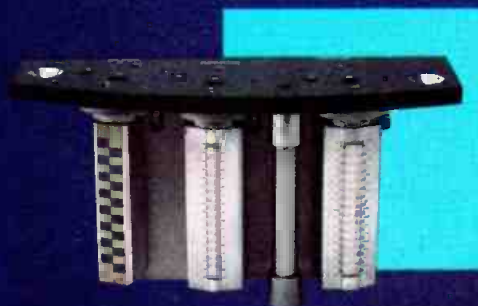
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the room. The main station ground point is then tied to the green wire ground connection at the ac distribution panel using a heavy gauge wire.

Care should be taken to ensure that a fault condition in a piece of equipment does not cause ac current to flow through the ground system at any time. An electrical contractor should be consulted before any work on a facility's power system is attempted. Local building codes specify permissible grounding arrangements for commercial structures.

#### Power center grounding

A comprehensive solution to ac power distribution and ground noise problems can be found with dedicated power distribution systems designed for use in computer room installations. This equipment is available from several manufacturers, with various options and features. A computer power distribution center generally includes an isolation transformer designed for noise suppression, distribution circuit breakers, power supply cables and a status monitoring unit. The system's concept is shown in Figure 3.

Input power is fed to an isolation transformer with primary or secondary taps to match the ac voltage required at the installation. A bank of circuit breakers is included in the chassis, and individual preassembled and terminated cables supply ac power to the various loads. A status monitoring circuit signals the operator if any condition is detected outside normal parameters.

The facility ground system is an important component in the computer center power distribution unit. A unified approach, designed to prevent noise or circulating currents, is taken to the ground system arrangement for the entire plant. This results in a clean ground connection for all of the equipment on line.

The use of a power distribution unit can eliminate the high costs and inconvenience associated with rigid conduit installations. Distribution systems are also expandable to meet future facility growth. If the plant is ever relocated, the power center can move with it.

#### Noise currents

Two basic types of noise can appear on ac power lines within a facility, and each has a particular effect on sensitive load equipment. The normal mode ac voltage is the potential difference that exists between pairs of power (or signal) conductors. This normal mode voltage is also referred to as the transverse mode voltage.

By contrast, the common mode voltage is a potential difference (usual-

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March 1985 **Broadcast Engineering** 103



ly noise) which appears between the power (or signal) conductors and the local ground reference (Figure 4).

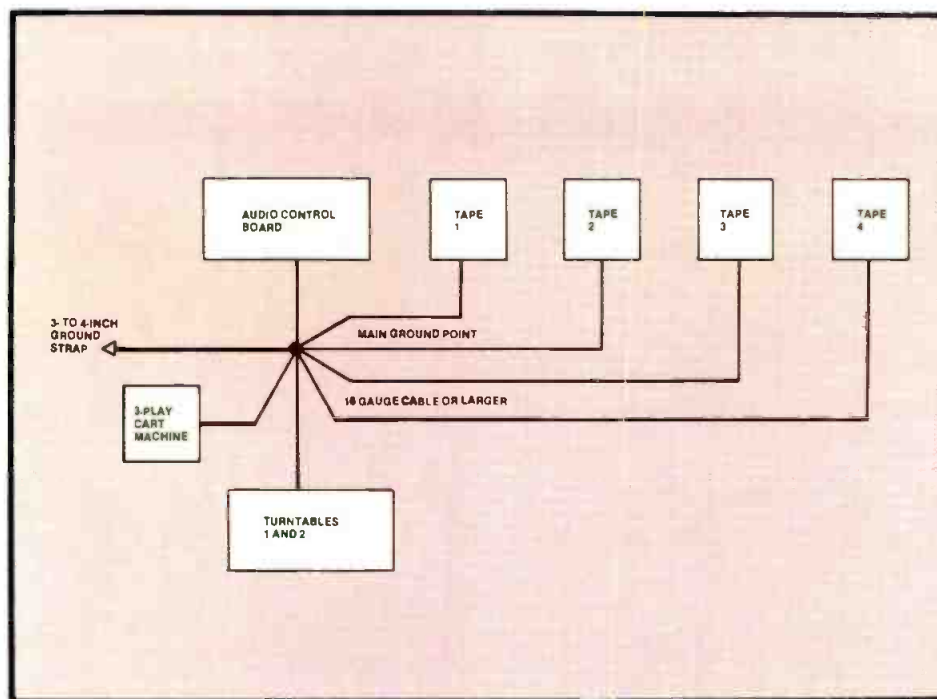
The common mode noise voltage will change depending upon what is used as the ground reference point. It is often possible to select a ground reference that has a minimum common mode voltage with respect to the circuit of interest, particularly if the

reference point and the load equipment are connected by a very short conductor. Common mode noise can be caused by electrostatic or electromagnetic induction.

In practice, a single common mode or normal mode noise voltage is rarely found. More often than not, load equipment will see both common mode and normal mode noise signals.

In fact, unless the power wiring system is unusually well-balanced, the noise signal of one mode will convert some of its energy to the other mode.

Momentary impulse voltage differences between parts of a distribution system that have differing ground potential references are a typical source of common mode and normal mode noise. If the different sections of a system are interconnected by a signal path in which one or more of the conductors are grounded at each end, the ground offset voltage can create a current in the grounded signal conductor. If noise voltages of sufficient potential occur on signal-carrying lines, normal equipment operations can be disrupted (Figure 5).



#### Protecting transmission equipment

Primary lightning protection for broadcast towers is generally provided by a lightning rod mounted at the top of the tower (for FM or TV stations) or by a spark gap at the base of an ungrounded tower (for most AM installations).

Figure 2. A typical grounding arrangement for an individual equipment room at a broadcast facility. The main ground line from the station ground point establishes a *local ground point* in the room, to which all source and control equipment is bonded.

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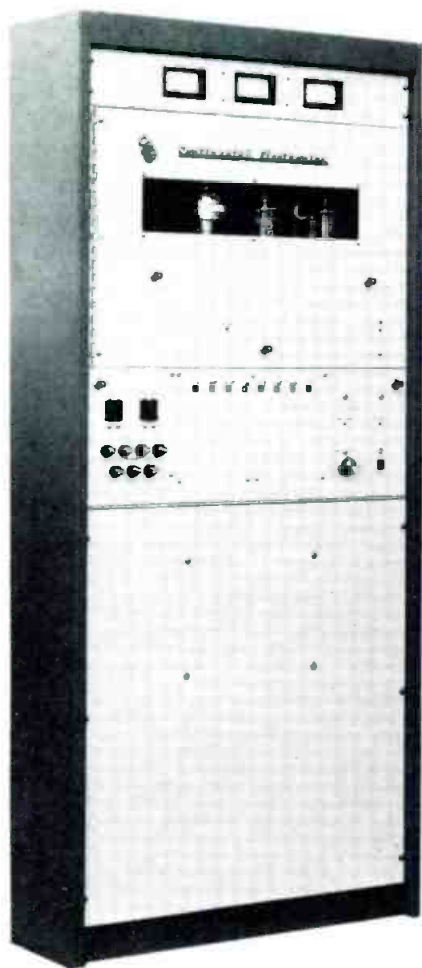
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The grounded tower system provides the best protection against lightning damage, if proper measures are taken to insure a low resistance ground. Drive several ground rods into the earth at equal spacing from the tower base to form a circle and connect the rods to the structure with a heavy gauge wire (such as No. 2/0). Ground all guy wires with at least one ground rod at each guy anchor point.

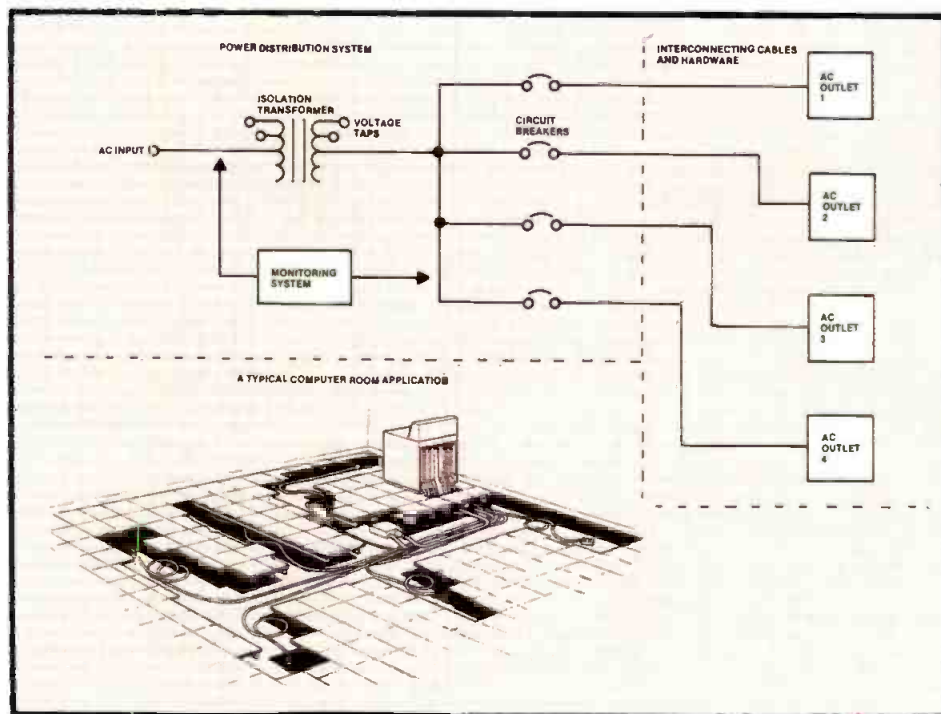
A well-grounded tower with a lightning rod attached does not guarantee that lightning strikes will not generate potentially damaging voltages. Long runs of coax (transmis-

sion line) and exposed antenna elements can suffer damage, or carry damaging voltages back into the transmitter building.

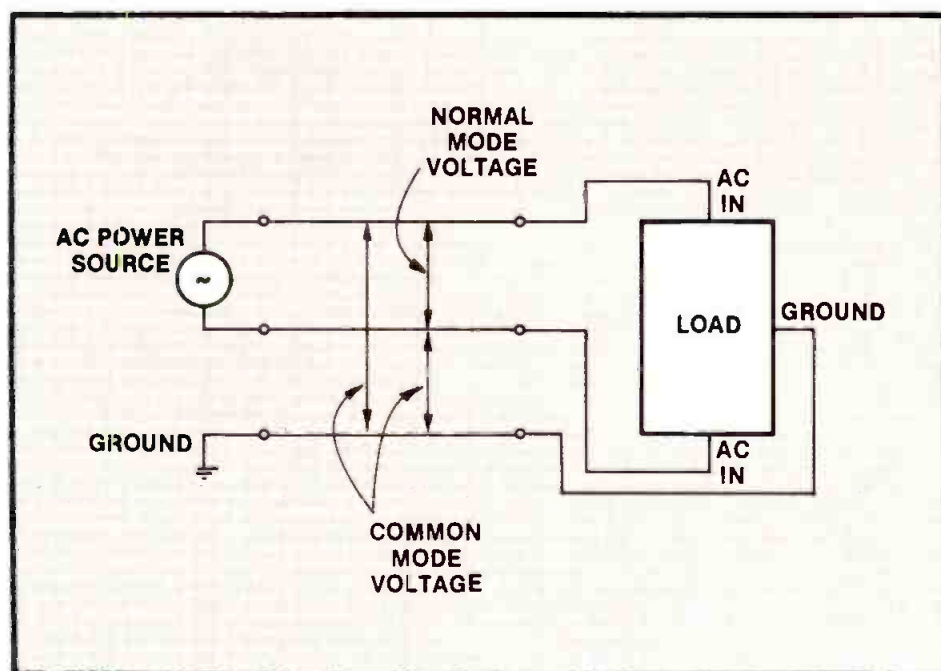
These voltages can be caused by a direct strike or by induction from the radiated field generated by a nearby strike. If lightning hits a tower, the structure itself becomes part of the discharge path and an efficient vertical radiator of the lightning frequency field.

### AM tower protection

Standard lightning protection for an ungrounded (series fed) AM tower is



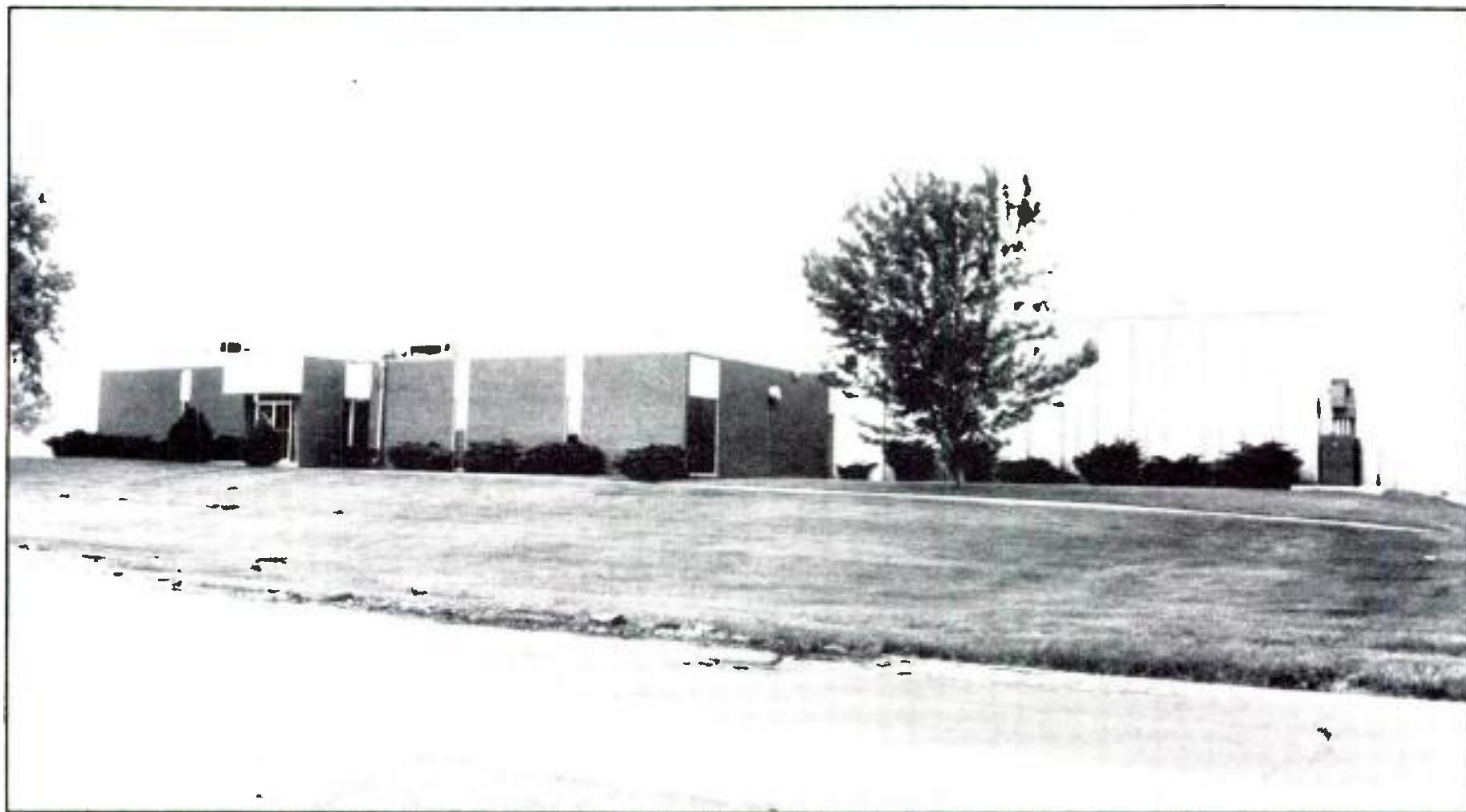
**Figure 3.** The basic circuit design of a computer room power distribution system. Both single- and multiphase configurations are available. When ordering a distribution unit, the customer can specify cable lengths and terminations, making installation quick and easy.



**Figure 4.** The principles of *normal mode* and *common mode* noise voltages, as they apply to ac power circuits.



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But, Television Technology Corporation is also a RADIO equipment company. Our Wilkinson Radio Division offers a complete line of FM Transmitters from 10 watts to 60 kilowatts, including the FM-3500J, 3.5 kilowatt FM transmitter, the first of a complete line of transmitters we think will change a lot of ideas about what's important in a broadcast transmitter. Wilkinson also offers simple, reliable AM Transmitters from 125 watts to 100 kilowatts.

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Max. Relative Aperture: 1:1.7 through 116mm

1:2.4 at 162mm



**J13x9BIE** for 2/3" cameras.  
The Portable Standard—used by cameramen around the world under all conditions, the J13x9BIE is a proven performer with superior sharpness and sensitivity.

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1:1.9 at 118mm



**J15x9.5** for 2/3" cameras.  
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1:2.3 at 143mm

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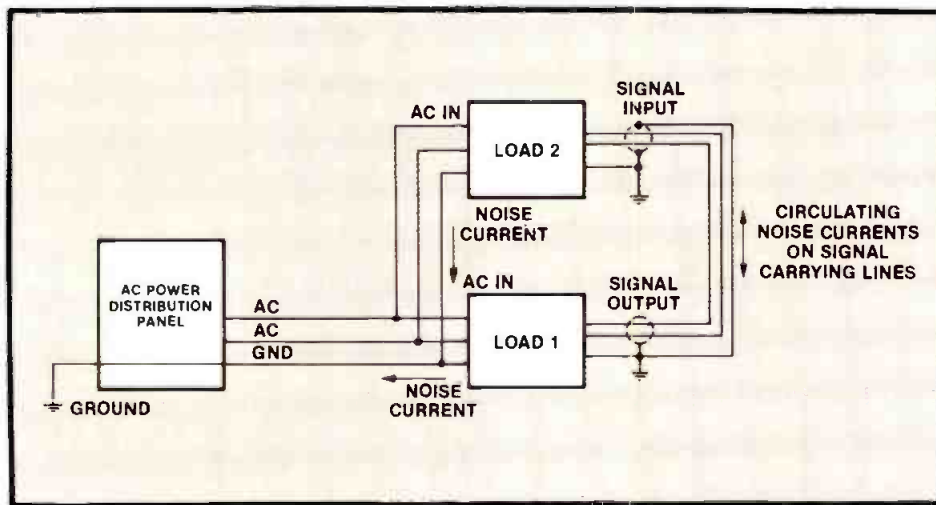


Figure 5. How noise currents can circulate within a system because of the interconnection of various sections of hardware.

not nearly so effective as provisions for a grounded tower. The protection used generally takes the form of a spark gap at the base of the tower and a loop or two in the feed line from the antenna tuning unit (ATU) to the tower. This loop is designed to retard the advance of lightning energy from the tower base into the ATU, until the spark gap has had time to fire.

Set the spark gap on a foggy or misty

night with the transmitter operating at full power and full modulation. Advance the gap far enough to just begin arcover. Then back it off slightly and secure the assembly.

Bond all guy wires of an AM tower to individual ground rods. Also, consider installing guy wire insulator chokes on all of the guys. The chokes will allow static charges on the tower to be safely dissipated.

Series fed towers using insulated guy cables often require a static drain choke at the base of the tower to remove charge buildup caused by lightning and other atmospheric conditions. The static drain choke is designed to be essentially invisible to the AM RF signal.

Figure 6 shows an effective method to protect an AM antenna from EMP radiation and to increase the amount of lightning protection at the same time. A gas-filled spark gap device is placed in parallel with the ATU vacuum capacitor, C-1. The gas-gap will function to protect both C-1 and the matching coil, as well as the transmission line and the transmitter.

Connection of the device typically adds about 1pF to the value of C-1. A gas-gap is not a substitute for lightning ball gaps, but will provide additional protection to the system from lightning and EMP because of the device's fast firing time.

## Analyzing the risk

The susceptibility of electronic equipment to failure because of disturbances on the ac power line was analyzed in a far-reaching study conducted between 1968 and 1978 by Lt. Thomas Key of the Naval Facilities Engineering Command, Washington, DC.

The work identified three

distinct categories of recurring disturbances on the utility company power system. In Table 1, note that the duration of the disturbance, not the magnitude of the voltage, determines the classification.

The study found that most com-

*Continued on page 112*

DEFINITION	TYPE 1 Transient and oscillatory overvoltage	TYPE 2 Momentary undervoltage or overvoltage	TYPE 3 Power outage
CAUSES	Lightning, power network switching, operation of other loads	Power system faults, large load changes, utility company equipment malfunctions	Power system faults, unacceptable load changes, utility equipment malfunctions
THRESHOLD*	200 to 400% of rated RMS voltage or higher (peak instantaneous above or below rated RMS)	Below 80-85% and above 110% of rated RMS voltage	Below 80-85% of rated RMS voltage
DURATION	Spikes 0.5 to 200 $\mu$ s wide and oscillatory up to 16.7ms at frequencies of 200Hz-5kHz and higher	From 4 to 60 cycles depending on type of power system distribution equipment	From 2 to 60 seconds if correction is automatic; from 15 minutes to 4 hours if manual

\*The approximate limits beyond which the disturbance is considered to be harmful to the load equipment.



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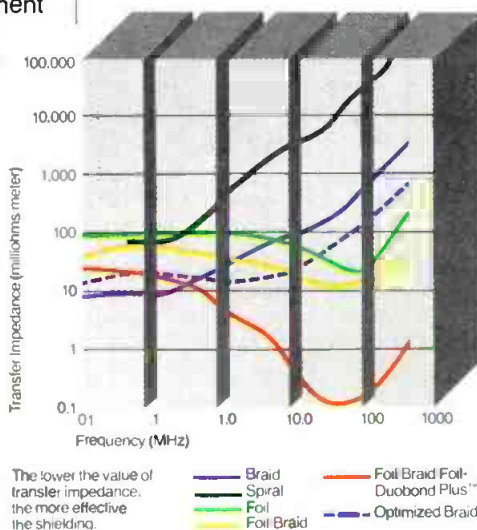
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### Test Methods Protect Your System

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The gas-gap should have a rating well above the normal operating voltages present at the point of connection (three times is common). The rating must also, however, be below the maximum working voltage of C-1 to protect the capacitor.

In order to prevent power follow-on, wind a short piece of 5mil tungsten wire (about six inches) into ¼-inch diameter, 2-inch long coil and place it between the gas-gap and ground. This wire provides enough current limiting to make the action of the device self-extinguishing. The wire also serves as a fuse to protect the transmitter in the event of a gas-gap failure.

Contact an experienced consultant before trying to implement a protec-

### Continued from page 110

puter failures caused by ac line disturbances occurred during periods of bad weather. In fact, according to a report on the findings of the study, the Incidence of thunderstorms in a given area may be used in predicting future equipment failures.<sup>1</sup>

The type of power transmission system used by the utility company was also found to have an effect on the number of disturbances observed on power company lines. For example, an analysis of utility system problems in Washington, DC, Norfolk, VA, and Charleston, SC, showed that underground power distribution systems experienced only a third as many failures as overhead lines in the same area.

The amount of money a broadcaster is willing to spend on protection against utility company failures is generally a function of how much money is available in the engineering budget and how much the station has to lose. Spending \$25,000 for system-wide protection for a major-market station, where spot rates can run into the hundreds or thousands of dollars, is easily justifiable.

At small- or medium-market stations, however, cost justification is not so easy.

Tables 2 and 3 show the various options available to station engineers to protect sensitive broadcast equipment from disturbances on the ac line, and the approximate costs of the protection. Because each installation is unique, an investigation of the station's needs should be made before it buys equipment.

### Bibliography

1. Key, Lt. Thomas. "The Effects of Power Disturbances on Computer Operation." Conference paper, IEEE Industrial and Commercial Power Systems, Cincinnati, OH, June 7, 1978.

Continued on page 114



# Comark's "S" Series UHF Television Transmitters

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Stereo-Ready



10kW/30kW/60kW model shown

Integrating low initial and operating costs, high efficiency and reliability, each "S" Series model incorporates state-of-the-art technologies to achieve a unique combination of unparalleled features:

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Comark's "S" Series transmitters are available in power ranges from 10kW through 240kW with advanced system features, including effective klystron beam current pulsers, motorized and Magic Tee RF switching systems and the services of Comark's 24-hour field operations group.

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tion scheme using a gas-gap device at the ATU. Selecting the wrong type of device or standoff voltage rating could result in serious operating problems for the transmission system.

#### Non-radiating tower protection

Protection of antenna equipment mounted on a grounded FM or TV tower generally follows the guidelines shown in Figure 7. The antenna is bonded to the tower and the transmission line is bonded to the structure at the point it leaves the tower and begins the horizontal run into the transmitter building.

Before entering the building, the line is bonded to a ground rod,

through a connecting cable. The transmitter itself is grounded to the ac power distribution system ground, which is bonded to a ground rod (or rods) where the utility feed enters the building. The design goal of this arrangement is to strip all incoming lines of any damaging transient over-voltages before they enter the facility.

One or more lightning rods are usually mounted at the top of the tower structure. The rods should extend at least 10 feet above the highest part of the antenna assembly.

#### The lightning hazard

The threat of a lightning strike to a facility is a function of several factors

associated with the particular installation. These factors include the geographical location, type and character of the facility, plant size and character of the lightning strike.

The Keraunic number of a geographic location expresses the threat of lightning in a given area. Figure 8 shows the Isokeraunic map of the United States, which estimates the number of lightning days per year in various areas of the country. There is an average of 30 storm days per year. This figure does not fully describe the lightning threat, however, because many individual lightning strikes occur within a single storm.

The structural character of a par-

Type of disturbance	UPS system and standby generator	UPS system	Secondary spot network <sup>1</sup>	Secondary selective network <sup>2</sup>	Motor-generator	Shielded isolation XFMR	Suppressors, filters, lightning arrestors	Solid-state line-voltage regulator
1	All source transients	All source transients	None	None	All source transients	Most source transients	Most transients	Most source transients
	No load transients	No load transients			No load transients	No load transients		No load transients
2	All	All	None	Most	Most	None	None	Some depending on response time of system
3	All	All outages shorter than battery supply discharge time	Most	Most	Only brown-outs	None	None	Only brown-outs

NOTES:  
 1. Dual power feeder network.  
 2. A dual power feeder network using a solid-state switch to select which line is fed to the load.

Basis of comparison <sup>1</sup>	UPS system and standby generator	UPS system	Dual power feeders	Motor-generator	Shielded isolation XFMR	Suppressors, filters, Lightning arrestors	Solid-state line-voltage regulator
Installation and equipment costs	\$1500 to \$2000 per kVA	\$1100 to \$1500 per kVA	Installation cost will vary greatly depending on site	\$250 to \$400 per kVA	\$50 to \$150 per kVA	\$1 to \$10 per kVA	\$250 to \$280 per kVA
Maintenance costs	\$2000 to \$4000 per year	\$1100 to \$3000 per year	None	Less than \$1000 per year	None	None	Less than \$1000 per year
Operating efficiency <sup>2</sup>	80-85%	80-85%	100%	80-90%	Up to 98%	100%	90-98%

NOTES:  
 1. A power conditioning system rated for approximately 25kVA is assumed.  
 2. Efficiency applies to the ac power conditioning equipment only. Losses in environment support systems are not taken into account.



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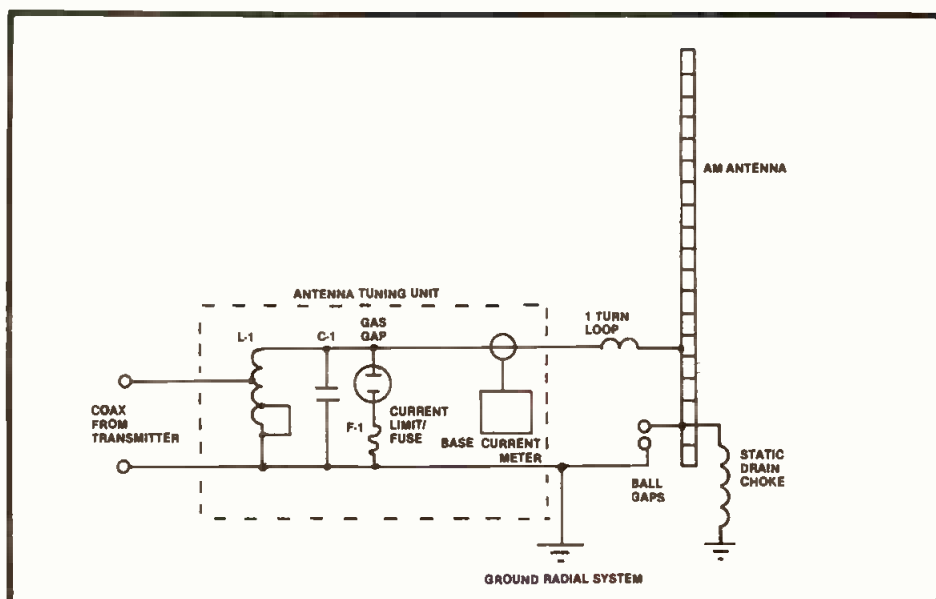
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March 1985 **Broadcast Engineering** 115

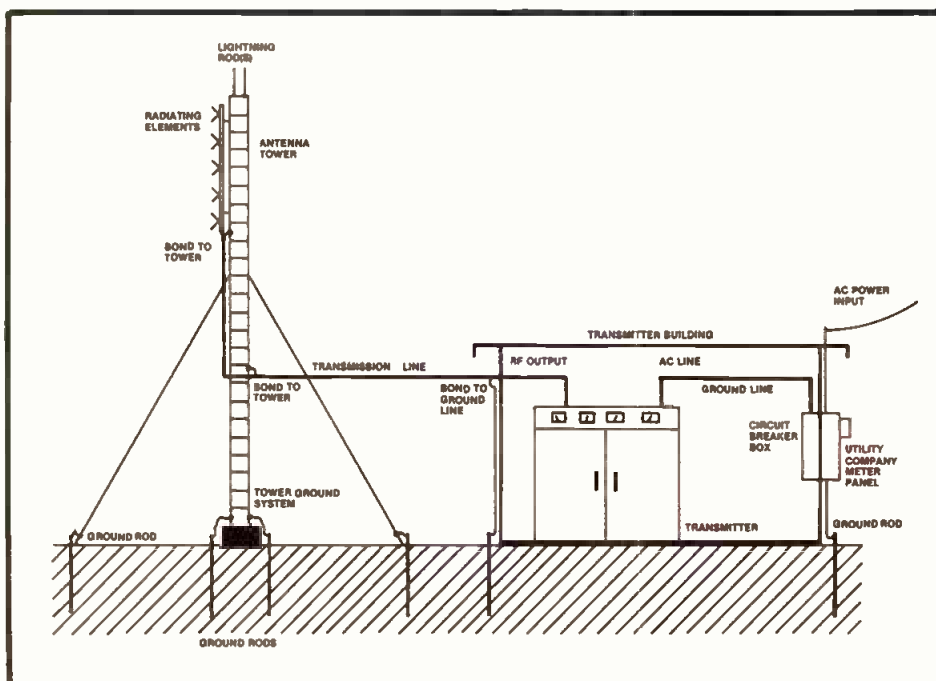




**Figure 6.** Lightning and EMP protection for an ungrounded AM broadcast tower. The current limiting coil (F-1) is designed to prevent power follow-on problems after the gas-gap has fired. The addition of the coil allows the device to recover from an active state without removing RF power.

**Figure 7.** Proper grounding procedures for a transmission facility using a grounded tower.

**Figure 8.** The *Isokeraunic Map* of the United States, which shows the approximate number of lightning days per year.



ticular facility will have a significant effect on the lightning threat to equipment operation. Higher structures tend to collect—and even trigger—lightning strikes. Further, because storm clouds tend to travel at specific heights above the earth, conductive structures in mountainous areas will trigger lightning activity more readily.

The plant exposure factor is a function of the size of the facility and the Isokeraunic rating of the particular area. The larger the physical plant, the more likely it will receive lightning strikes. It also follows that the longer an ac power transmission line, the more lightning strikes it will likely receive.

### Conclusion

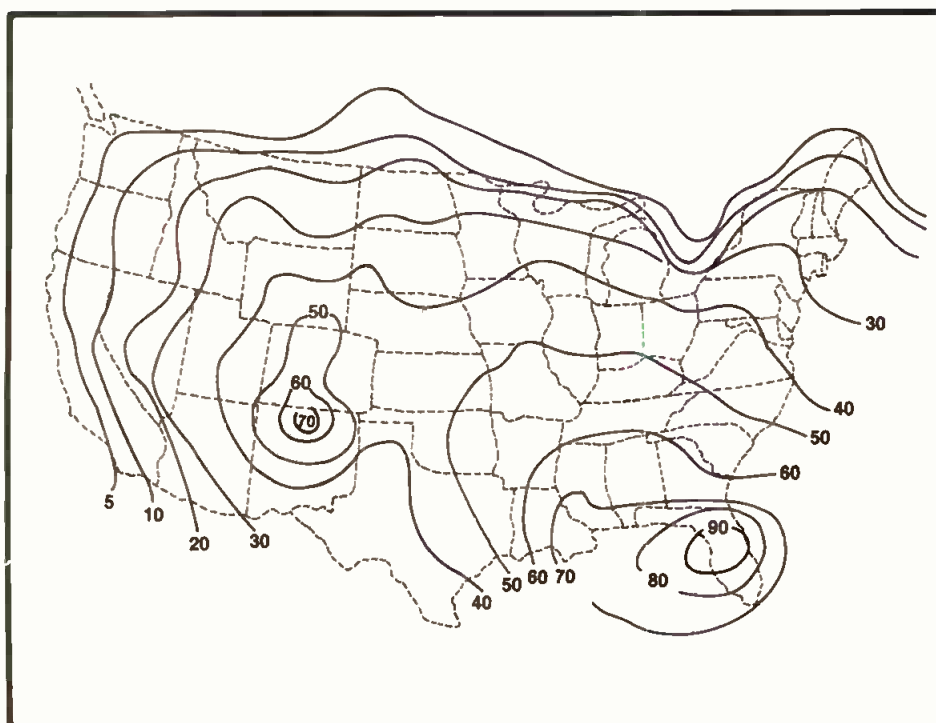
With this article, we conclude our 6-part examination of ac line disturbances. The utility power company line into a facility is the lifeblood of any broadcast operation. It is also, however, a frequent source of equipment malfunctions of various types. To deal with the ac disturbances that will occur, engineers must understand how these disturbances are created and how they can be eliminated. We hope this series has been of help in this regard.

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- Technical Reports LEA-9-1, LEA-0-10, LEA-0-8, Lightning Elimination Associates, Santa Fe Springs, CA.
- Defense Civil Preparedness Agency. EMP Protection for AM Radio Stations. Washington, DC: TR-61-C, May 1972.
- Defense Civil Preparedness Agency. EMP and Electric Power Systems. TR-61-D. July 1973.

### Editor's note:

In Part 4 of our series, December BE, in the discussion of *apparent power*-vs.-*true power*, an example on page 62 given to illustrate the relationship implied that the true power in a circuit could exceed the apparent power. As clearly shown in a diagram on the same page (Figure 2), however, this cannot be the case. In a discussion of power factor calculations, apparent power is always greater than or equal to true power.





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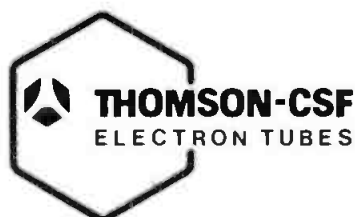
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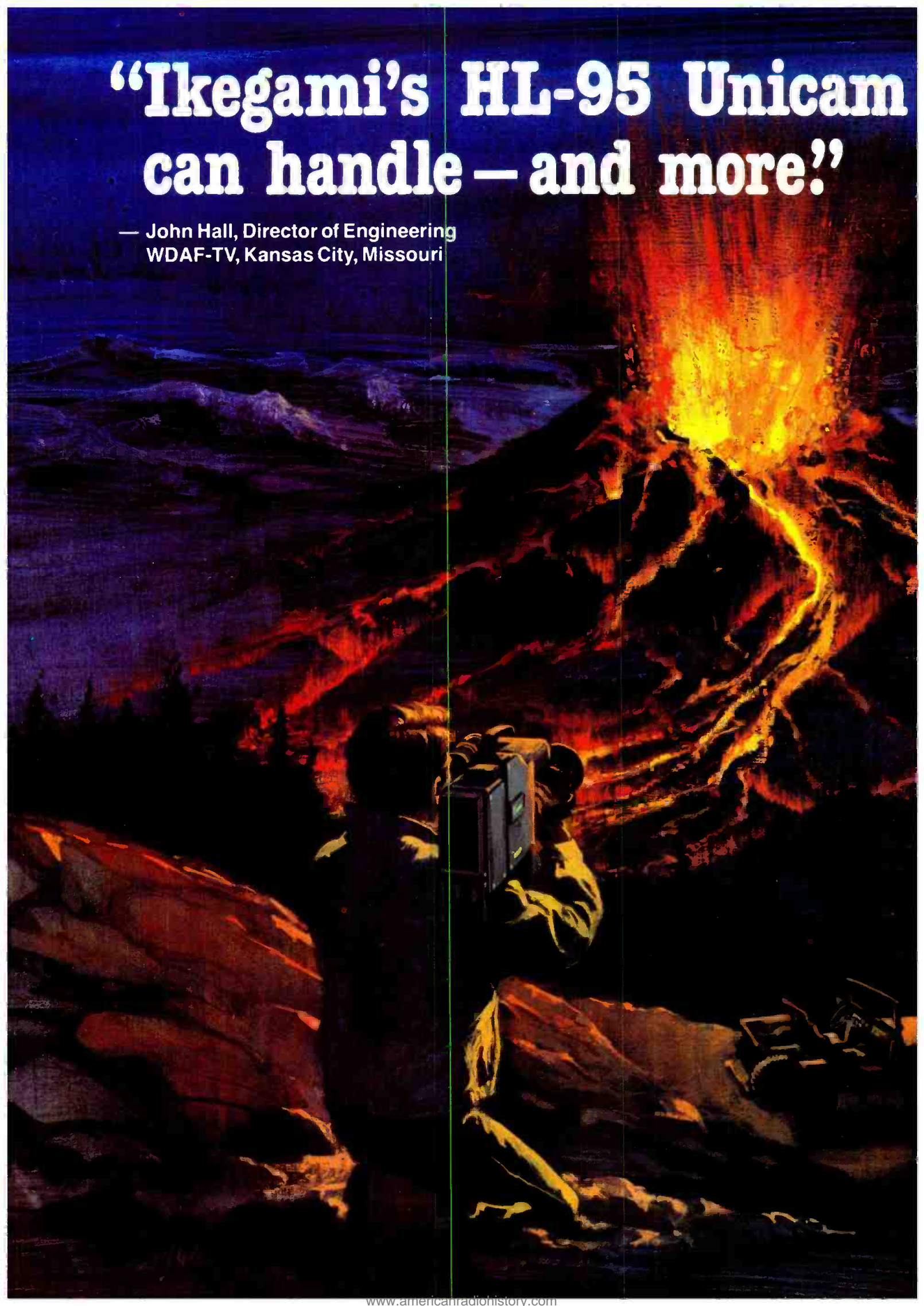
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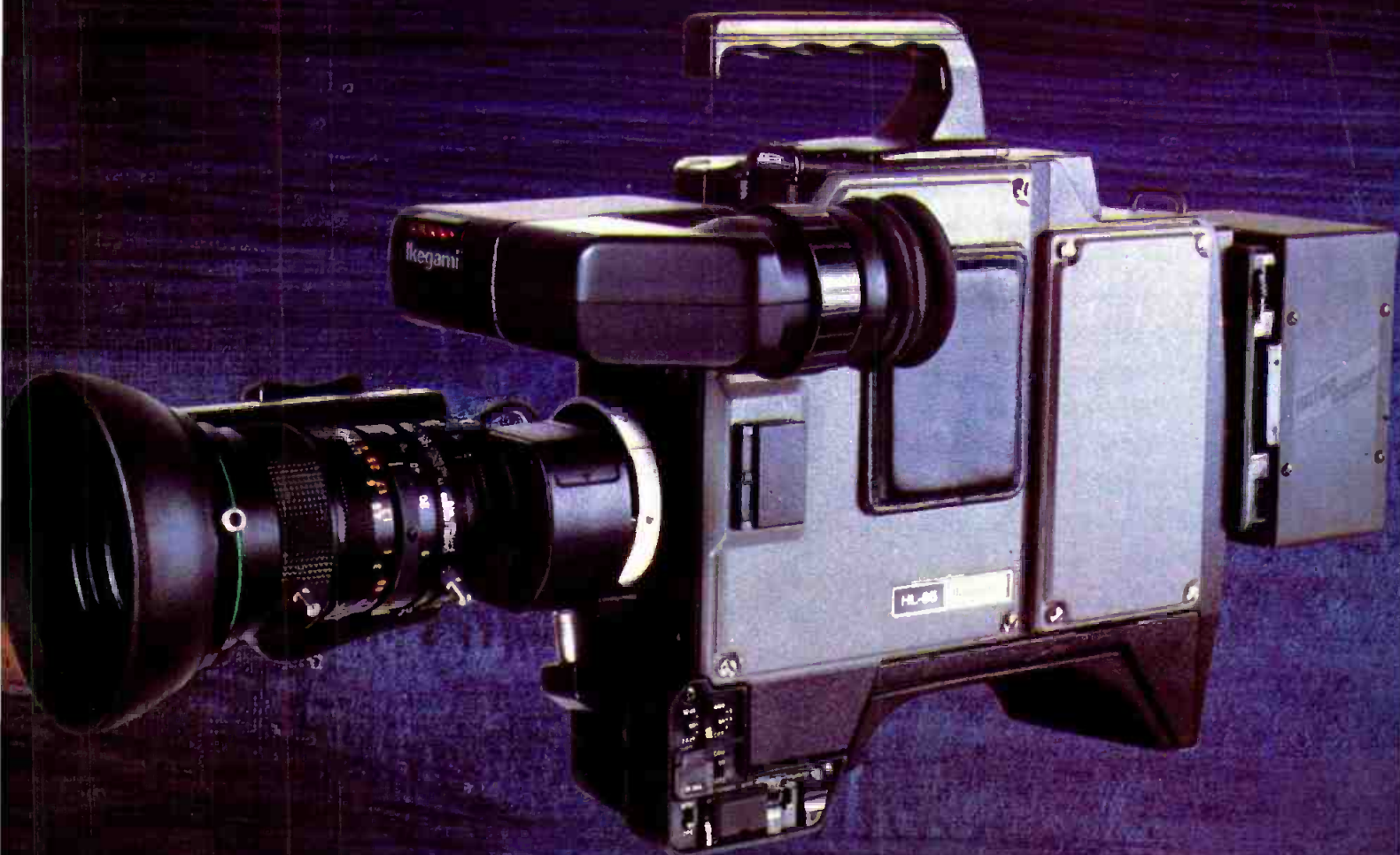
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# Improving CD performance

By Christopher B. Downing, chief engineer, KUDL-FM, Merriam, KS

The digital compact disc has emerged as a practical source of high-fidelity broadcast audio, and the variety of commonly available CD albums by pop, rock and country artists is now quite good.

The performance of consumer compact disc players is impressive. Because system performance limits are set primarily by the 16-bit digitization and 44.1kHz sampling rate, the measurable audio performance of professional and consumer playback equipment is similar.

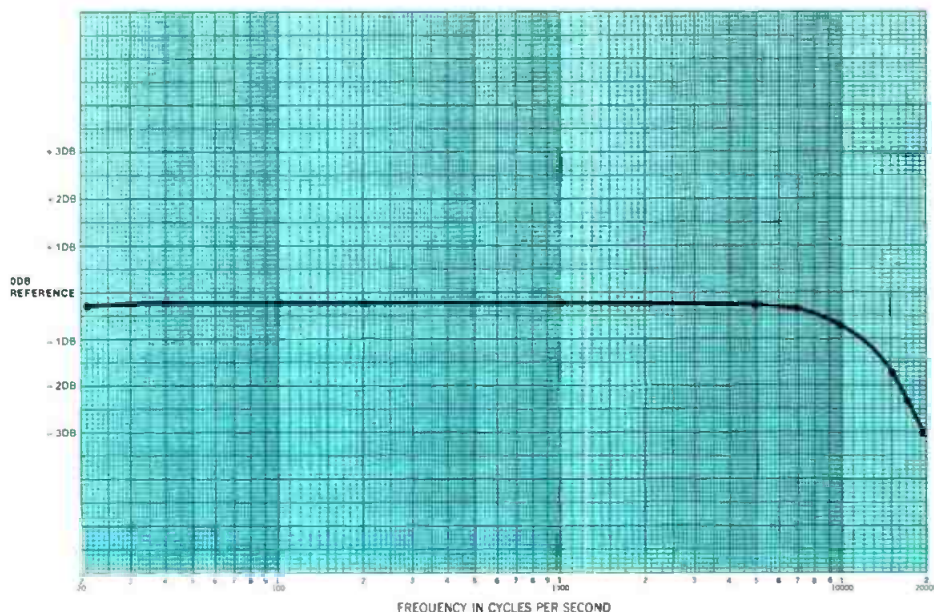
One disadvantage, however, in the use of consumer-grade compact disc players is the high frequency cancellation which may result when the right and left stereo channels are summed into mono. Mono compatibility is an important consideration for stereo FM and, now stereo AM. Mono sum frequency cancellation results from slight interchannel phase difference in CD players that use a single digital-to-analog (D/A) converter for both channels.

It would seem reasonable to dedicate a separate D/A converter to each channel. However, high-speed 16-bit converter chips are expensive, power-hungry and take up extra circuit board space. The use of a single con-

verter eases some design and fabrication problems, but may also create a new problem for broadcasters.

## Conversion delay

In most single converter CD systems, decoded digital data are fed to the D/A chip and the analog output of



An operator prepares a CD disc for on-air playback at KUDL-FM.

**Figure 1.** The frequency response of a typical consumer compact disc player with the left and right channels summed to mono. (These data were compiled using an active mono summing network, Toshiba XR-270K Compact Disc player, Fluke 8050A DVM and a Sony type 3 test disc).



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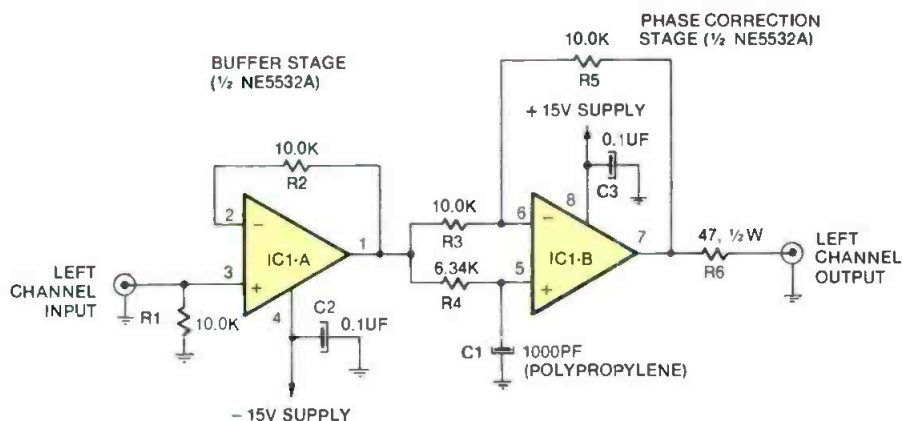


Figure 2. Schematic diagram of the author's phase corrector circuit for CD players.

the converter is then time-multiplexed between the left and right channels. The D/A converter delivers an analog sample to each channel every  $22\mu\text{s}$ . The conversions are interlaced in the conversion interval so that one converter can serve both channels.

The delay between conversions is  $11\mu\text{s}$ , or one-half the period between channel samples. The  $11\mu\text{s}$  time delay between channels is insignificant for stereo listening. The human auditory system effectively integrates such short delays.

Unfortunately, the  $11\mu\text{s}$  delay corresponds to a significant phase difference for audio frequencies above  $10\text{kHz}$ . The phase difference is inaudible in stereo, but leads to partial cancellation of the audio signal when the left and right channels are summed into mono. The phase difference typically measures about  $41^\circ$  at  $10\text{kHz}$ , and rises to about  $61^\circ$  at  $15\text{kHz}$ .

Figure 1 shows the mono sum frequency response of a popular consumer CD player. The high frequency roll-off is gentle, with response down about  $2\text{dB}$  at  $16\text{kHz}$ . The drop in response is similar to the cancellation effects that result from improperly aligned stereo tape heads.

Elimination of the built-in inter-channel phase difference will restore the lost monophonic frequency response. In some consumer machines, the right channel lags the left channel. Therefore, if left channel audio is delayed by  $11\mu\text{s}$ , the right channel will be caught up and the time (and phase) differences will vanish.

### Solving the problem

Delaying the audio signal of one channel to correct the mono sum problem turns out to be fairly easy. There is a class of active filters with a response known as *all-pass*. These filters have a flat amplitude response for all frequencies, but produce a frequency-dependent phase shift.

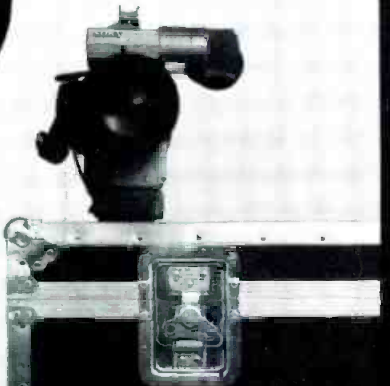
The circuit shown in Figure 2 is a *first-order all-pass network*. There is a range of frequencies for which the reactance of the capacitor at the non-inverting input of IC1-B will interact with the signal at the inverting input to produce a constant-amplitude phase-shifted response.

It might appear that the circuit produces an inverted output, but the configuration actually is a unity-gain non-inverting amplifier at audio frequencies. With the component values shown, the phase shift closely approximates the interchannel phase difference commonly found in consumer CD players.

Figure 3 shows the mono sum frequency response after phase correc-

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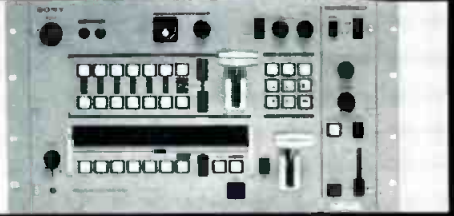
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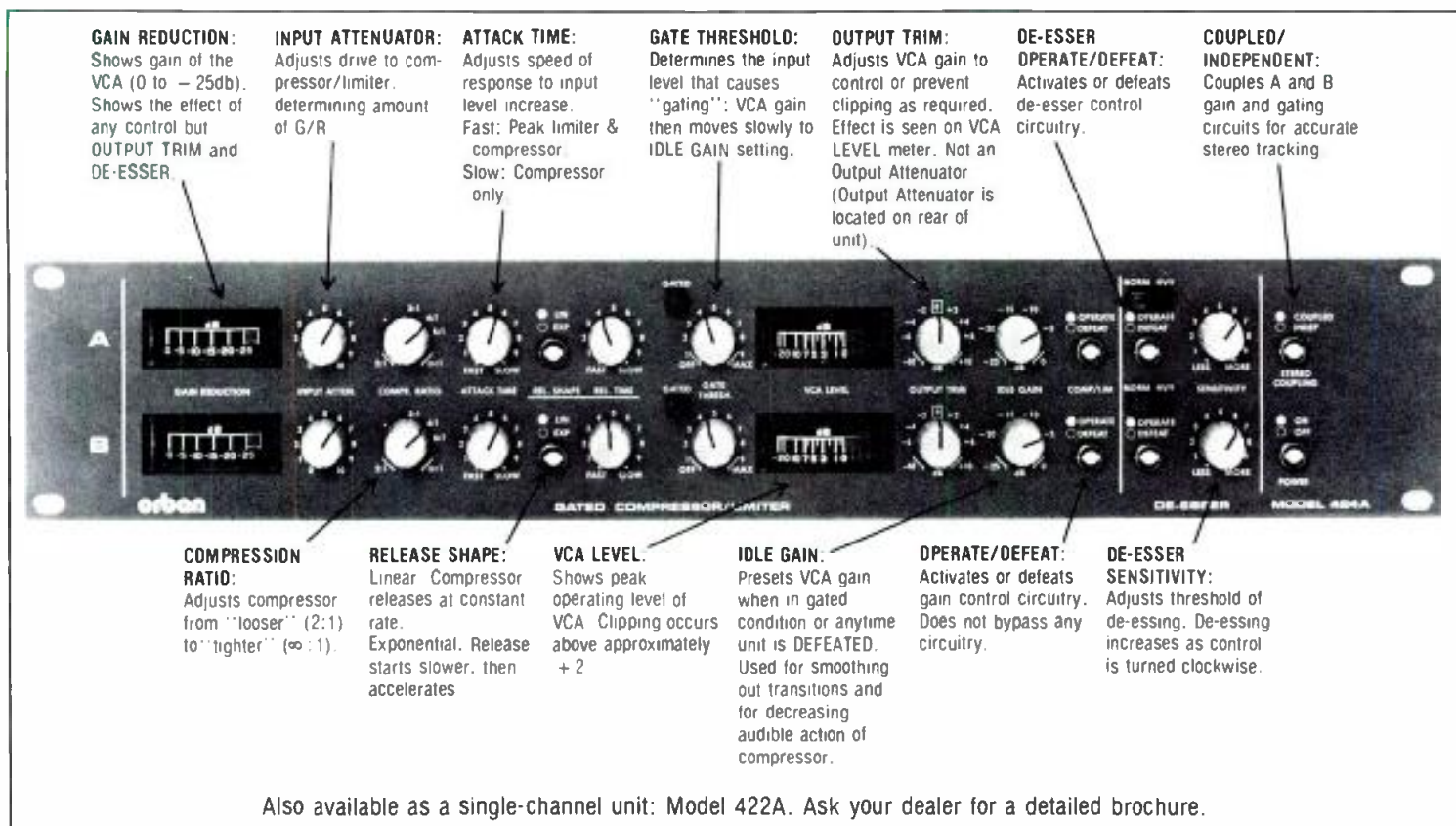
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Hugh Ford, *Studio Sound*  
November, 1983

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John Monforte, *db Magazine*  
July-August 1983

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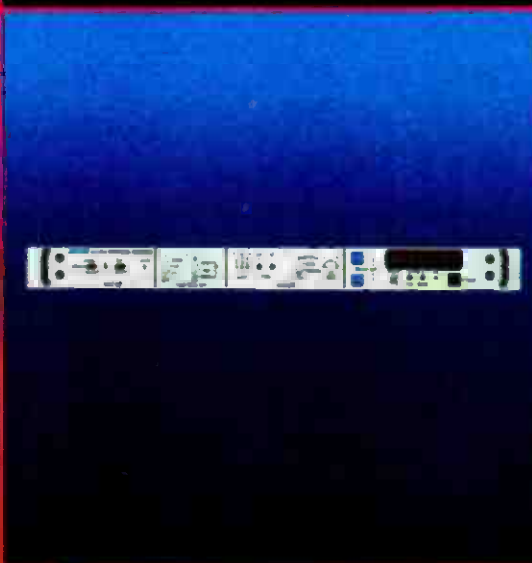
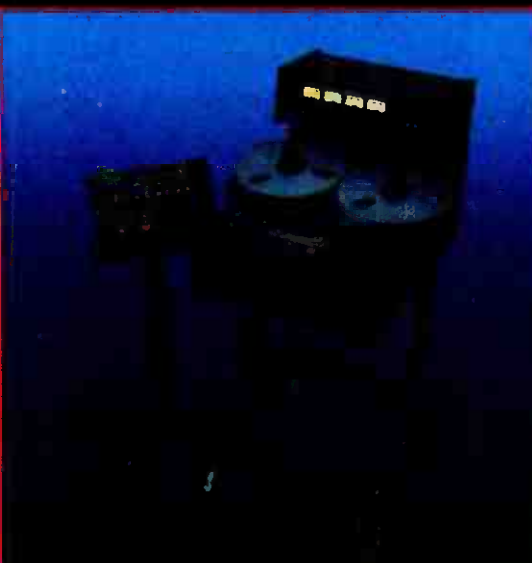
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**The DP-4050-OM** is an open reel master reproducer, capable of driving up to 28 cassette slave units at 8-1 speed. The OM is fully automatic, with rewind, cue and repeat functions, and is available in versions providing 3-75 and 7-5 ips, or 7-5 and 15 ips.

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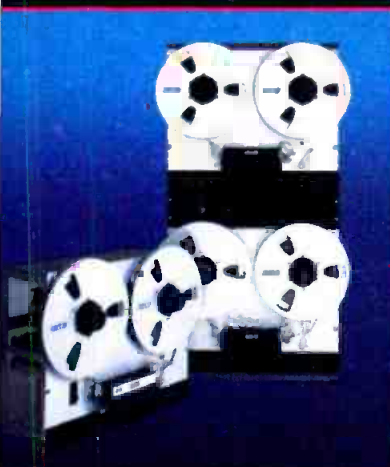
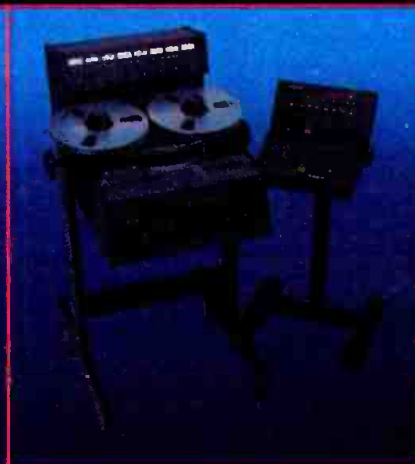


The MTR-12 combines the advanced features of the MTR-10, with expanded reel capacity to 12.5 inches, important for recording studio and post-production applications. It is available in several formats, including the state-of-the-art 1/2" 2-channel for record mastering

widely accepted 1/2" multi-track recorder for broadcast production, recording studio, and audio post-production applications. The MARK III/II is available with a remote controller and an auto-locator for quick cueing and punch-ins

Super-Accord™ with computer controlled Record self-alignment. The MTR-20 features 4 speeds and 14-inch reels, with a transport specifically engineered for audio post-production, an application where precise machine control is a must.

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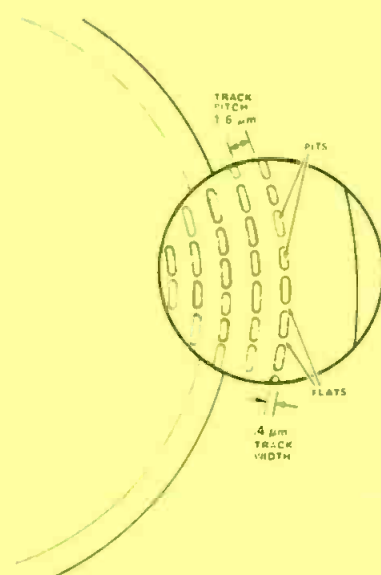


# CD optics: How it works

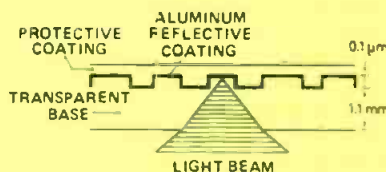
A compact disc is composed of thousands of circular tracks made in a continuous spiral from the inside to the outside of the disc (see the figure below). These tracks are analogous to grooves in an LP record.

However, the tracks of a compact disc are not grooves. They consist of microscopic *pits*: minute indentations in the disc material.

The width of each pit is about  $0.4\mu\text{m}$  and the depth is about  $0.1\mu\text{m}$ . The distance between the spiral tracks is held constant at  $1.6\mu\text{m}$  and is called the *track pitch*.



A magnified view of the data tracks on a compact disc.



A cross section of a compact disc.

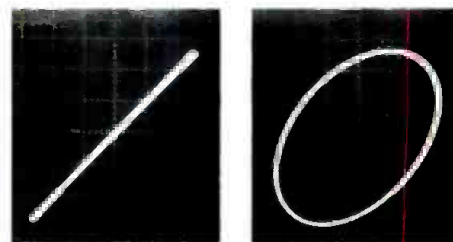
The encoded data contained in the pits and flats (the area between successive pits) are used to reproduce the digitally recorded information.

The pits and flats that represent the digital data are actually  $1.1\text{mm}$  below the transparent surface of the disc, as shown in the figure above. The CD player light beam passes through the transparent base material to retrieve the encoded information. Light reflected by the pit areas is not as bright as light reflected by the flat areas.

The rotation of the disc, combined with the pits and flats passing over the light beam, creates a series of *on* and *off* flashes of light that is reflected into the optical reading system. The length of the pits and flats is a function of the digital data contained on the track. Typical lengths vary from  $1$  to  $3\mu\text{m}$ .

## Editor's note:

This material was adapted from the NAP Consumer Electronics publication, *Technical Training Manual for the Compact Audio Disc Player*.



The stereo phase performance of a typical consumer CD player with the all-pass network switched in (left) and out (right) while reproducing a  $16\text{kHz}$  test tone.

tion of the left channel of a Toshiba XR-270K CD player. The chart shows frequency response for the unit flat to within  $\pm 0.06\text{dB}$ , indicating that high-frequency response has been restored in the mono sum mode.

The circuit shown is inexpensive and easy to construct. The resistors, except for R-6 (the  $47\Omega$  output protection resistor), should be 1% metal film types. The  $1000\text{pF}$  capacitor (C1) should have a polypropylene dielectric. The power supply leads for the NE5532A dual op amp IC should be bypassed to ground near the chip. Although the NE5532A operational amplifier has a relatively low input impedance—which is unsuitable for many active filter designs—it was chosen in this application for its low distortion and high output current.

The circuit shown produced a noise floor lower than  $-95\text{dBm}$  (A-weighted), and delivered  $+20\text{dBm}$  into a  $600\Omega$  load with less than  $0.06\text{dB}$  THD ( $20\text{Hz}$  to  $20\text{kHz}$ ). The dynamic range of the circuit is about  $120\text{dB}$ , and the sonic performance of the compact disc system is not compromised.

## On-air performance

The effect of phase correction on mono response was just barely audible in listening tests at KUDL, mainly because there isn't much energy above  $10\text{kHz}$  in most contemporary music. Phase correction was definitely observable, however, with an oscilloscope connected to the left and right channels for X-Y observation. Switching in the phase correction always improved the visible phase pattern for sibilants, both on-the-air and in bench tests (photos above).

## Other considerations

Some new CD players use a technique called *oversampling* to relax low-pass filtering requirements on playback. Audio samples are converted at a much higher rate than every  $22\mu\text{s}$ , and the corresponding interchannel time delay is smaller. Phase correction is, therefore, unnecessary for oversampling CD players.

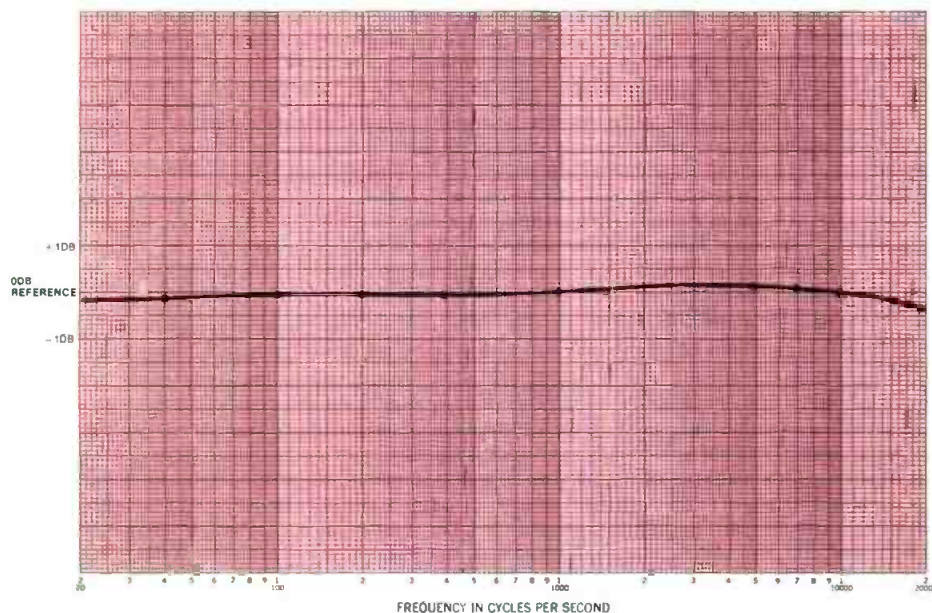


Figure 3. Frequency response of the system charted in Figure 1 with the phase corrector circuit installed.





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# Field report:

# Aphex Compellor

By Andy Laird, chief engineer, KDAY Radio, Los Angeles

The Aphex Compellor is an audio processor that combines the functions of an expander (leveler), compressor and peak limiter. The unit uses an Aphex Systems 1537 high performance, voltage controlled amplifier (VCA) as the gain controlling device.

This VCA—along with unique side chain circuits, simple operating controls and a unique metering system—makes the Compellor easy to use and suitable for a broad range of applications in the broadcast and recording industries.

## Circuit description

The Compellor is a 2-channel audio processor packaged as a single unit. The input and output connections are made through XLR connectors. Primary ac power enters through a standard receptacle with a built-in fuse, voltage selector and RFI filter assembly.

The audio path is straightforward, beginning with an in/out bypass relay controlled by a front panel push-button switch (Figure 1). The audio then passes through an RF protection low-pass filter network. The input amplifier is an instrumentation type, providing a true balanced bridging input of 40k $\Omega$ .

Input reference selection jumpers for each channel allow setting of the internal calibration to a particular house standard (+8, +4, 0, or -10dBV). The input amplifier drives both the silence gate detector and the input of the VCA. The output of the VCA drives the control side chain and feeds the output level control. An output reference selection circuit, with jumpers to adjust the output calibration, drives a balanced line amplifier, whose output is routed to the bypass relay, and then to the back panel output port.

## The controls

Controls for the system are simple and direct. Push-buttons allow the user to select the circuit functions displayed on two multicolor LED meters, one for each channel. Input level, output level and gain reduction are selectable for observation.

The input level adjustment (one for each channel) acts as a dc control circuit that sets the amount of gain reduction desired by the user. The actual input calibration is set using internal jumpers.

The process balance control establishes the time characteristics of gain reduction anywhere between

total leveling and total compression.

The output level control is used to adjust the unit's output after gain reduction. The output level meter responds to adjustment of this control.

In the center of the front panel is an in/out operation bypass button, a silence gate threshold control (with LED indicator) and a stereo enhance button (also with an LED indicator). The silence gate threshold is adjustable from 0dB to -40dB from the selected input reference.

When audio input to the processor falls below the selected threshold for a preset length of time, all gain movement in both channels is frozen. The silence gate prevents background noise buildup, such as crowd noise in sports broadcasts or teletype beds during newscasts. The silence gate feature also permits normal program audio fades.

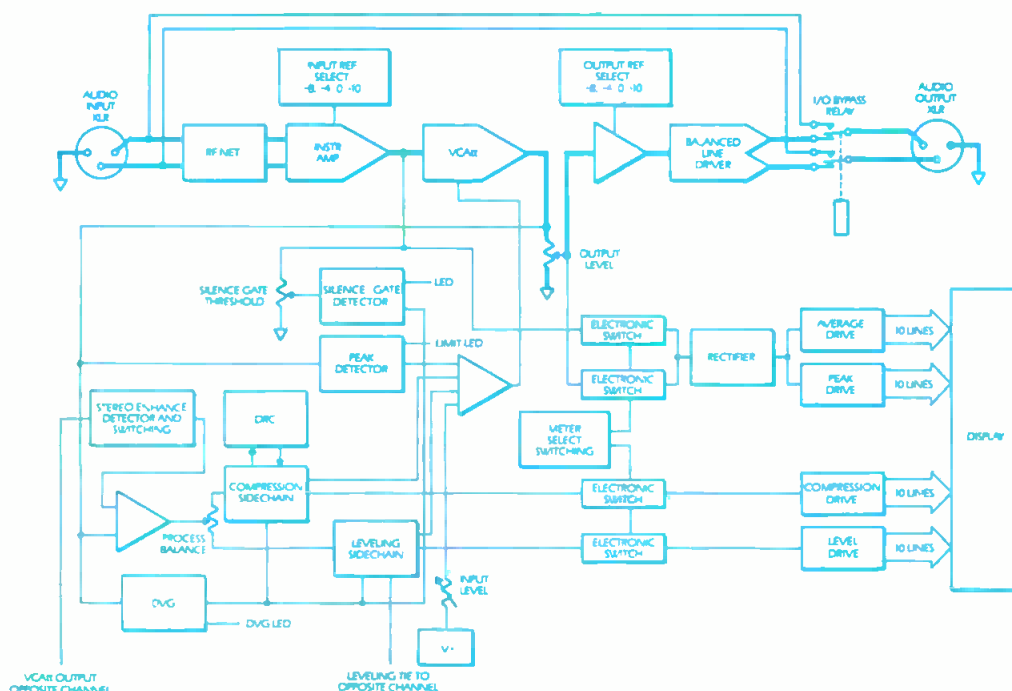
The stereo enhance button switches a detection and matrixing circuit into a control loop, which causes a widening of the stereo image without affecting non-stereo information.

## Metering provisions

Metering of the primary circuits is provided by two sets of 10-segment horizontal red/green LEDs. With the meter select button in the program mode, VU level is shown as a red bar. Simultaneously, the peak audio level is shown as a green bar to the right of the red. Switching from input to output allows an instant display of changes in the peak-to-average ratio of the program audio.

When selecting the gain reduction mode, the meter displays total gain reduction as a green bar. The amount of gain reduction due to the level control setting is shown as a red dot within the green bar. The green gain reduction LED display is generated by the level control circuit and the red gain reduction display is generated by the compression control circuit.

Two LEDs are used to indicate the status of the in/out (bypass) and stereo enhance switches. Another LED, located above the silence gate threshold control, lights when gain movement is frozen. A red peak LED, located to the right of each LED bar meter, flashes when the peak reduction circuit is in operation. A dynamic verification gate indicator lights when the com-



**Figure 1.** Block diagram of one channel of the Compellor audio processor. The primary audio channel is shown by the bold line.



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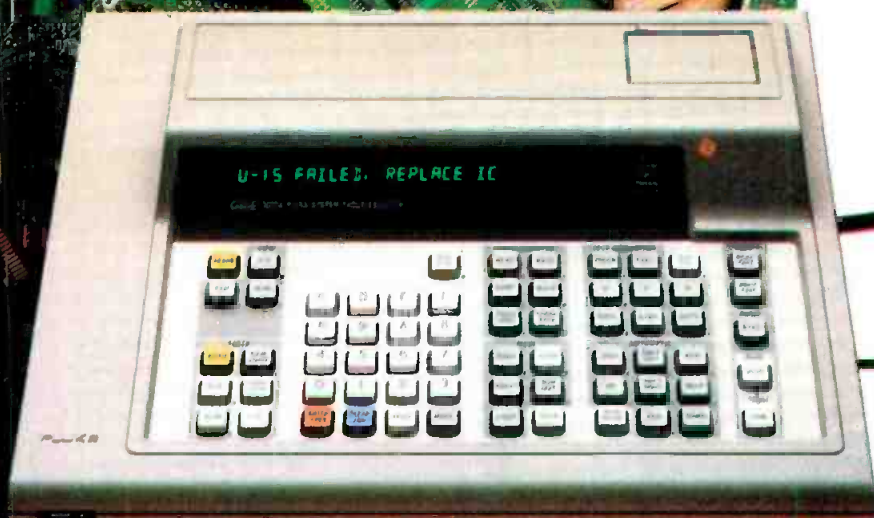


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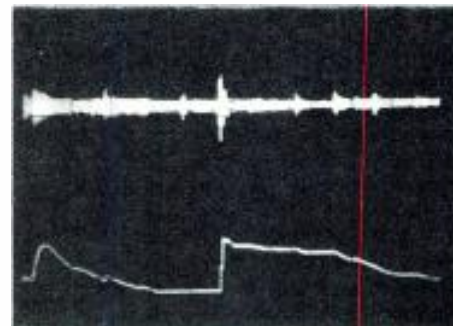
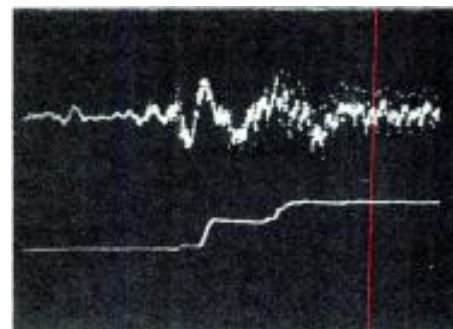
pression and leveling control voltages are being held constant.

#### Control side chain

In addition to the leveling, compression and peak detection sidechains, two special circuits combine to give the Compellor some unique dynamic characteristics.

The dynamic verification gate (DVG) monitors short-term and long-term average levels, compares them, and inhibits gain changes when program dynamics might be compromised by arbitrary gain reduction. The DVG also prevents gain release during short-term program pauses. The dynamic recovery computer (DRC) allows rapid recovery from gain reduction under certain complex wave conditions.

Signals that are high in peak amplitude but low in relative power can cause an increase in the compression release rate. Excessive gain reduction is, therefore, avoided. This prevents the loss of transient wavefronts and holes in the program audio.



Three oscilloscope display photographs showing actual audio processing activity of the Compellor. In each, the upper trace is the unprocessed input audio and the lower trace is the resulting VCA control voltage from the compression sidechain.



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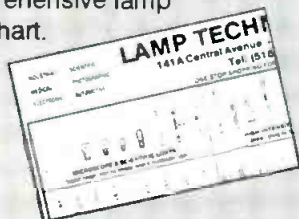


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## Performance measurements

Performance tests are summarized in Table 1. The results are impressive for a signal controlling device. They cannot, however, fully describe the sonic capabilities of the processor. The attack and release times of the leveling and compression circuits, and the ratio of compression, are program dependent, making measurement of these parameters difficult.

The leveling circuit has slow attack (approximately 2.5s) and slow release (about 5s) time constants, with a measured compression ratio of approximately 30:1. Aphex specifies a compression attack time of 5ms to 50ms and release time of 200ms to 1s, with a compression ratio varying from 1.1:1 to 20:1.

The threshold of the peak limiter is fixed at 12dB above the reference level

selected by the user, with an attack time of 1ms and a release time of 10ms (Aphex specs).

The three scope photos on page 130 illustrate the complexity of the attack and release control voltages generated by the unit. The upper trace on each of the scope photographs shows unprocessed audio from a compact digital disc player. The bottom trace shows the simultaneous control voltage to the VCA from the compression sidechain.

The first photo, taken with a total screen sweep time of 200ms, shows a gain reduction of approximately 3dB with the control circuit completely ignoring the transients. (As the lower trace goes up, gain is reduced.)

Table 1. The results of standard performance tests on the Compellor.

All measurements were made with the input and output references set at 0dBm and in the presence of a strong (50kW) AM RF field.

- S/N RATIO: (input signal level at processing threshold) Left - 67.5dB, Right - 68dB (nature of noise purely random)
- FREQUENCY RESPONSE: (10dB of gain reduction)

Frequency	Full leveling		Full compression	
	Left	Right	Left	Right
20Hz	-0.2dB	-0.2dB	+0.1dB	-0.2dB
50Hz	-0.1	-0.1	+0.1	0
100Hz	-0.1	-0.1	0	0
400Hz	0	0	0	0
1kHz	0	0	0	0
5kHz	+0.2	+0.2	+0.2	0
10kHz	+0.4	+0.35	+0.1	+0.1
15kHz	+0.6	+0.55	+0.1	+0.1

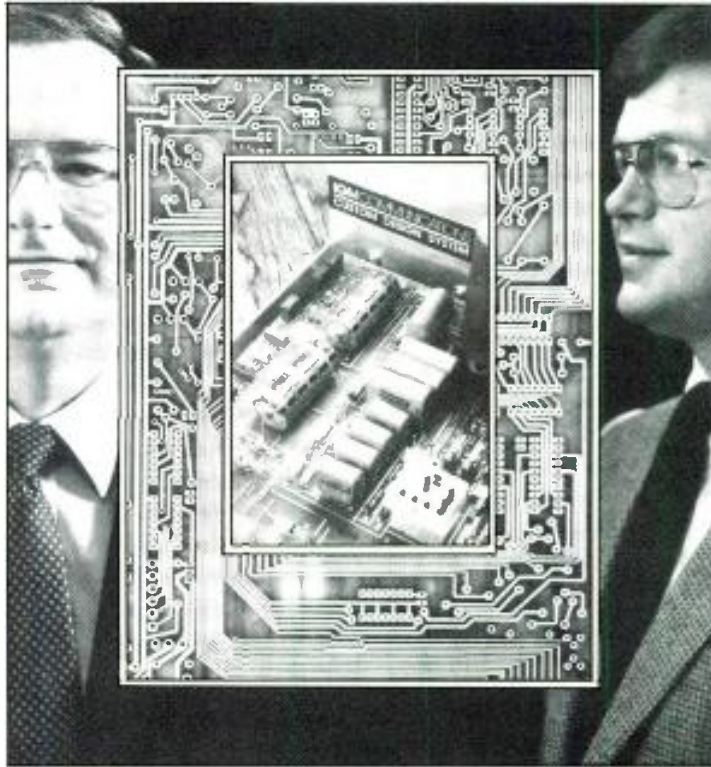
Amplifier function only (with no gain reduction): -0.4dB at 10Hz, -1dB at 100kHz

- SMPTE IM DISTORTION, 4:1: (10dB of gain reduction)  
Full leveling 0.92% Full compression 0.86%
- HARMONIC DISTORTION: (10dB of gain reduction)

Frequency	Full leveling		Full compression	
	Left	Right	Left	Right
20Hz	0.23%	0.23%	1.4%	1.35%
50Hz	0.095	0.098	1.05	1.05
100Hz	0.055	0.062	0.61	0.62
400Hz	0.038	0.045	0.155	0.16
1kHz	0.04	0.045	0.069	0.073
5kHz	0.11	0.065	0.038	0.04
10kHz	0.175	0.086	0.038	0.041
15kHz	0.21	0.105	0.04	0.041



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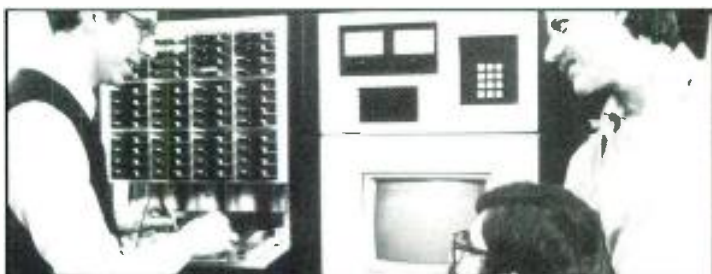


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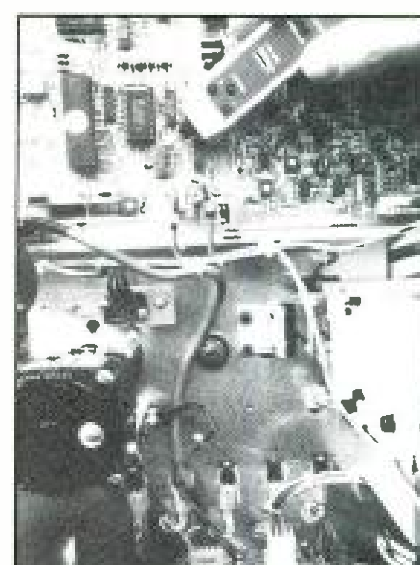
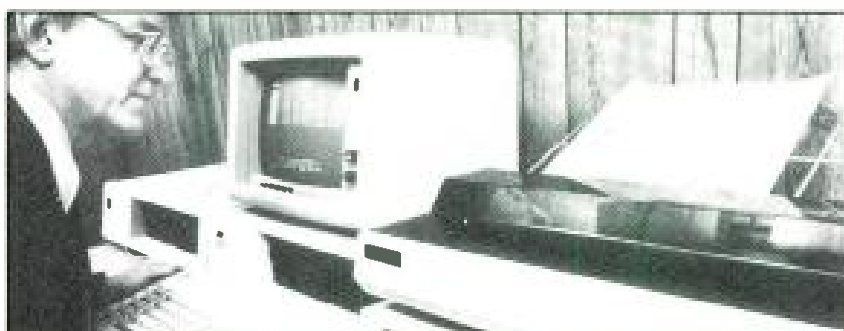


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With your approval of the specifications and placement of order, *system design* begins.

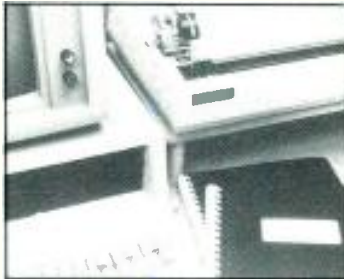
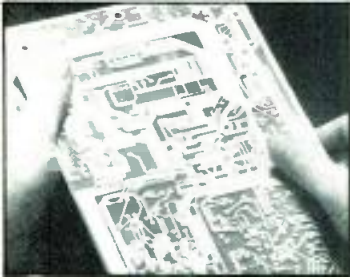
Components are specified for purchasing. Software and hardware development *schedules* are developed.

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Final hardware specifications are *released* for production.





With final engineering design released, the *manufacturing process begins*.

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completed. Our *quality control* staff, and those of *your staff*, if requested, will be *involved* in this critical step.

Final operations and technical manuals are produced, and then, according to the delivery schedule, the system is *shipped*.



• NATURE OF HARMONIC DISTORTION: (at 50Hz)

Harmonic of 50Hz	Full leveling	Full compression
	Left	Right
2nd	-80dB	-42dB
3rd	-63	-48
4th	-80	-56
5th	-73	-72

• COMMON MODE REJECTION:

Frequency	Left	Right
2kHz (and below)	below noise	below noise
5kHz	-66dB	-67.2dB
10kHz	-64	-65.8
15kHz	-63	-64.8
20kHz	-62.5	-64.2
50kHz	-60	-60.5
100kHz	-57.5	-57.5



The other photos, taken with a total screen sweep time of 1s, show the changing nature of the release characteristics, the stepping action created by the DVG and the changing release rate produced by the DRC.

#### Operation

Setting the operating controls is easy: adjust the input control for the amount of total gain reduction desired, set the process control to achieve a balance between gain reduction because of leveling and compression and then adjust the output control for desired level.

The dynamic characteristics are well matched, making it difficult to create processing artifacts because of excessive gain reduction.

#### Broadcast applications

The ability to handle level differences from one event to another rapidly and inaudibly, without resorting to heavy compression or multi-band limiting, is a difficult task for any audio processor. The unit, however, does an effective job in maintaining proper levels and allows the

The Compellor audio processor from Aphex Systems Ltd. The unit is housed in a cabinet 1-rack unit high.

station to use a small amount of overall limiting for an open, unprocessed sound.

Production studio processing is another natural application, especially for multitrack mixdowns and commercial dubs to cart. As a mic processor, the unit provides consistent levels without processing side effects. The Compellor also works well as an STL system audio processor. In this application it will maintain the STL system's rated S/N ratio and provide protection from high-energy program audio peaks.

#### 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.

In essence, these field reports are prepared by the industry and for the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author if support is requested in some area.

It is the responsibility of Broadcast Engineering to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement or disapproval by Broadcast Engineering.

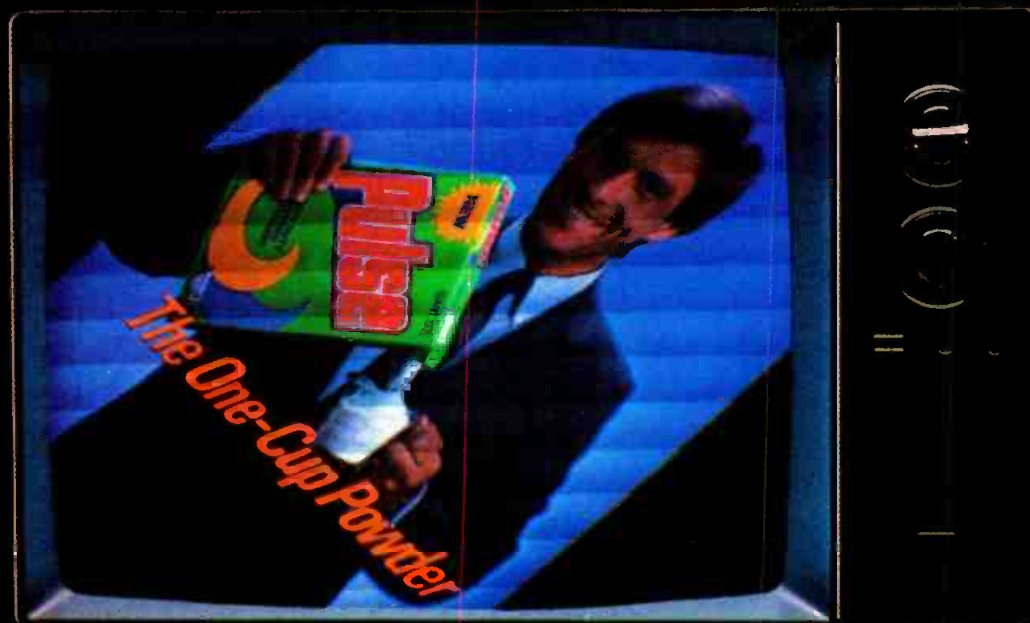
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And, as its name implies, the Sony Betacart uses Betacam cassettes—which cost less than a third of what 2-inch cartridges cost. Its format also makes the system ideal for ENG use during newscasts—thanks to its compatibility with the Betacam<sup>TM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

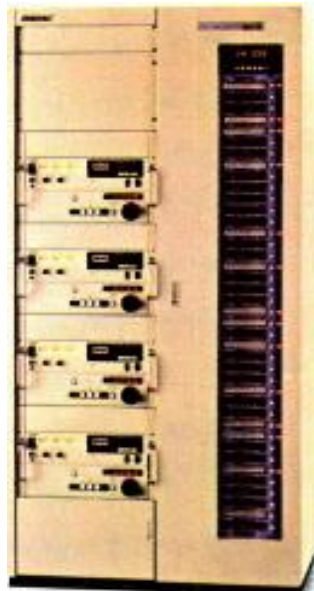
All these advantages, plus its low initial cost make the Sony

Betacart multicassette an investment that will pay for itself quickly. And it will keep paying off in new ways. Its stereo capability, for example, will allow you to capitalize on the coming introduction of stereo TV broadcasting.

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

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# Radio on the road

By Jerry Whitaker, editor

New technology is giving new freedom to radio stations, allowing them to take to the road.

Remote broadcasts give the listener an added sense of realism and excitement that cannot be duplicated in the studio. Stations looking to the future recognize the importance of these live broadcasts from the field.

Stations involved in outside broadcast activity have a wide range of possible methods of program audio return. Options range from standard telephone company (Telco) broadcast loops to sophisticated radio (RENG) systems.

The key to the success of any remote is careful consideration of what equipment to use and how to use it.

## Setting up a wired remote

If you choose a wired remote for a broadcast, the station has a number of equipment and configuration options. The decision on how to originate the remote location programming will depend upon the requirements of the particular broadcast. Some general-

izations can be made, however, that apply to most events.

A program transmitted back to the studio via a standard dial-up telephone company line—without any bandwidth extension—will usually be brief, if for no other reason than the poor audio quality typical of such an arrangement. Spot news reports are common examples of this method of program return.

Small, battery-powered mic-to-line amplifiers are available to drive dial-up telephones through direct connection to the tip and ring wires of the phone company cable or through clip leads at the handset microphone pins.

The direct connection method of coupling is preferred to the handset connection because the former bypasses the telephone hybrid coil assembly with its associated level loss. The broadcaster's motto when it comes to dealing with Telco equipment is usually, "The more you can bypass, the better off you will be."

A broadcast transmitted to the studio over one or two dial-up Telco lines using bandwidth extension equipment can provide impressive audio quality. Reasonably flat frequency response from 50Hz to 5kHz is possible using a 2-line system.

The equalized broadcast loop is probably the most popular method of relaying lengthy remote programming to the studio. Some stations prefer to order unequalized lines and adjust the loop themselves for the required frequency response. This procedure can be effective on relatively short Telco lines.

Generally, however, any audio loop that goes through more than one exchange should be left to the phone company, which has had decades of experience in making miles of twisted pair cable sound decent.

If a station decides to equalize the line and not rely on Telco, equalization should be applied only at the studio (receiving) end. Applying frequency selective boost to a telephone line input can raise components of the signal to a point that will cause crosstalk into other lines or clipped audio because of the action of network protection devices.

The receiving equipment for a wired remote broadcast should be given careful consideration. Sophisticated telephone interface equipment is available from a number of manufacturers. This hardware can ensure that

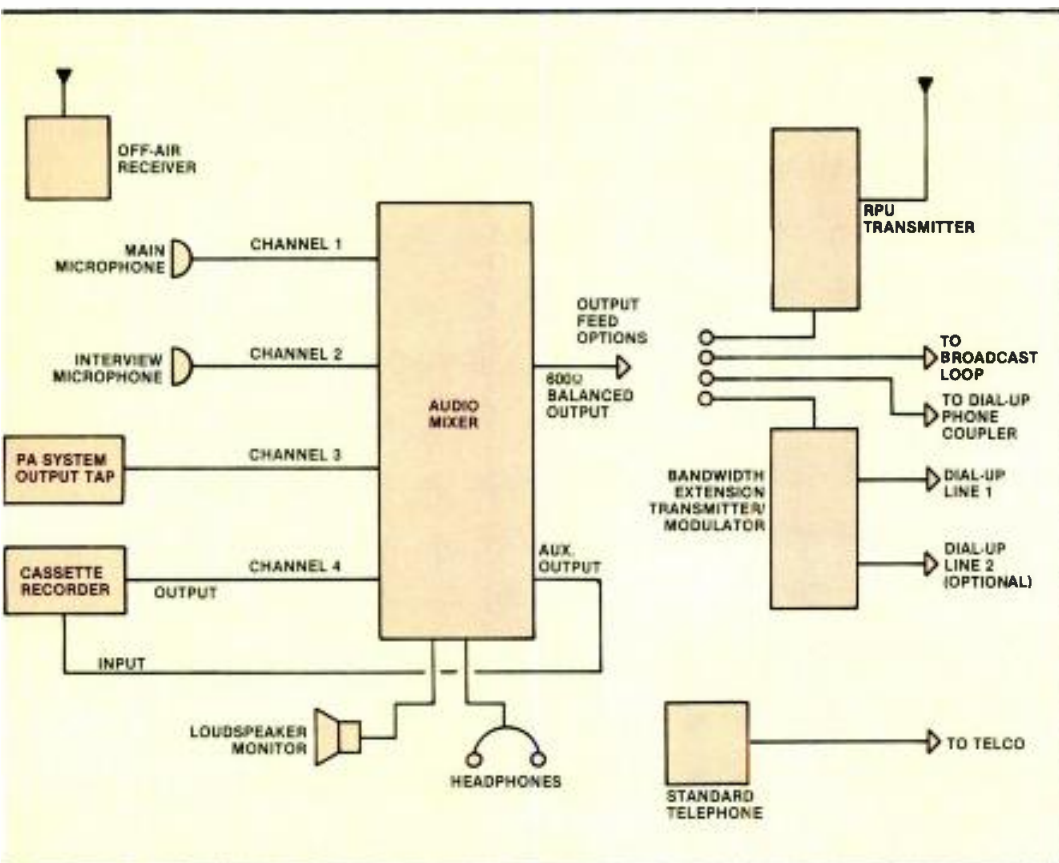


Figure 1. A typical equipment configuration for a medium-scale remote broadcast.



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Circle (106) on Reply Card



maximum audio fidelity is recovered from the line. Some new generation interface equipment includes automatic gain control circuits, equalization and dynamic noise reduction systems.

#### Remote site equipment

The audio equipment used at the site of the remote will vary as widely as the types of programs broadcast. Figure 1 illustrates a typical application for either a wired or wireless relay system.

A 4-channel audio mixer is used to mix the audio sources and drive the Telco loop or RPU transmitter. Careful attention should be given to the connection of the mixer output to the telephone line. A phone coupler should be used between the mixer and the telephone unless the mixer is specifically designed to work directly into a hot dial-up line (one with dc voltage across it). This caution applies to a connection made either to the phone line tip and ring wires or to the telephone set through the microphone terminals.

As shown in Figure 1, two microphones are used—one for the announcer and another for interviews. An output is taken from the local PA system to pick up audio from meetings, speeches, music or whatever. A cassette recorder is often useful at a remote broadcast because it gives added flexibility to the remote crew.

The recorder input signal can be taken from an auxiliary output on the audio mixer, allowing interviews or material from the PA system to be mixed and recorded for later use on the air.

A tone oscillator is useful in setting up the remote broadcast. Most mixers designed for remote applications include an oscillator that can be switched on to the program channel. This feature is especially useful when a Telco line is employed to return program audio to the studio.

Having the proper monitoring facilities is important to the success of any remote broadcast. A loudspeaker and set of headphones should be provided for the remote crew. It is often desirable to have several headphones available for personnel at the remote site. Not all portable mixers can support a loudspeaker and multiple headphone outputs, and so a separate power amplifier and headphone booster may be needed.

An off-air receiver is a requirement for nearly all remote broadcasts. The receiver gives the remote crew a way of checking the total link and allows easy cuing of talent at the event.

For complicated remotes, a separate dedicated telephone set provides an easy means of communicating with the studio. It can also serve as a

backup line for program audio in case the RPU system or Telco loop fails.

#### Wireless microphones

The use of wireless microphones to free up the talent at a remote broad-

cast is gaining popularity with stations involved in RENG activity. The advantages to the talent are obvious: complete freedom of movement and nothing to carry around but a microphone and air monitor receiver.

## Getting the signal back

By Marc Wiskoff, Motorola Communications & Electronics, Whitestone, NY

The requirements of broadcasters for the return of program audio from the site of a remote broadcast vary greatly from one event to the next, and from one station to the next. The concept of mobile repeaters has, therefore, become an important part of engineering major remotes for both radio and television.

Mobile repeaters allow live broadcasting from remote sites

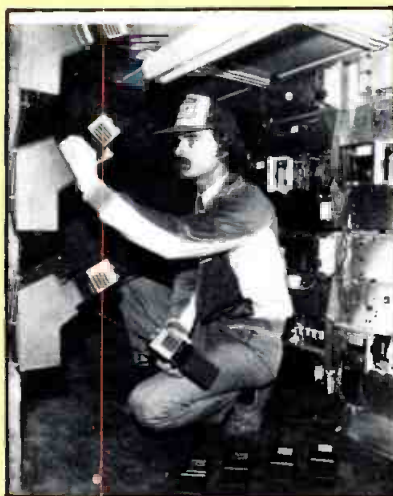
that cannot be reached using a direct radio link, such as an area shadowed by a hill or row of large office buildings. The use of a mobile repeater can also give the talent at the event site greater flexibility, because a small hand-carried transmitter can often be used for the broadcast, rather than a larger, more powerful unit with antenna and power cables.

Mobile repeaters proved their usefulness during the Summer Olympics. Vans were constructed capable of transmitting and receiving on four individual channels for the relay of program audio and event coordination. Each van included a 37-foot mast, which supported the antenna system for the unit.

Coverage of the Olympics was an electronic marvel in itself, with the following 2-way equipment being used:

- 70 repeaters;
- More than 100 control stations;
- 4800 mobile radios;
- 3000 pagers; and
- 60 cellular radios and trunking systems.

The equipment inventory—including all antennas, transmission lines, remote consoles, batteries, spare parts and test equipment—totaled more than 10,000 pieces of communications gear.



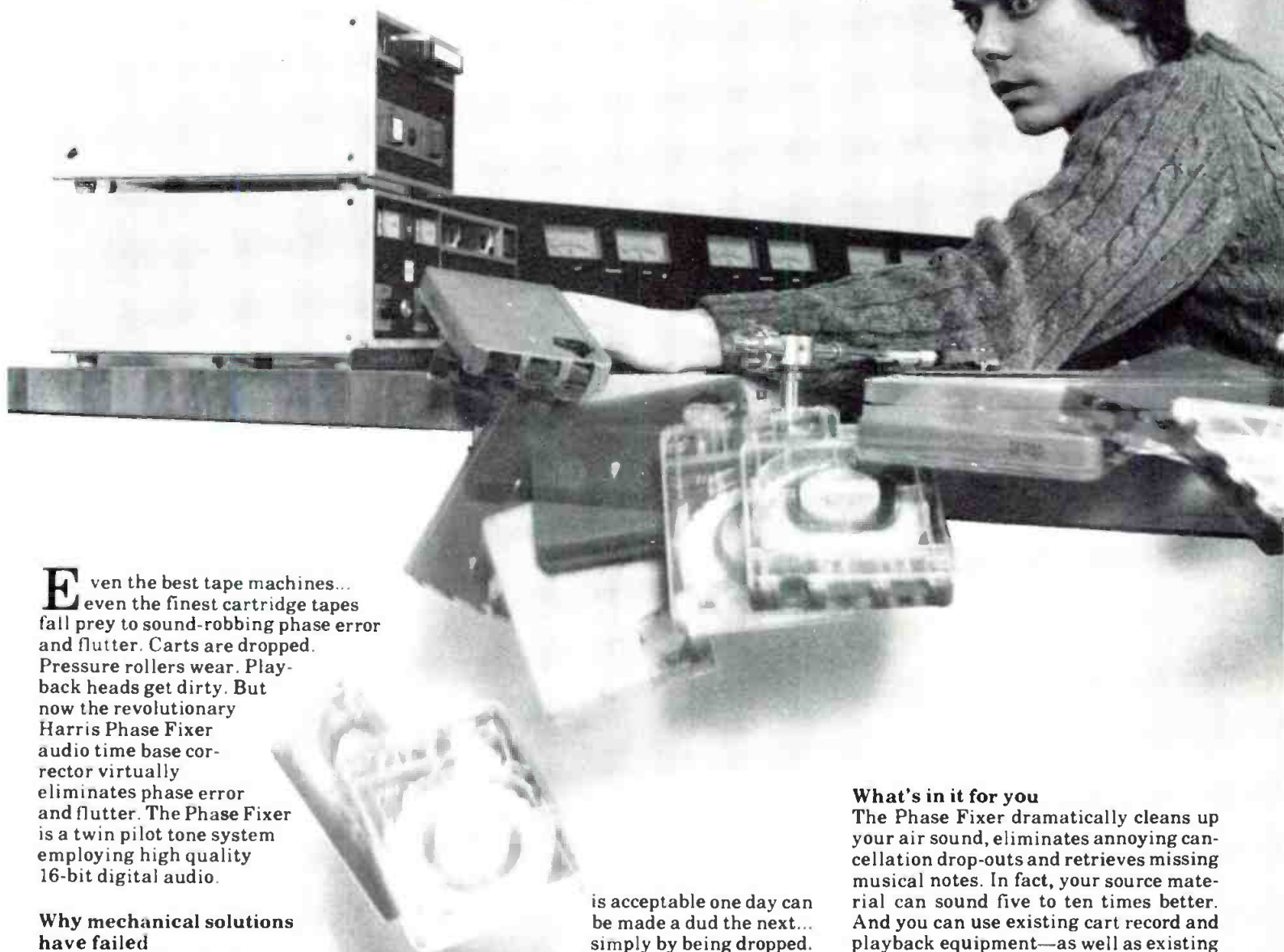
The mobile repeater vans developed by Motorola for broadcast coverage of the Olympics each include four radio repeater systems, battery charging bays, portable 2-way radios and test equipment.



The repeater vans are each equipped with a portable gasoline-powered generator to recharge the on-board battery bank.



# It's no wonder 5 out of 6 cartridge tapes sound bad. Phase Fixer makes them sound good.



**E**ven the best tape machines... even the finest cartridge tapes fall prey to sound-robbing phase error and flutter. Carts are dropped. Pressure rollers wear. Playback heads get dirty. But now the revolutionary Harris Phase Fixer audio time base corrector virtually eliminates phase error and flutter. The Phase Fixer is a twin pilot tone system employing high quality 16-bit digital audio.

## Why mechanical solutions have failed

Extremely critical tolerances are essential to keep phase error in check. Visualize your cart playback head being expanded to 300 feet high—as tall as a football field is long. Even on this greatly exaggerated scale, tape path errors of as little as two inches will cause signal cancellation within the audio passband for the mono listeners of your stereo programming! Obviously, these close tolerances in the tape heads and moving tape paths cannot be maintained mechanically. And a tape cartridge that

is acceptable one day can be made a dud the next... simply by being dropped.

## How Phase Fixer works

The Harris Phase Fixer consists of two compact rack-mounted units. The first, a pilot encoder, injects an inaudible pilot signal on the audio as it is recorded onto tape. The second unit is the time base corrector. When an encoded tape is played, the time base corrector is automatically enabled, *electronically* reducing stereo phase error and flutter to insignificant levels. Tapes that are not encoded will play normally.

## What's in it for you

The Phase Fixer dramatically cleans up your air sound, eliminates annoying cancellation drop-outs and retrieves missing musical notes. In fact, your source material can sound five to ten times better. And you can use existing cart record and playback equipment—as well as existing carts—*without modification*. Just one Harris Phase Fixer system can accommodate all the tape source machines at your station.

## Take charge

Don't accept substandard performance as the inevitable trade-off of cartridge tapes. Eliminate it with a Harris Phase Fixer audio time base corrector. Contact Harris Corporation, Studio Division, P.O. Box 4290, Quincy, Illinois 62305. 217/222-8200.



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We know how you work, what creative tools you need, and most importantly, the level of quality you demand.

The Neve line of audio for video consoles, integrates a depth of studio experience and advanced electronic design—matching human-engineered features with superior technical performance. Unlike the competition, Neve equalizers don't just boost or cut a frequency, they mold all frequencies to match the adjusted musical blend.

## Built to Handle the Speed of Sound

Compact and affordable, the Neve 542 series is ideally suited for editing suites and remote

broadcast applications. With its transparent sound and proven ruggedness, the 542 line is the favorite of those who demand straight forward operation.



*Neve's 542 4 bus console. Part of the 542 series of easy to operate, quality consoles.*

For versatility, the Neve 51 series offers a distinct modular design that lets you customize *your* board for *your* studio—from on-air production to multitrack audio sweetening. Neve 51 series consoles can be configured anywhere from 16 to 60 inputs, with dynamics built into every channel.

For master recording assignments, the Neve 8128-TV series is ideal for multitrack scoring sessions, as well as all effects, narration, and sweetening needs. The 8128-TV provides as many master mixes as you have master buses. Moreover, the 8128-TV is easily used and mastered with all the necessary controls at your fingertips.

## Power Behind the Wheel

Neve understands that a console must always feel as good to the touch as it sounds to the ears.

The layout and color scheme of all Neve consoles have been arranged for superb handling and efficiency. Faders glide smoothly and all



*Neve's 5104/24 console. The 51 series offers distinct modular design with 16 to 60 inputs.*



# Television Audio Console great a horn can sound.



*Neve's 8128/32 console.  
The 8128-TV series is ideal for  
master recording assignments.*

functions can be monitored from the bottom of the channel strip—just where they belong.

We've even computerized the mixing process with our NECAM 96 console automation—using servo controlled moving faders so you always know what's going on. A color video display makes all mix data easy to read. And NECAM 96 mixes the way you would—that is, if you had a limitless memory and a few extra hands.

But then, Neve has always been at the forefront of audio-for-video excellence—from our rack-mounted limiter/compressors and distribution amplifiers to the DSP, the world's first totally digital console.

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Television pros know that Neve products will perform flawlessly for years, will grow with their business and will always produce the quality sound that their clients expect. Test drive a



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Because we wrote the book on audio-for-video production. And we'll be glad to send you a copy of our publication—"Buying an Audio Console for Broadcast Video." It's yours with no "patch cords" attached by simply filling out and mailing in the coupon below or calling Neve at (203) 744-6230.



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There are no controls or meters for talent to worry about. The range of a wireless mic is somewhat limited, but a properly designed system for remotes that are more or less stationary can provide simple setup and coverage of an event.

The receiver used with the wireless microphone may employ either diversity or non-diversity reception techniques. A non-diversity receiver is used where multipath cancellation is not a problem, such as in open areas or during fixed-position interviews.

If, on the other hand, the wireless mic will be moved from one location to another and the possibility of multipath cancellation exists because of nearby reflective objects, a diversity receiver is recommended.

The diversity receiver uses two antennas, located in different areas of the event site. A minimum separation of 20 feet is usually recommended. The receiver automatically selects the stronger of the two signals for demodulation. The switching of RF sources occurs silently without any squelch-type noise bursts.

Many wireless microphone systems include audio compandor circuits to extend the dynamic range and lower the apparent noise floor. A properly engineered wireless microphone sys-

tem can be treated by engineering personnel as essentially a piece of wire between the microphone and the audio console input.

#### Remote cues and orders

Communications with a remote crew from the studio can be accomplished in several ways. The simplest method is an over-the-air cue in which the talent simply listen to the station's air signal and take their cues from the studio announcer or a prerecorded introduction cart.

Other methods include use of the station's subcarrier signal for cuing information or a separate, dedicated, radio link specifically used for cuing instructions, either from the remote truck or from the main studio.

If a station needs a more sophisticated intercommunication system, a trunked 800MHz radio system can be considered. A 5- or 10-channel trunked repeater acts like a small telephone exchange in which the number of users (telephones) exceeds the number of channels (trunk lines).

Telephone system theory is used to predict the busy level that can be expected during periods of heavy radio traffic. Three-minute time-out timers are usually included in mobile transmitters to enforce time limits.

These trunked systems can tie into the regular telephone system at hilltop repeater sites or at trunked base stations. Broadcasters interested in 800MHz trunked radio should contact their local area land mobile operator to see if such a system is available.

In certain situations, a station may be able to design and license a UHF business radio system for dispatch and coordination of RENG crews. These systems offer the user the luxury of not encountering a busy signal, as may occasionally happen in a trunked system. As with the trunked network, no programming is allowed on a UHF business radio system.

One of the problems often encountered when carrying remote broadcasts on an automated station is the need to have an operator stand by during the broadcast to trip the automation system to the next event when the talent at the remote site give the proper cue.

The simplest way around this problem is to use a subaudible tone that is high enough in frequency to not interfere with the ARS subaudible tone for repeater equipment, and low enough in frequency so that it does not interfere with normal program audio.

For example, in a system where the

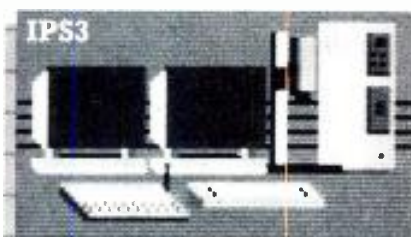
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## From The Industry Leader Standards of The Broadcast Industry

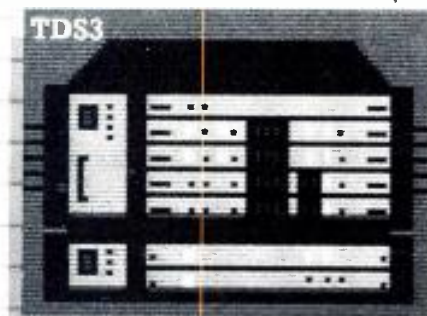
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NABTS is the EIA North American Basic Teletext Specification  
NAPLPS is the ANSI North American Presentation Level Protocol Syntax

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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.

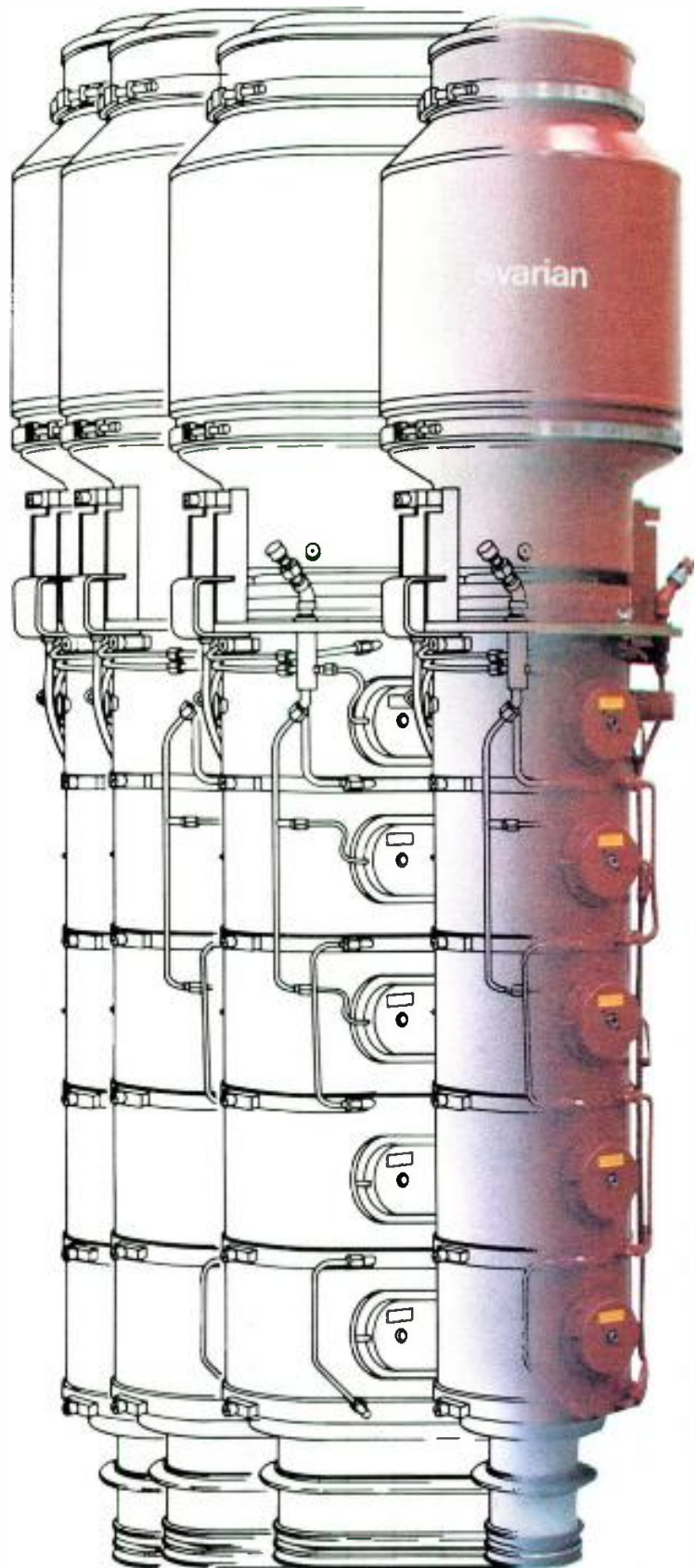
More information on Varian's new S-Tube is available from Varian Microwave Tube Division, or any Electron Device Group worldwide sales organization.

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**varian**



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ARS access subaudible tone is 25Hz, an advance system control tone of 45Hz could be used. To prevent premature automation system trip commands, the program audio input to the remote location transmitter would be passed through a high-pass filter to remove any audio components below about 60Hz.

At the studio, the receiver audio output would run through another high-

pass filter to remove any control tone signals from the automation system program channel feed.

#### Selecting transmitting/receiving equipment

Whatever the configuration of the planned RENG system, there are several important points that should be considered. Most of these items apply to receiving equipment, which

usually presents the greatest problems to a system designer.

Transmitting equipment must also be selected with care, but the receiving links in an RENG system are the ones most often subjected to conditions that may make good performance difficult.

Select a receiver that has sufficient dynamic range and headroom to

*Continued on page 154*

## The VOA Voyager

The Voice of America has taken to the road with a new mobile production and air studio. The unit, dubbed the VOA Voyager, will travel throughout the country gathering regional news for international broadcasts.

The mobile studio is expected to be on the road for about 50 weeks out of the year. One of its first stops was Nashville, TN, for a live country music broadcast in English and 11 other languages.

The VOA can produce programs

on board the Voyager in several ways. Programs can be broadcast live via a telephone loop or satellite circuit to VOA headquarters, or edited on-site and shipped to Washington for later use. The mobile facility is capable of broadcasting up to eight programs simultaneously.

The figure on page 152 shows the floor plan of the VOA Voyager. Soundproofing the unit was a prime consideration. An acoustic barrier to outside noise was pro-

vided by lining the walls that surround the vehicle's studio with a special lead shield. Acoustic absorption material was then added on the interior surfaces. The air conditioning system was also custom-designed to eliminate low-frequency rumble.

Broadcasting in English and 41 other languages to an audience estimated at more than 110 million regular listeners, the VOA is the global radio network of the U.S. Information Agency.

*Continued on page 152*



The Monroe Model 5002 Remote Control will handle channel selection for two dual audio or voice cue modules for the Scientific Atlanta DAT-32\* and the Comtech DART-384\*. It will also provide remote transponder selection for the DART-384\*.

**THE NEW 5002 WILL SAVE YOU TIME AND MONEY AS YOU REDUCE THE NUMBER OF DEDICATED LINES AND CHANNEL CARDS.**

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To help broadcast engineers contend with a wide variety of voices, the Shure SM7 is really four microphones rolled into one. That's because the SM7 Unidirectional Dynamic Microphone features two frequency-tailoring switches that provide a choice of four different response curves—to best suit each individual voice and situation.

Depending on the switch settings, the SM7 can provide an extremely wide-range flat frequency response, add presence and crispness to speech, boost vocal clarity, roll off low frequencies to provide natural closeup miking, or help reduce sibilance.

At the same time, a tight cardioid pattern effectively rejects unwanted background noise and minimizes off-axis coloration.

Beneath the SM7's integral foam windscreen is a rugged steel cage that



surrounds and protects the cartridge from damage. And Shure's patented air suspension shock mount offers uncompromising isolation, cutting down on the effects of mechanical vibration in the studio.

Engineers will also appreciate the built-in humbucking coil that guards the SM7 against electro-magnetic interference.

With so many talents, it's no wonder the SM7 is following in the successful footsteps of Shure's legendary SM5. And that's quite an act to follow.

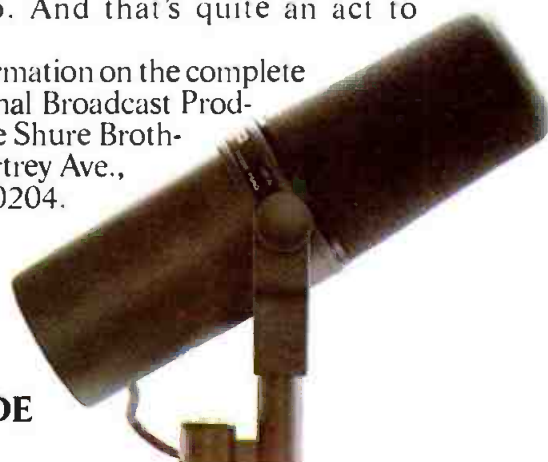
For more information on the complete line of Professional Broadcast Products, call or write Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60204. (312) 866-2553.

# SHURE

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[www.americanradiohistory.com](http://www.americanradiohistory.com)





The VOA system is made up of a vast technical network that stretches across the country and around the world. The VOA inventory includes:

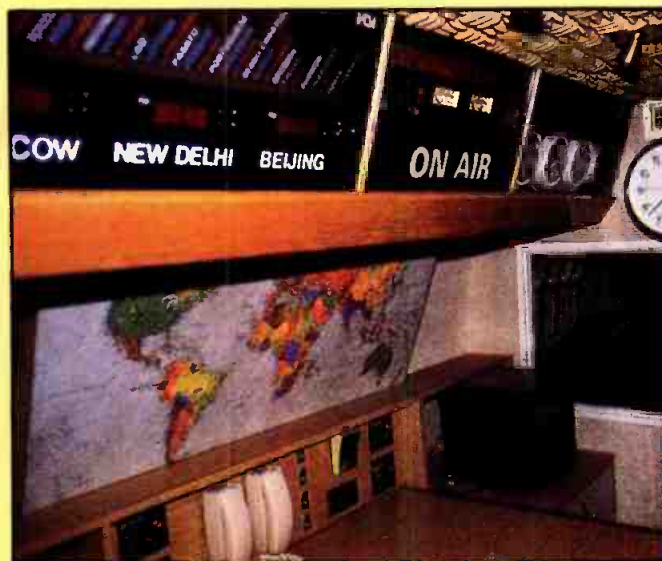
- Studios—31 in Washington, DC; two in New York; one in Chicago; one in Los Angeles; one in Miami.

- Domestic transmitters—34, located in Delano and Dixon, CA; Marathon, FL; Greenville, NC; Bethany, OH.
- Overseas transmitters—77, located England, West Germany, Greece, Liberia, Morocco, the Philippines, Sri Lanka, Thailand, Antigua and Botswana.

- Power—Total of 111 transmitters—21,820,000W.
- Satellite circuits—18 commercial circuits are used to feed VOA overseas relay stations, which in turn beam programs on medium wave and short wave frequencies to listeners in the Middle East, Europe, East Asia and the Pacific.



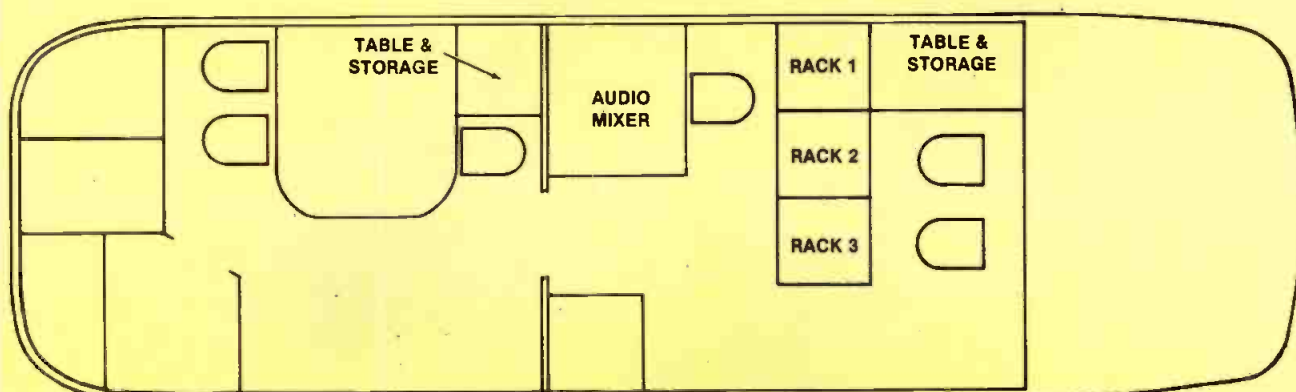
The exterior of the VOA's new mobile production studio.



Part of the interior studio area of the Voyager.



The control room of the Voyager.



The floor plan of the VOA Voyager mobile production and air studio, built by Shook Electronic Enterprises, San Antonio, TX.





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March 1985 **Broadcast Engineering** 153

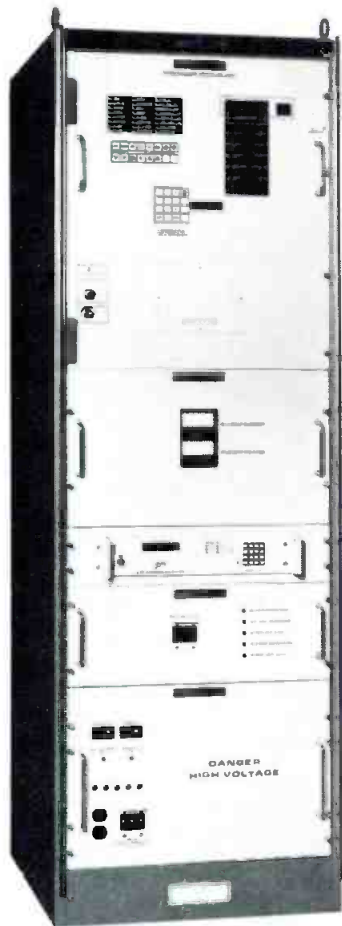


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in the continuously evolving line of MCL's State-of-the-Art Satcom transmitters. Options include the M/N 13049 microprocessor controlled Channel Selector unit.

Used throughout the world, the desirability of MCL microwave transmission equipment constantly grows. This includes Satcom C- and KuBand TWTAs (75W-3KW), instrumentation TWTAs Satcom and instrumentation KPA's and coaxial low frequency transmitters.

MCL assures you of 24 hour maximum parts replacement; provides 24 hour — 7 day access to MCL personnel for assistance in installation or servicing.

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allow the system to deal with strong adjacent-channel signals, as well as weak and strong co-channel signals from transmitters in the network. A receiver with inadequate headroom will clip and yield distortion. Wide dynamic range active devices should be used in the receiver front end, such as gallium arsenide field effect transistors (GaFETs).

Consider the need for a pre-amplifier or cavity preselector network ahead of the first RF stage. RF pre-amplifiers can add sensitivity, but they can also cause overload conditions in the presence of medium-level co-channel signals. Preselectors are often necessary at mountain-top or antenna farm locations because of the high-level RF signals present at such sites.

It is not uncommon to have a 1kW land mobile paging transmitter operating in the 454-455MHz range located nearby an RPU band receiver that is working in the 455-456MHz frequencies. High power FM or TV transmitters can also cause desensitization of the receiver front end, unless adequate bandpass filtering has been included in the receiver design.

The locations commonly used for relay sites are seldom ideal from an environmental standpoint. They are often inaccessible during portions of the year, hot in the summer and cold in the winter. For this reason, select equipment that is rugged.

Temperature extremes can cause problems for frequency-determining elements and receiver accessories such as cavity filters, preselectors and pre-amplifiers.

Because relay sites are often difficult to reach, equipment should be designed for easy maintenance, preferably through module replacement. Keep a spare stock of modules at the site so that the system can be quickly returned to operation in the event of a failure.

The defective module can then be serviced at studio, or returned to the factory for repair. It makes little sense to haul a truck full of test equipment to a remote site whenever a problem occurs. It is not cost-effective, either.

Conduct regular performance tests of the RENG system, just as you would with any other important piece of equipment at the station. Regular checks and measurement often allow the engineer to spot problems that could cause a total system failure, if left unattended.

If you have trouble with a piece of receiving equipment, do not overlook the possibility of interference from other services. A spectrum analyzer is invaluable for such work. [:-:~))]]

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SP multi-track unit

360 single-track units

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CN 226 for  
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EACH PRODUCT IS DESIGNED TO PERFORM TO THE SAME DEGREE OF PRECISION AND RELIABILITY THAT HAS MADE OUR ROUTING SWITCHERS THE INDUSTRY'S STANDARD OF COMPARISON, AND EACH IS BACKED BY OUR FIVE YEAR WARRANTY ON BOTH PARTS AND LABOR.

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DYNATECH BROADCAST GROUP

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TWX: 910-925-4037  
Circle (118) on Reply Card



## CORPORATE DATA

**Interactive Systems**, Boulder, CO, has merged with the Grass Valley Group, Grass Valley, CA. The agreement went into effect on Feb. 1. As part of the agreement, ISC moved operations to Grass Valley. Sales and customer service will be combined in April, starting with NAB '85.

**Artel Communications**, Worchester, MA, has relocated its research and development operations to Marlboro, MA. The new location will exclusively deal with the company's engineering activities. Corporate headquarters will remain in Worchester.

**Mitsubishi and Wold Communications**, Los Angeles, have announced an agreement to jointly pursue new telecommunications business in Japan and the United States. The first project will be to market transpacific communications between Tokyo and Los Angeles. Intelsat channels, through Comsat and KDD, will initial-

ly be used to offer the service.

**Adams-Russell**, Waltham, MA, and **Tele-Measurements**, a New Jersey-based company, have announced an agreement establishing Tele-Measurements as the East Coast sales and systems integrator. Tele-Measurements will represent Adams-Russell in New Jersey, New York, Delaware, Pennsylvania, Maryland and southern Connecticut.

**Panasonic Industrial**, Secaucus, NJ, has announced the signing of Satellite Reception Systems, Athens, OH, to distribute Panasonic's satellite television receiving equipment. SRS will distribute Panasonic's C-band low noise block down converters and satellite receivers. The agreement began March 1.

**AKG Acoustics**, Vienna, Austria, has taken over ownership and operations of AKG Acoustics, Stamford, CT. The Stamford company was affiliated with North American Phillips for 20 years. The parent company will take over all U.S. distribution.

**General Electric Information Services**, Rockville, MD, has announced an agreement with Bonneville Telecommunications, Salt Lake City, to jointly market both companies' services for providing point-to-point and point-to-multipoint communications. This will allow Bonneville Data Network users to transmit data to Bonneville on GE's Mark-Net service.

**Cohu**, San Diego, has announced that an agreement to acquire 100% of the outstanding stock of Broadcast Microwave Services, San Diego, for 50,000 shares of Cohu common stock has been completed. BMS will operate as a wholly owned subsidiary of Cohu.

**Tom Hay**, formerly vice president and director of engineering for MCI/Sony, has announced the formation of Heie Engineering, Ft. Lauderdale, FL. Its first product, the Commander BCI on-air console, was available for delivery in January.

**Paltex**, Tustin, CA, a designer,

*Continued on page 160*



*"Our savings from Shook were substantial...(they) watched our pennies as if they were (their) own."*  
John Crowe, John Crowe Productions

*There are 3 reasons  
John Crowe Productions  
came to Shook.*  
1. They needed a fast  
delivery  
2. They demanded  
Network quality and

## WE STAYED IN THEIR BUDGET

See us at NAB Booth #1310

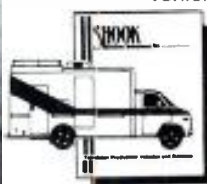
# SHOOK

ELECTRONIC ENTERPRISES, INC.

6630 Topper Parkway San Antonio, Texas 78233 (512) 653-6761

### WE MAKE 'EM ALL SIZES

Size is a matter of need...and choice. Shook manufactures mobiles that range from ENG Vans up to 45 foot network production trailers. Shook vehicles are custom built



to meet your exact requirements, ready for your equipment or turn-key, with your choice of equipment.

Shook feels the most important thing about custom crafting mobile facilities is to deliver quality...and stay within the budget. That's probably why we're the fastest growing television production vehicle manufacturer in the southwest. Don't let all those little plush extras like trim and surprise storage areas fool you when you look into a Shook van—they may look like deluxe features but they're standard items with no hidden cost. We guarantee our product to have the quality you expect and that's why Shook mobiles serve the industry nationwide.

Circle (312) on Reply Card



# BIG NEWS. SMALL PACKAGE.



Announcing Thomson Betacam.™ The smallest, lightest 1/2" camera/recorder ever. All in one neat package. With superior signal-to-noise performance. Designed with both ENG and EFP operators in mind. For on-the-spot news gathering or complicated field production, now there's a system just right for you. And your budget. Because Thomson Betacam also carries the lowest price tag.

Available in one- or three-tube camera models, Thomson Betacam utilizes the newest electronics and manufacturing techniques. A 2/3" 'Mixed Field' Saticon tube design that virtually eliminates beam de-focusing. A VTR featuring a rugged new recording format with



greater chrominance bandwidth and signal-to-noise ratio. Built-in Dolby® noise reduction for high-quality audio. And a cassette player with TBC as standard, providing full broadcast quality output. Plus, the playback unit can be interfaced with U-Matic® and one-inch editing systems. This makes Thomson Betacam the ideal complement to your existing production equipment.

It's the smallest, lightest, most precise, camera/recorder system.

It's easy to operate. And it's energy efficient. Thomson Betacam is setting new standards for performance and flexibility in a fully integrated camera/VTR system. All of it at a very affordable price.

Get the whole story. Call or write Thomson-CSF Broadcast, Inc., 37 Brownhouse Rd., Stamford, CT 06902. Tel. (203) 965-7000. TWX (710) 474-3346. Telex 6819035-



Answer Back 6819035 TCSB UW.

**THOMSON BETACAM.  
ONE FOR ALL.  
ALL IN ONE.**

**THOMSON-CSF  
BROADCAST, INC.**

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U-Matic and Betacam are registered trademarks of Sony Corp.

Circle (117) on Reply Card



## Continued from page 8

With full single channel (left, for example) modulation in an AM stereo system using a matrix audio processor, the following conditions exist:

- The main channel (L+R) is modulated 50%.
- The stereo (L-R) channel is modulated 50%.
- Total FM carrier modulation level remains at 100%.
- Mono FM receiver loudness decreases 50% (a 6dB loss).
- Stereo receiver left channel loudness (in this example) remains constant.
- The stereo receiver right channel goes to zero.

There is a catch, however. First, most AM stereo systems cannot decode a signal with fully modulated

Second, to maintain consistent listening levels on stereo AM receivers, modifications to the simple matrix (L + R and L - R) audio processing method are required. These problems will be examined in the April's "AM Stereo Update."



## Continued from page 158

**General Instrument, New York, has announced that its Jerrold Division has been selected to supply CATV electronics equipment to STL Cablevision Partners, St. Louis. The company will purchase all needed electronics to construct the St. Louis cable system.**

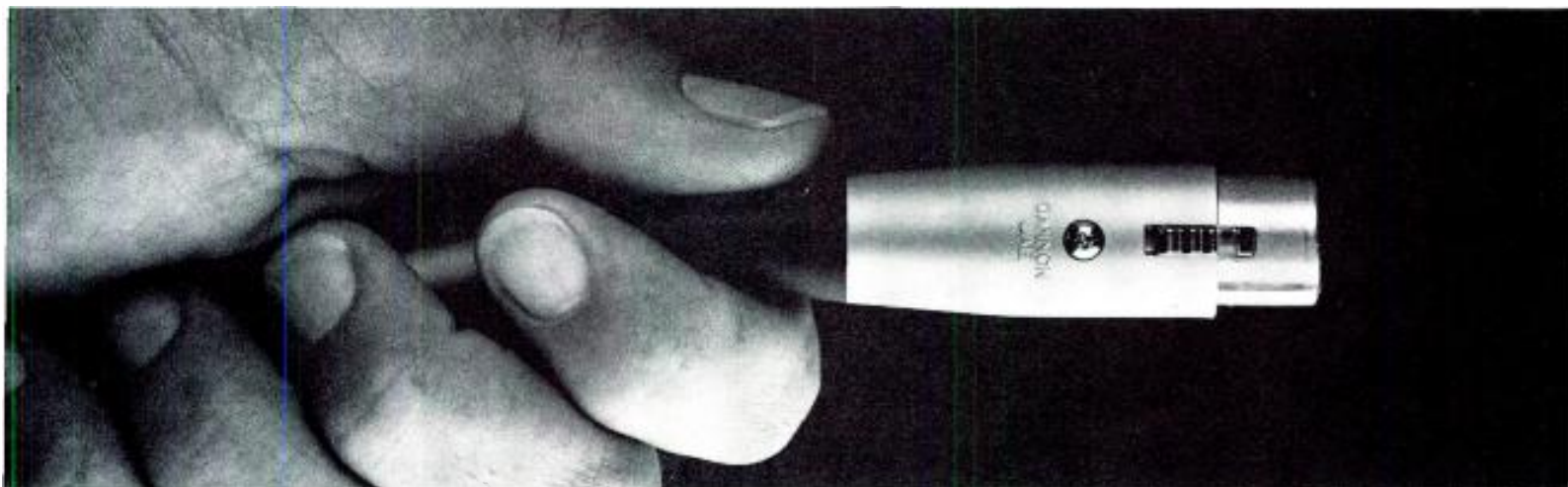
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[www.americanradiohistory.com](http://www.americanradiohistory.com)



# Protect your investment with a cannon.

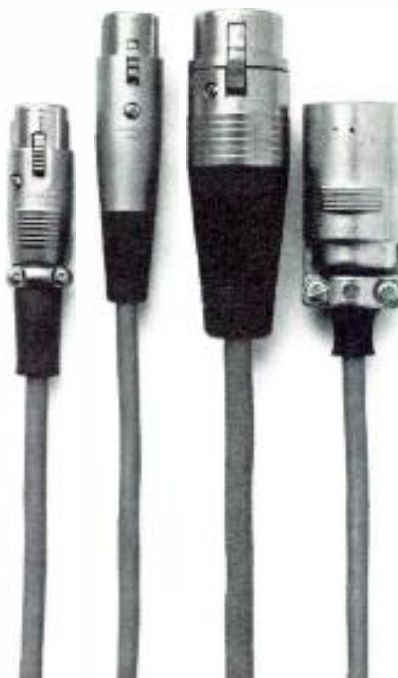


An audio connector by any other name is simply not an ITT Cannon audio connector. Which is precisely why so many audio engineers continue to specify Cannon® connectors for use with their audio equipment.

The XLR, the new XLB and XLA series are small, rugged, quick-disconnect connectors designed for use in audio/video and other low-level circuit applications where reliability, quiet operation, elimination of mechanical interference and ease of use are necessary. Four different plug styles are available.

The EP connector is ideally suited to applications where extreme ruggedness and versatility are required. The new AP connector is a popular choice for heavy-duty audio applications and is interchangeable and intermateable with the EP series. Both the EP and AP series may be used where as few as 3, or as many as 18 contacts are required.

## Audio Connectors from Cannon



The AP LNE and AX LNE are specifically designed to handle the special needs of mains and other power supply applications.

For more information, please contact Commercial/Industrial Products Marketing Manager, ITT Cannon, a Division of ITT Corporation, 10550 Talbert Avenue, Fountain Valley, CA 92708, (714) 964-7400. For the sales office nearest you, call toll-free (800) 845-7000.

Now available at the following stocking locations:

XLR/XLB at:  
Time Electronics  
Ramtronix

EP/AP at:  
Ritchey Electronics  
Yale Electronics  
Connector Corp.  
Ramtronix

**CANNON ITT**  
The Global Connection

Circle (119) on Reply Card





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

Perhaps we have.  
Thanks to the success of  
Studer recorders, we're often thought of as  
strictly a tape recorder company. But, Studer has also  
been making audio consoles for over 16 years, and doz-  
ens 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 pro-  
duction 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 sys-  
tem 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 1/4" 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 pre-amps 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.

# STUDER REVOX

Circle (120) on Reply Card



Various numbers of channels are proposed, with the predominant configuration having six channels per satellite.

The FCC's basic rules for defining DBS systems are that they must operate in the Broadcast Satellite Service (BSS) frequency band (12.2-12.7GHz) and use a minimum channel transmit output power of 100W for half-conus coverage. This assures adequate signal power and performance margin for 3-foot diameter receiving antennas.

At the same time, the risks associated with this type of satellite technology are great enough that the FCC has not excluded the possibility of DBS-type services in the Fixed Satellite Services (FSS) portion of the Ku-band, just in case the true DBS technology proves to be too risky or too costly.

## Ku-band

Medium-power Ku-band satellites, operating in the 11.7GHz-to-12.2GHz band, offer the most practical DBS-type technology for the next few years. The United Satellite Communi-

cations system is a good example, which has operated for the past year offering a 5-channel service direct to 4-foot diameter roof-mounted dishes.

The USCI system has been a technical success and a business disappointment. The technical success of the USCI system is significant for the DBS industry, however, and it may have been a factor in the decisions by CBS, Western Union, RCA and Comsat to delay entry into the DBS market.

A very important factor in favor of other systems patterned after the USCI model is that the number of medium-power Ku-band satellites in orbit will increase dramatically in the next two years. These satellites will offer 40W and 50W TWT output amplifiers, which is double the power available on the satellite carrying the USCI services.

This will provide another 3dB of EIRP to work with to potential DBS-type systems, and reduce even more the technical advantage of going to higher power DBS satellites.

As the three segments of satellite technology develop, they will play an increasingly important role in the broadcasting industry. Satellites are

natural signal distributors and also offer tremendous advantages in terms of network control and remote feeds, as demonstrated by the NBC network. Satellites also provide several opportunities to small broadcasters.

LPTV stations expected to go on the air in the next few years can utilize satellite feeds as the cable industry has done in the past 10 years. Regional television and radio networks can be configured easily and cost-effectively via satellite, making possible a new segment of the industry.

Video teleconferencing and high definition TV are two more important and related segments of satellite technology for broadcasters because of new opportunities that will be presented. Information age trends are also significant, as more information services find a path into the home via satellites and broadcasting channels.

The broadcasting industry has an opportunity to take advantage of the potential in satellite technology, and the extent to which this happens will be determined by its understanding of all of the facets of this new technology.

1:~>))))

## Whose new AGC packs 110 dB of dynamic range into 1-3/4 inches of rack space?

Only the new Harris Ulti-Mate 91 Tri Band AGC! Here's more signal shaping flexibility than you'll get from anything else on the market...with phase coherent design that won't degrade even digital source material. Ulti-Mate's phase coherent circuitry insures waveform fidelity and minimizes distortion as signals are processed and amplified.

**Improve any audio source**  
You'll hear the difference immediately. Beef up your audio chain with Ulti-Mate's unprecedented 110 dB dynamic range. Use it as your final broadband limiter. Put it in front of your Optimod or other audio processing system for a remarkable improvement in sound. The linear VCA gain control allows extraordinary processing capability to enhance even the purest system.

### Stereo Ready

When you're ready for stereo—whether it's AM, FM or TV—so is Ulti-Mate 91. It's totally compatible with all broadcast stereo systems. And it can drive your STL, too.

### Takes only 1 1/4" of rack space

The Harris Ulti-Mate 91 Tri Band AGC slips neatly into 1 1/4" of vertical rack space (3 1/2" for stereo version). Adjustments are deftly concealed but easily accessed through a slide-out drawer. And if unauthorized adjustments are a concern, secure tamper proofing is easily achieved.

### First-rate equipment for first-place ratings

Good sound is the currency of Radio;

it buys audience. Ulti-Mate gives you better dynamic equalization through the phase coherent Tri Band AGC, for markedly improved signal transmission. At a surprisingly low cost.

The Harris Ulti-Mate 91 Tri Band AGC. Audio processing has never been this good. For more information, contact Harris Corporation, Studio Division, P. O. Box 4290, Quincy, Illinois 62305. 217/222-8200.

 **HARRIS**



## For your information, our name is Harris.

Circle (121) on Reply Card



# To know how good your camera tube is, look it straight in the eye.

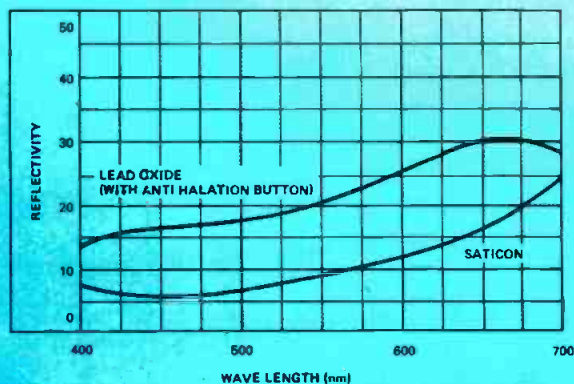
Saticon II

Plumbicon™

For better color pictures, compare the color of the photoconductors.

This simple comparison demonstrates why you'll get better broadcast quality with Saticon® II. The dark red faceplate of Saticon II shows its selenium-arsenic-tellurium photoconductor. The lighter reddish-yellow faceplate of the Plumbicon™ tube reveals its lead-oxide photoconductor.

This color difference indicates significant Saticon II advantages. Because the darker photoconductor absorbs more light, picture quality is enhanced. On the other hand, Plumbicon's lighter color photoconductor reflects more light at all visible wavelengths, as shown in the chart below.



Because Saticon II reflects less light, you benefit with reduced flare and less blooming. Low-light colors maintain their integrity and accuracy.

As a consequence, Saticon II does a remarkably good job of handling high contrast scenes in uncontrolled lighting conditions because of its low flare. What's more, Saticon II's photoconductor is a glassy, amorphous, high resistivity film. Its structure serves to ensure high resolution, high sensitivity and unmatched depth of modulation.

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

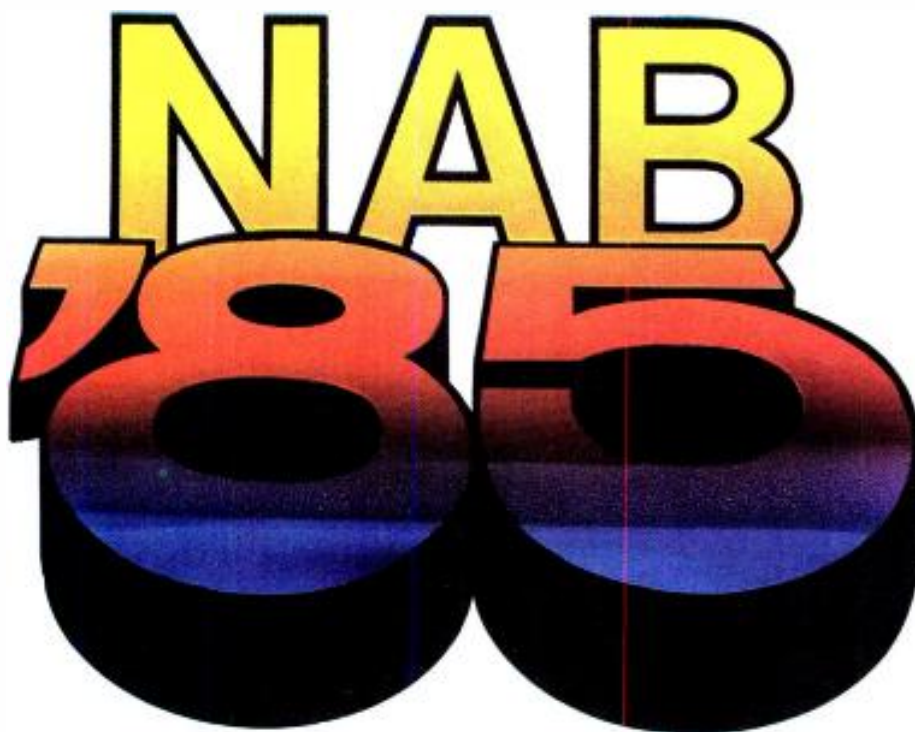
\*Used by permission of trademark owner.

# RCA

**Take out the doubt.**

Circle (122) on Reply Card





This special section alphabetically lists the NAB-'85 exhibitors and previews products to be on display in Las Vegas. The parenthetical number following the exhibitor name is the booth site in the convention hall.

Below each exhibitor listing are two more numbers. The number on the left that reads, "Circle (#)," is the number on the Reader Service Card that you may circle to receive additional information from that manufacturer. If the exhibitor is advertising in this issue, the page of the advertisement is indicated by the red callout reading, "See ad page #." You may obtain more information about the company and its products by referring to the ads.

Although this listing is as comprehensive as possible at press time, there are changes and additions occurring every day in exhibitor sign-ups, products to be shown and booth assignments. Check the final program at NAB '85 to make your final plans.

## Exhibitor listings

### **ABP Systems (1607A)**

Product line \_\_\_\_\_  
Consultant services, facilities planning, design and construction, transmission system repairs.  
Circle (400)

### **ADC Magnetic Controls (1320)**

Introductions \_\_\_\_\_  
• Dense Patch: insulation displacement (punchdown terminal block).  
• MH20: modular hybrid audio and video patching system, self-adhesive patchbay designation strips.

Product line \_\_\_\_\_  
Prewired audio and video patchbays, coaxial patching equipment, interface panels, hum filters.  
Circle (401) See ad pages 92-93

### **ADDA (1100)**

Product line \_\_\_\_\_  
TBC/frame synchronizers; still-stores; editing controllers; random-access playback systems.  
Circle (402)

### **ADM Technology (1223)**

Introductions \_\_\_\_\_  
• Post-pro: compact audio console with 8-to-12 VCA inputs; interfaces to video editors via integral GPI or optional serial interface; in-line EQ, dual monitor buses.  
• S/TV: 24-input TV console with VCA control, any mix of mic or stereo line inputs; in-line or aux EQ or preselect; mono or stereo outputs; submastering.

Product line \_\_\_\_\_  
Audio consoles for stereo radio and television on-air and production or post-production.  
Circle (403) See inside front cover

### **AF Associates (1609)**

Introductions \_\_\_\_\_  
• Commercial compilation system: computerizes assembly of daily spot, promo reels, uses existing VTRs.  
• AVS6500: digital standards converter.  
• TV mobile production vehicles.  
Product line \_\_\_\_\_  
Turnkey TV production vehicles and fa-

cilities; standards converters; audio consoles; audio DAs; TV cameras; monitors; high-tech TV products.

Circle (404)

### **AKG Acoustics**

Product line \_\_\_\_\_  
Phono cartridges; microphones; pre-amps; headphones; audio delay system.  
Circle (405) See ad page 90

### **AMCO Engineering (1218)**

Product line \_\_\_\_\_  
Communications consoles; equipment racks; aluminum structural system; blowers, fans; EMI-rated racks.  
Circle (406) See ad page 187

### **AMEK Consoles (1620)**

Introductions \_\_\_\_\_  
• M 2500 STV: 36x24 stereo teleproduction audio console.  
• Scorpion: 24x16x2 broadcast production console.  
• MX: 16x8x2 broadcast console.  
• ANGELA: 28x24 stereo television audio console.



# Discover a high-performance mixer with a personality all your own.

## The Ramsa WR-8616.

Inside every recording engineer is the desire for more creative control at the board.

Now there's a post-production/recording mixer designed to make your sessions sound more like you. And less like everybody else's. The Ramsa WR-8616. And its modular design is as ambitious as your needs.

You can have 16 channels of either full stereo or mono modules. Or a combination of the two.

The WR-8616 will also save you valuable time. By letting you simultaneously monitor as many as 16 channels on a multi-track machine while recording.

What's more, this high-performance mixer gives you two discrete mixes. This allows for full monitoring capability, which can be independent from the control room's mix.

#### SPECIFICATIONS:

- $\pm 4\text{dB}$ , 600-Ohm Line Input and Output Signal Levels
- Frequency Response: 20-20,000Hz;  $\pm 0.5\text{dB}$  to  $-2.0\text{dB}$
- Noise:  $-128\text{dB}$  (IHF "A" WTD, 150 Ohm)
- THD: 0.05% typical at 1kHz,  $+20\text{dB}$ M
- CMRR: Greater than 80dB typical

And in the mixdown, you'll have access to all 16 inputs without having to repatch or reset the board.

You'll also find the 3-band continuously variable input EQ will give you more precise control over the highs, midrange and lows. And the six-channel remote start/stop capability lets you program materials using turntables, or tape and cart machines.

To make the WR-8616 even more compatible, we've given it a dual set of meters. Eight LED bar graphs will monitor the 16 input signals. While the six VU meters handle the Master, Group, Send, Echo outputs and Solo level.

And the balanced Mic and Line inputs and Main outputs won't let any unwanted noise come between you and your sound.

The Ramsa WR-8616. A post-production/recording mixer designed to treat you like an individual.

# RAMSA



Please send me more information about the Ramsa WR-8616.

Name \_\_\_\_\_ PLEASE PRINT

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone ( ) \_\_\_\_\_

Return Coupon To: Panasonic Industrial Company, Professional Audio Systems, One Panasonic Way, Secaucus, N.J. 07094.

See RAMSA at NAB  
audio hall booth 437

**Panasonic**  
PROFESSIONAL AUDIO SYSTEMS



Supplier of Sound Systems  
for the 1984 Olympic Games



AMEK, continued

- BCO-1-II: portable ENG field mixer.

Product line \_\_\_\_\_

Audio consoles for production, recording, ENG.

Circle (407)

**AMP Special Industries (634)**

Product line \_\_\_\_\_

Connectors, coaxial, hex screw; fiber-optic devices; pistol grip tools.

Circle (408)

**ANT Telecommunications/  
SOLWAY (2351)**

Introductions \_\_\_\_\_

- Telcos-MC: routing switcher system.
- NEWSWIRE 2000: newsroom computer and automation system for press agencies, television and radio.

Product line \_\_\_\_\_

Switching systems; audio noise reduction equipment; automation systems.

Circle (409)

See ad page 100

**ASACA/ShibaSoku (1017)**

Introductions \_\_\_\_\_

- ACL-6000B: Betacam format automation system; holds 600 cassettes for random access; barcode ID.
- Standards converter: NTSC, PAL and SECAM capable.
- Digital still-store system.
- Stereo aural TV generator.
- HDTV system.

Product line \_\_\_\_\_

Video switchers; audio, video test equipment; videocassette automation; still-

stores; editing system accessories; standards converters; stereo television, HDTV equipment; video monitors.

Circle (410)

See ad page 63

**ATI-Audio Technologies (420)**

Introductions \_\_\_\_\_

- MM100: Match-Maker bidirectional IHF to 600Ω level and impedance matching interface.
- DP100: Disc-patcher IHF to 600Ω matching interface for CD digital players.

Product line \_\_\_\_\_

Phono preamps; audio mic, line amps; audio DAs; power amps; level metering.

Circle (413)

See ad page 171

**AT&T Communications (407)**

Product line \_\_\_\_\_

Program distribution services; promotion management; teleconferencing, information management via data services.

Circle (411)

**AT&T Information Systems (1429)**

Product line \_\_\_\_\_

Teleconferencing and communications products.

Circle (412)

**Abekas Video Systems (1228A)**

Introductions \_\_\_\_\_

- A62: Digital video recorder, Winchester disk-based, with 50s or 100s capacity; random-access, variable-speed, single-frame or real-time simultaneous record play; can interface to editing con-

trollers.

Product line \_\_\_\_\_

Still-stores; digital special effects systems.

Circle (414)

**Accu-Weather (1010A)**

Introductions \_\_\_\_\_

- Database: real-time weather database; forecasts and data; access on as-needed basis; low cost. Satellite imaging: cloud coverage of entire hemisphere or U.S. sections; for on-air presentation.
- National Radar: precipitation patterns throughout continental United States.
- Graphics: news, sports, financial graphics package, for on-air use; available on 24-hour basis.
- NAFAX: weather charts, maps accessed through weather graphics system; usable in meteorological forecasting.

Product line \_\_\_\_\_

Weather data, graphics service.

Circle (415)

**Accurate Sound (632)**

Introductions \_\_\_\_\_

- AS-200LB: high-speed, loop-bin system for cassette duplication, operating at 120ips, 240ips or 480ips.
- Starbird 180RP: remote panner adapter for the Starbird 180 mic boom.
- AF100-DF: servo motor replacement for Ampex, Scully and other popular ATRs.

Product line \_\_\_\_\_

Tape duplicators; recording heads; distributor of audio products.

Circle (416)

## TURN-ON TO COMTEK... IT'S TIME YOU HEARD FROM US!

We've been making sound believers out of critics of wireless microphone systems for nearly fourteen years. Contractors and engineers throughout the country have come to **depend on COMTEK** for:

- WIRELESS MICROPHONES, FULL DUPLEX COMMUNICATIONS, PERSONAL CUING SYSTEMS, RF ASSISTIVE LISTENING DEVICES FOR THE HEARING IMPAIRED.

- SYSTEMS OPERATING IN THE HIGH BAND FREQUENCIES UP TO 216 MHz.

- GUARANTEED PERFORMANCE AND HIGHEST BATTERY EFFICIENCY IN THE INDUSTRY FOR RELIABLE OPERATION.

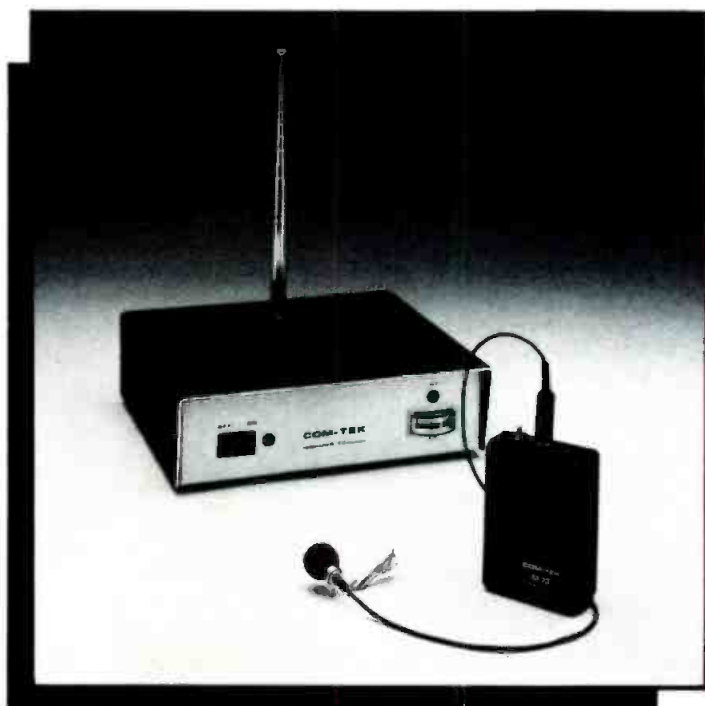
- FACTORY TECHNICAL SUPPORT AND A FULL ONE-YEAR WARRANTY PLUS 24-HOUR TURNAROUND SERVICING ON COMTEK EQUIPMENT.

See Us at NAB Booth 1122B

# COMTEK®

357 West 2700 South, Salt Lake City, Utah 84115

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**First quality in wireless sound**

FOR FULL PRODUCT INFORMATION  
CALL COMTEK OR YOUR NEAREST  
COMTEK DEALER TODAY.

Phone: (801) 466-3463



# MULTI-TRACK PRODUCTION FOR MERE MORTALS

Otari's Mark III-8 and Mark III-4 audio machines are helping today's radio broadcasters meet the challenge from music video and stereo TV by allowing a Producer's creativity to soar to new realms. And, they keep costs down to earth.



The Mark III-8 eight channel, and Mark III-4 four channel recorders give you exciting and affordable aids to creativity that can quickly be mastered, even if you, until now, followed the two-track path. With eight channels, you can lay down stereo music tracks, cross fade from one stereo program to another, layer effects, or multiply voice overs — on one tape, on one machine. Spots are created more efficiently, and are more effective.

So don't wait for divine intervention to determine the fate of radio. Make it happen today with *the stereo production machines*, from Otari: The Technology You Can Trust.

Contact your nearest Otari Dealer for a demonstration, or call Otari Corporation, 2 Davis Drive, Belmont, CA 94002 (415) 592-8311 Telex: 9103764890

Circle (125) on Reply Card

**OTARI**®





# SHIVELY LABORATORIES FM and TV ANTENNAS



FM MODEL 6814 25KW PER BAY



FM MODEL 6810 10KW PER BAY



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Booth 623

## SIRA TV MODEL UTV-01/24

PATTERN STUDIES AND  
OPTIMIZATIONS AVAILABLE

WRITE OR CALL FOR INFORMATION ON  
ANTENNAS  
TRANSMISSION LINE  
FILTERS  
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TWX 710-223-8910  
Shively BRGT

## Acrodyne Industries (1228)

### Introductions

- TLU/1KAC: 1kW UHF LPTV transmitter.
- TRU-5KA: 5kW UHF TV transmitter.

### Product line

UHF, VHF TV transmitters, translators, 1W to 10kW.

Circle (417)

## Adams-Smith (1508)

### Introductions

- 2600BPI: Bi-phase interface module to tape synchronizer, permits sprocketed film transport control by external bi-phase signals to be masters or slaves.
- 2600VRG: Video reference generator, develops crystal-referenced NTSC, PAL composite sync signals for applications that do not require a sync generator.

### Product line

LTC, VITC time code generators, readers, character inserters and translators; tape machine synchronizers and communications interfacing; event/edit controllers, displays.

Circle (418)

## Advanced Designs (1620C)

### Introductions

- DOPRAD II: Doppler weather radar system, with 768x480 pixel resolution; pan, zoom, fast frame time lapse looping and animation; 16 display levels, 4096 colors, 100-image storage.
- RCD-1000: remote radar display unit including six calibrated color rainfall rates; pan, zoom, auto time lapse; dial-up NWS display of 100nm and 200nm calibrated ranges.

### Product line

Doppler weather radar products.

Circle (419)

## Advanced Imaging Devices (1782)

### Introductions

- Ct1500: videographic printer.

Circle (420)

## Advanced Music Systems (1330)

### Introductions

- RMX16 updates: software improvements.
- DMX15-80S: keyboard interface, allowing volt-per-octave control of digitally sampled material
- Timeflex: digital audio time compression, expansion device.
- DMX15P: dedicated profanity digital delay with edit and catchup circuit.

### Product line

Digital audio products, including reverb systems; audio delays; pitch changers; time compression systems.

Circle (421)

## Agfa-Gevaert (1608)

### Introductions

- Broadcast Plus 1: type C videotape in 34-, 66-, 96- and 108-minute lengths in flame retardant shipping cases.

### Product line

Videotape products in ¼-inch and ½-inch Beta and VHS formats.

Circle (337)

See ad page 21

## Alamar Electronics (1507B)

### Introductions

- MC-2000: TV automation system with intelligent machine controller; directory program cross-references tape di-

rectory; SMPTE time code controller and multiterminal software.

### Product line

TV commercial insertion and program automation.

Circle (422)

## Alden Electronics (1785)

### Introductions

C2000D/C: color weather radar display system, designed for radio users, accesses National Weather Service by direct or dial-up lines.

### Product line

Color weather display systems for live radar or satellite weather graphics.

Circle (423)

## Alexander Mfg. Co. (1714)

### Product line

ENG, VTR battery packs; battery chargers, analyzers.

Circle (424)

See ad page 192

## Allen Avionics (1627)

### Product line

Video, pulse delay lines; video filters; hum filters; pre-, de-emphasis networks.

Circle (425)

See ad page 249

## Allied Broadcast Equipment (639)

### Introductions

- DSP-2000: Compusonics audio computer generates, controls, processes, reproduces digital audio.

### Product line

Distributors for a range of audio and RF products.

Circle (426)

## Allied Tower (409)

### Product line

Towers and services for AM, FM and television.

Circle (427)

## Allsop (1177)

### Introductions

- 67,000: U-matic cleaner, update includes cleaning ribbon.
- 62,000: recorder cleaner.
- 63,000: Beta format cleaner for professional use with Betacam; Recam compatible.

### Product line

Video recorder care products.

Circle (428)

## Alpha Audio (210)

### Product line

Acoustic materials.

Circle (429)

See ad page 58

## Alpha Video & Electronics (1790)

### Introductions

- 5850 Alpatize: Sony VO5850 with zero offset time code and time code re-stripping.
- Highband U-matic VCR.

### Product line

Video recorders; production vans.

Circle (430)

## Amber Electro Design (422)

### Introductions

- 5500: programmable noise and distortion analyzer.

### Product line

Audio test equipment; distortion analyzers.

Circle (431)

Circle (126) on Reply Card





# Only the beginning

A thing of beauty . . . this Dynair System 21.

Begin with this single, high density frame using as few as 10 inputs and 10 outputs. Select combinations of video, audio, time code, data, tally, or machine control switch modules.

Grow sensibly, easily and cost effectively to impressive matrices of one thousand inputs and one thousand outputs of every module type by simply adding frames and modules.

Grow into high definition TV, if this possibility is in your future, without changing a thing. Bandwidth of the System 21 is already 30 MHz.

Write or phone. We would like to send you additional information. Give us a chance to begin with you as you upgrade your plant.

## DYNAIR

5275 Market Street, San Diego, CA 92114 U.S.A. Phone (619) 263-7711 TWX (910) 335-2040

Circle (303) on Reply Card



# There's more to than meets

Producing effective multichannel sound isn't easy. Though the procedures borrow heavily from recording studio and film sound techniques, audio for video is a specialist art with a unique set of requirements.

As its early practitioners have discovered, the inherently complex process of stereo teleproduction and post-production can be made even more difficult by cobbling together a collection of modified equipment in the hope of serving these advanced needs.

While makeshift arrangements may satisfy the technical minimums of the task, they introduce tradeoffs in operational flexibility and efficiency which can ultimately affect both production quality and costs.

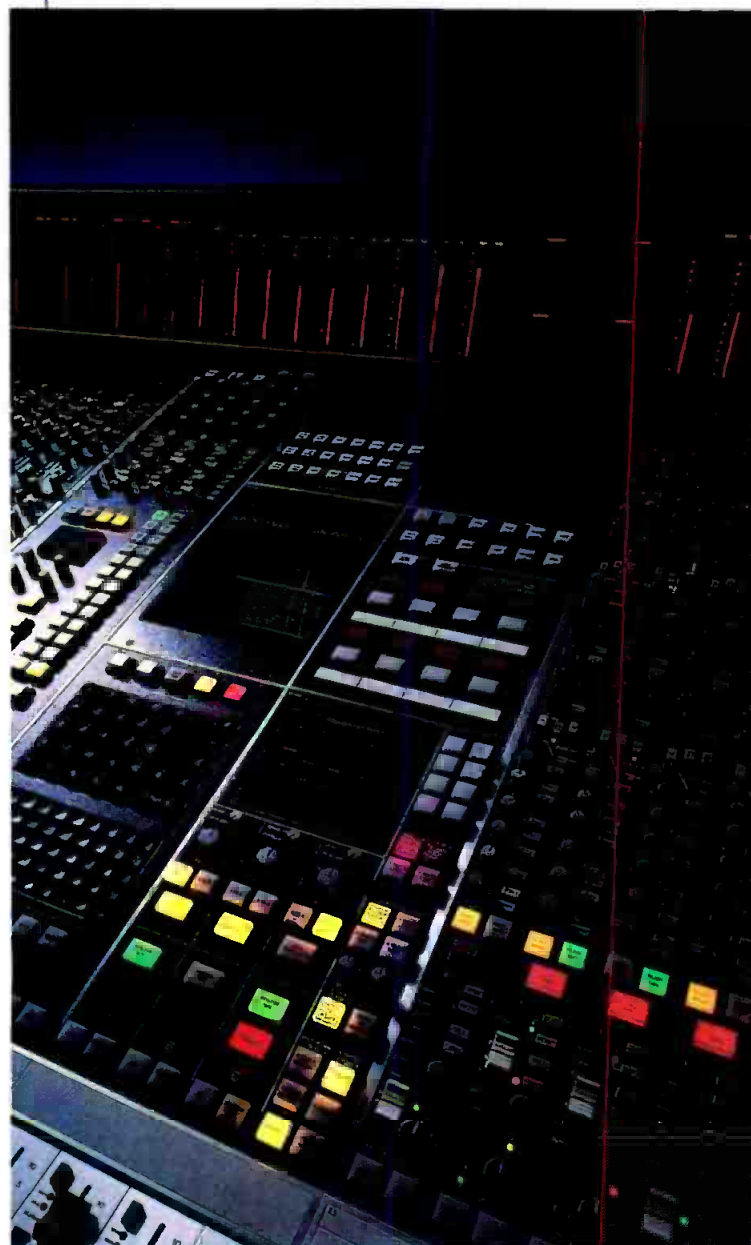
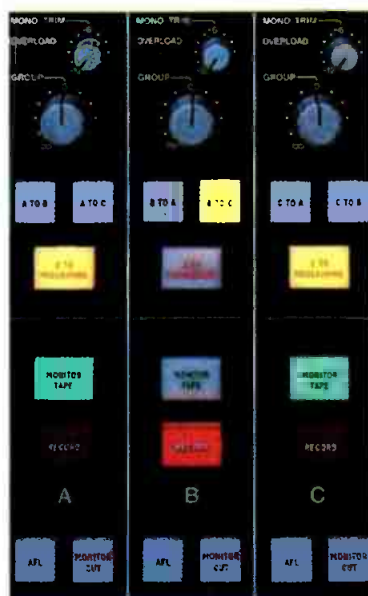
Fortunately there is an alternative, developed for the leading post-production houses and refined in collaboration with major broadcast organizations throughout the world: The SL 6000 E Series Stereo Video System from Solid State Logic.

## SSL Puts it all Together

The SL 6000 E Series is a thoroughly integrated system designed specifically for the stereo video environment. Combining the most advanced aspects of multitrack, motion picture and broadcast audio technology, it provides extensive signal processing, routing and mixing capabilities as well as comprehensive machine control and communications—all commanded by a single operator at a logical, unified control panel.

SSL's multichannel mix matrix allows separate stereo music, effects and dialogue mixes to be created at the same time as the stereo program mix. In live production, multiple stereo splits or mix-minuses can be structured at the touch of a button. Mono composites of each mix are always available, and a mono programme feed is provided. Advanced formats such as stereo plus a secondary audio programme or centre-channel dialogue are also supported.

Changeover between live and post-production modes and different output configurations is instantaneous. The rigid architecture of ordinary consoles is replaced with patchfree audio subgrouping and pushbutton signal processor routing, allowing the engineer to customise the signal flow for each project.





# Stereo Television the eye.

Meticulous electronic design creates the shortest signal path for each requested function, allowing SSL to maintain a dynamic range and bandwidth that far exceeds the performance of even the best 16-bit digital recorders, converters and routing switchers.

## Complete Machine Control



The SSL Stereo Video System also provides the operator with central control of up to five synchronised audio, video and film transports. Cue points are stored and called by timecode, foot/frames or key words.

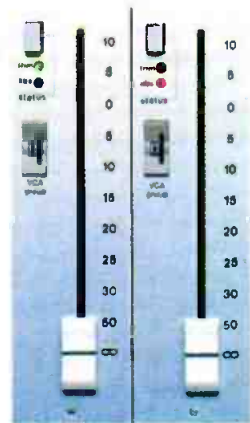
The SSL Studio Computer provides complete list management with floppy disk storage, video display and hardcopy printouts. Distributed processors ensure rapid search and lock-up. There's even a Sync Preset function which automatically calculates offset values between reels and stores these for subsequent setups.

## Dynamic Mixing Automation

The machine control functions are integrated with SSL's audio mixing software to provide powerful, versatile and efficient assistance. Engineers can retain their existing mixing methods, or supplement them with simple yet powerful new routines that allow unlimited frame-accurate mix revisions to be performed with outstanding results and uncanny speed.

SSL's computer assisted rollback and pickup recording enables mixes to be assembled within the automation itself, using traditional techniques. Video layback can then take place in a single first-generation pass, directly from the multitrack!

Beyond fader automation, the SSL System optionally provides programmable parametric equalisation, dynamic stereo panning, and multiple Events Control of up to 32 external devices—each with its own pre-roll memory.



## Total Recall™

SSL's Total Recall computer records the settings of every control on each I/O module. A high resolution display of the stored values interacts with the console, allowing fully detailed setups to be restored to a control accuracy of a quarter dB. Total Recall greatly reduces setup time, maximising productivity and creative continuity.



## Stereo Perspectives

Not all stereo channels were designed to serve video requirements. Only SSL provides parametric stereo EQ, filters, compressors, gates and expanders on stereo inputs as standard, along with image width and stereo reverse controls. There is no easier or more effective way to match music, ambience and effects perspectives with television images.



## Get the Full Picture

As you can see, there is a lot more to producing stereo television than meets the eye. To help you get the full picture, Solid State Logic has published a forty-page colour booklet which thoroughly explains the functions, applications and operation of the SL 6000 E. If you are involved in television production, outside broadcast, video post-production or music video, we'd like to send you a copy. Just drop us a line or give us a call.

# Solid State Logic

## Oxford

Solid State Logic Ltd  
Stonesfield · Oxford  
England · OX7 2PQ  
Tel: (099 389) 8282  
Fax: (099 389) 8227  
Tlx: 837400 SSL OXG

## New York

Solid State Logic Inc  
200 West 57th Street  
New York · NY 10019  
Tel: (212) 315-1111  
Fax: (212) 315-0251

## Los Angeles

Solid State Logic Inc  
6255 Sunset Boulevard  
Los Angeles · CA 90028  
Tel: (213) 463-4444  
Fax: (213) 463-6568



**American Diversified (176)****Introductions**

National pager service, via broadcast SCAs.  
Circle (432)

**American Image Productions (653)****Product line**

Program, production services.  
Circle (433)

**Ameritext (808)****Product line**

Teletext equipment, services.  
Circle (434)

**Amperex Electronic (1412)****Introductions**

- XQ4087: 1/2-inch high-stability camera tube.
- XQ4187: 3/4-inch high-stability camera tube.
- XQ3457: 3/4-inch mixed field camera tube.
- XQ3467: 3/4-inch electrostatic focus camera tube for low cost, high-performance TV cameras.
- YK1233: High-efficiency Klystron.
- YK1263: High-efficiency Klystron.
- 9018/YL1631: Tetrode and cavity for AM, FM or television.

**Product line**

TV camera tubes and accessories; transmitting tubes; TV Klystrons.  
Circle (435) **See ad pages 102-103/271**

**Ampex Corporation (1400)****Introductions**

- ACE plus: updated system, includes more powerful CPU, more RAM, more extensive EDL and Winchester disc in addition to two 8-inch floppy disc drives; upgrade kit for existing ACE systems planned.
- ACE Jr.: software oriented editing controller; full transport control to four VTRs; preview in any mode or combination of audio/video inputs or switcher effects; EDL with all sequence parameters; interfaces to most serial controlled VTRs.
- ADO enhancements: advanced 3-D effects incorporated into system.

**Product line**

Video recorders; post-production systems; video switchers; editing systems; digital effects systems; still-stores; electronic graphics; TBC/synchronizers; audio and videotape; ENG cameras.  
Circle (436) **See ads pages 18-19/59**

**Amtel Systems/  
Evertz Micro Systems (1745)****Introductions**

- EV Bloc: modular time code system, including generators, readers, translators, character inserters, synchronizers, for LTC and VITC modes.

**Product line**

Time code systems; DAs; routing switchers; clocks and timers.  
Circle (438)

**Anchor Systems (1618C)****Introductions**

- AN101: video-powered audio monitor.
- Product line**  
Speaker systems; public address systems.  
Circle (439)

**Andrew (1201A)****Introductions**

- Receive-only earth station: combined Ku- and C-band system uses prime focus design, pedestal mount, 2-degree compliant, dual polarized, 4.5m, fully motorized; available with or without receiver equipment.

**Product line**

Earth station systems for receive only, transmit/receive; TV transmitting antennas; coaxial, waveguide feed lines.  
Circle (440) **See ad page 193**

**Angenieux (1201)****Introductions**

- ENG lens: 14x9, 9-126mm, f/1.6.
- EFP lens: 25x10 HP.
- Studio lens: 15x17, 15x13.

**Product line**

Zoom lens systems for video and cinema cameras.  
Circle (441)

**Antenna Technology (1737)****Product line**

Antennas; earth station systems.  
Circle (442)

**Anton/Bauer (1337)****Introductions**

- Mobile fast charger: single position universal charger.
- Microphase: provides adjustable black burst signal and gen-lock to Micro-Control systems.
- LightLink: fiber-optic link for gen-lock, intercom, camera control and video on one fiber.
- UltraKit: portable 12V lighting kit.

**Product line**

Battery packs, belts, chargers; ac power supplies; portable lighting systems.  
Circle (443)

**Anvil Cases (1112)****Product line**

Equipment transportation cases.  
Circle (444) **See ad page 122**

**Apert-Herzog (1703)****Introduction**

- Film step: Editing system enhancement facilities clean audio edits.

**Product line**

TBC/synchronizers; digital video tester; video DAs; DA ICs.  
Circle (445) **See ad page 256**

**Aphex Systems Ltd. (513)****Introductions**

- 9004: mic pre-amp, modular to fit dbx 900 series rack.
- 402: mic pre-amp, 2-channel, rack-mount, self-powered.
- 9002 Aural Exciter: modular version of the psycho-acoustic audio enhancer, to be housed dbx rack.
- 301 Compellor: combined compressor, leveler and peak limiter in mono-aural format.
- Dominator: intelligent multiband audio processor for broadcast use.

**Product line**

Audio processors for level control and spectral enhancement.  
Circle (446) **See ad page 298**

**Applied Digital Technology (1730)****Introductions**

- Relecon: remote level controller.

- ELT 100: alarm system.

**Product line**

Video correction equipment.  
Circle (447)

**Arrakis (211)****Introductions**

- 150 SC: redesigned audio mixing console.
- 2100 SC: audio console.

**Product line**

Audio mixers; routing switchers; audio DAs; phono pre-amps.  
Circle (448)

**Arriflex (1421)****Introductions**

- Arrilite 600: portable Tungsten light.
- Lightflex: for film and video cameras.

**Product line**

Cine cameras, accessories; lighting equipment; camera support products.  
Circle (449)

**Artel Communications (1163)†****Introductions**

- SL-3000L: fiber-optic transmission system for video, audio or high-speed data; LED-based, laser FM system, single mode; distances to 32km.
- 216-17: Optical fiber system designed for electronic graphics video or data signals.

**Product line**

Fiber-optic transmission systems.  
Circle (450)

**Associated Production Music (150)****Product line**

Music service.  
Circle (451)

**Atlas Tower (443)****Product line**

Power products, services.  
Circle (452)

**Auburn Instruments (1711)****Product line**

Machine remote control systems.  
Circle (453)

**Audico (1343)****Introductions**

- System III-Q: cue-tone feature on video loader for U-matic, VHS, Beta cassettes and 1-inch reels.
- Label sheets: U-matic, VHS, Beta type, pressure-sensitive, for printing, typing or copying machines.

**Product line**

Video, audio cassette tape loaders, reloaders, rewinders for all formats.  
Circle (455)

**Audi-Cord (123)****Introductions**

- E series: cartridge recorders, reproducers, electronic and mechanical updated version of previous A series.

**Product line**

Cartridge recorders, reproducers, multi-decks.  
Circle (454)

**Audio Broadcast Group (637A)****Product line**

Studio system design and construction.  
Circle (458)



**Form.  
Function.  
Five Days.**

**Introducing the AMCO 500 Series**

Vertical Consoles. Sloped Front Consoles. Low Silhouette Consoles. Computer Desks. Desk Top Cabinets. Blowers, Accessories & Hardware.

AMCO's new expanded 500 Series combines structural integrity with refinement in style in this quick-delivery enclosure program. Generous standard features with many optional sizes allow flexibility in design combinations. Plus... every credit approved or C.O.D. order is shipped from stock within 5 work-days!

Write or call AMCO today for your free copy of our 36 page Catalog 500-A in full color.



**AMCO Engineering Co.**  
3801 N. Rose Street  
Schiller Park, Illinois 60176

**312-671-6670**



Circle (131) on Reply Card



**Audio + Design/Calrec (2115)****Introductions**

- Series M: Calrec portable mixer, to 16 inputs, full auxiliaries, optional dynamics.
- Studio production consoles, custom console service.
- SCAMP compression system; multi-band noise reduction.
- COMPEX 2: combines compressor, peak limiter, noise expander, noise gate.
- Ambisonic: Surround Sound mic system.
- Music voice-over limiter.

**Product line**

Microphones; audio processors; audio

DAs; audio effects equipment; monitor amps; PCM digital recorders; audio mixers; level matching systems.

Circle (456)

**Audio Developments****Introductions**

- 160-ENG: 4x1 audio mixer; 3 mic, 1 line inputs.

**Product line**

On-location audio mixers.

Circle (459)

**Audio Engineering Associates****Introductions**

- MS-38: MS-XY stereo matrix.

- Synch-Lock: tape synchronizer system.

- Video Technology stereo simulator.

**Product line**

Microphones; record care products; audio amplifiers; audio impedance matching devices.

Circle (460)

**Audio Kinetics**

(1173)

**Introductions**

- Mastermix: console automation system.
- Q-Lock: machine synchronizer enhancements.
- Time Link.

**Product line**

Machine synchronizer systems for editing; programmed effects editing.

Circle (461)

**Audio Precision**

(325)

**Introductions**

- System One: automated audio test system; includes high-level, balanced generator and measurement modules for level, frequency, noise, harmonic distortion; requires IBM-PC or compatible computer for operation.

Circle (462)

**Audio Service****Product line**

Sales rental and service of equipment for on-location production; audio mixers; mic power supplies; audio accessories.

Circle (463)

**Audio-Technica US**

(1141)

**Introductions**

ATM5R: miniature condenser vocal mic. AT-RMX64: 6-channel, 4-track mixer recorder.

- ATH Series: 250Ω open-and-closed back headphones.

**Product line**

Mics and accessories; phono cartridges, tone arms; mic cable; mixer recorder.

Circle (457)

**Audio Video Consultants****Introductions**

- AVC-5: Interface module.

**Product line**

Remote control for multicassette duplication system.

Circle (464)

**Auditronics**

(505)

**Product line**

Audio consoles; audio accessories; audio metering equipment.

Circle (465)

See ad page 287

**Aurora Systems**

(1312)

**Introductions**

- AU/100-QCR: Aurora/Matrix QCR D4-2 interface for 2048- or 4096-line resolution film output.

**Product line**

Electronic graphics systems for animation painting, drawing, weather/sports displays.

Circle (466)

**Autocue**

(1318A)

**Product line**

Video prompting systems based on

# FIBER OPTICS EXPERIENCE AT YOUR FINGERTIPS.



Broadband communications has entered a new era. Ten years ago, opto-electronics was viewed as new and exciting technology. Today many view fiber optics as the standard for all new communications systems.

With over 1200 WAVELINK® systems installed, we are rapidly assuming a leadership position in this growing market. And, we want to share a piece of our expertise with you.

Send us a request, on your letterhead, and we'll give you this system performance/allowable loss budget slide rule absolutely free. If you're one of those forward thinking individuals who's recognized the potential of opto-electronics, we'll put the measure of fiber optic performance in the palm of your hand.

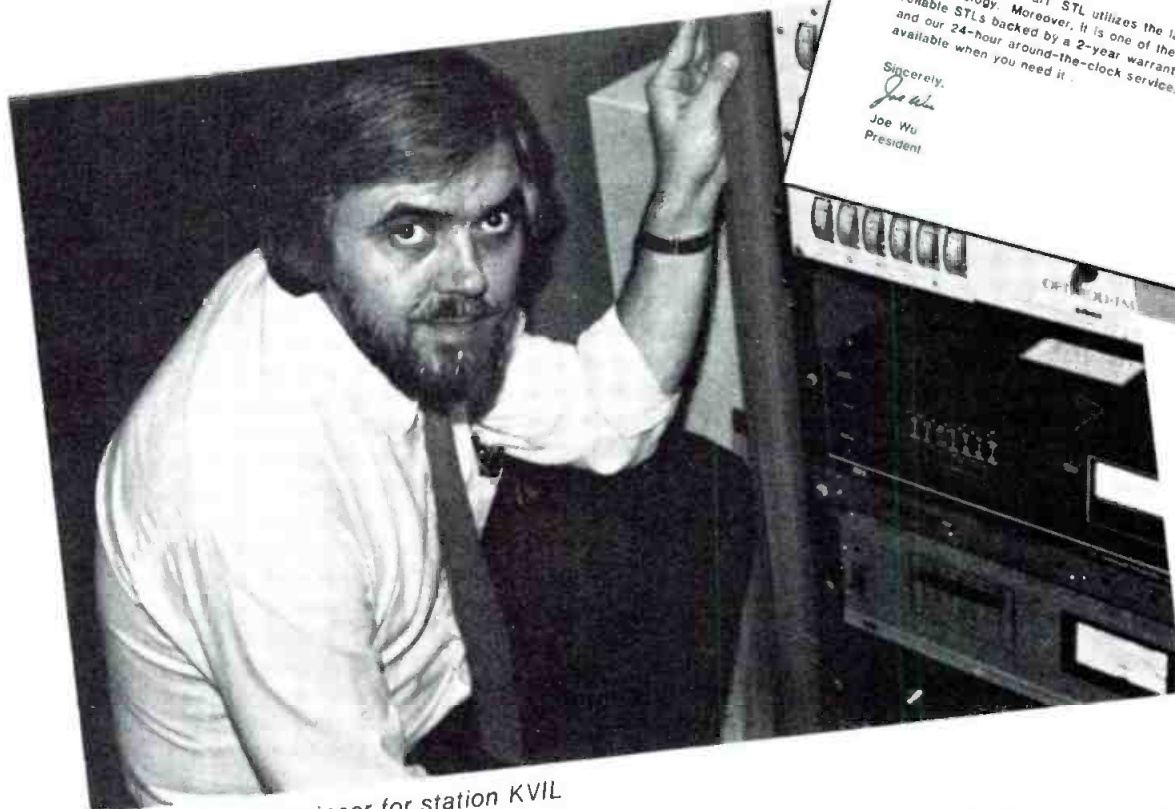
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The Grass Valley Group Inc.\*  
Wavelink Department, 13024 Bitney Springs Rd., Grass Valley, CA 95945

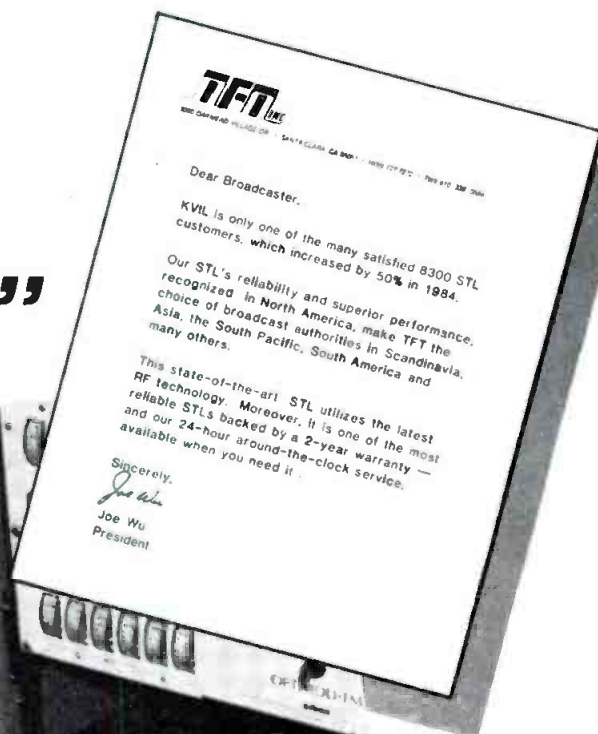
Circle (132) on Reply Card



# "TFT 8300 STL's Superior Design Made an Audible Difference on the Air"



Bill Ryan-Chief Engineer for station KVIL  
Dallas/Ft. Worth Area



See us  
at NAB  
Booth 109

Dallas/Ft. Worth Station KVIL has enjoyed a Number One share of the market for the past several years, and Chief Engineer Bill Ryan aims to keep it that way. That's why he turned to the TFT 8300 STL when their antenna site on Cedar Hill became overcrowded.

**"We needed a superior system** with enough bandwidth and selectivity to overcome the RF congestion and white noise. TFT's new 8300 system provided a 100% audio improvement at both the high end and the low end."

**"Hearing is all important.** You can measure a lot of things, but you can't necessarily hear all the specs. The excellent audio quality of TFT 8300 was a very pleasant surprise."

**"The 8300 System is helping to keep me young.** Every problem you can eliminate adds a few years to your life. The installation and operation of TFT 8300 was literally problem free. You just plug it in and turn it on."

**"With TFT, it wasn't just another sale.** All the way from the local rep to the president of the company, they did a great deal of groundwork. They were genuinely trying to help us solve a problem. I never have any trouble contacting TFT for help."

**"I'd have no problem recommending TFT 8300** to any of our other group stations throughout the country."

These comments are from another satisfied TFT 8300 user. Call us today for full facts on the STL system with a difference you can hear!



**Committed to keeping you, on the air!**

3090 Oakmead Village Dr., Santa Clara, CA 95051 ■ (408) 727-7272 ■ TWX 910-338-0584



Autocue, continued  
camera or computer video.  
Circle (467)

**Autogram** (120)  
Product line  
Audio consoles; automated audio mixing systems.  
Circle (468)

**B&B Systems** (1336)  
Introductions  
• AM-3: audio scope, phase display with headroom, VU metering for three channels, for TV stereo.  
• AM-2: 2-channel audio scope, for radio, recording use.  
Product line  
Audio phase monitors; time code phase monitors.  
Circle (470) [See ad page 252](#)

**BASYS** (1129)  
Introductions  
• BASIC: newsroom computer system, stand-alone, for radio and bureau application.  
Product line  
Custom newsroom computer systems.  
Circle (471)

**BGW Systems** (421)  
Introductions  
• Model 85: stereo broadcast audio amp, 35W/channel, 8Ω.  
Product line  
Audio power amps.  
Circle (472)

**BIW Cable Systems** (1405)  
Product line  
TV camera, VTR cables, assemblies; tri-axial, fiber-optic cables, assemblies; TV cable repair service; armored and quick disconnect VTR cable assemblies.  
Circle (473)

**BMI (Broadcast Music)** (619)  
Product line  
Music licensing.  
Circle (474)

**BSM Broadcast Systems** (837)  
Introductions  
• 5000A: audio/video routing switcher, expandable from 8x8 to 256x256.  
Product line  
Audio, video DAs and routing switchers.  
Circle (475) [See ad page 95](#)

**B-W Lighting Systems** (1753)  
Introductions  
• 70DTRS: Cyclorama rotary switch.  
Product line  
Lighting instruments, stands, rigging; light dimmers, dimmer controllers; studio draperies; equipment cases; furniture; light powering cable; set, system design.  
Circle (476)

**William Bal**  
Introductions  
• Silver Line: equipment cases.  
• Survivors: heavy-duty shipping containers.  
Circle (477)

**Barrett Associates**  
Product line  
Used, remanufactured radio products

including transmitters; phono equipment; audio consoles; reel, cart recorders; automation systems; STLs.  
Circle (478)

**Beaveronics** (1313)  
Introductions  
• FAVAG 2QMS-2: dual master clock system with auto changeover, pulse sensing.  
• FAVAG PR80: 7-day microprocessor controlled programmer with permanent and temporary memory.  
• BI-3.5F: color subcarrier countdown system, synchronizes FAVAG clock to rubidium frequency standard.  
Product line  
Video production switchers; downstream keyers; master clock systems with analog and digital slaves.  
Circle (479) [See ad page 242](#)

**Belar Electronics** (203)  
Introductions  
• Aural modulation monitor, baseband, for multichannel sound.  
• Stereo modulation monitor, NTSC television.  
• SAP channel modulation monitor.  
• PRO channel modulation monitor.  
Product line  
RF frequency monitors; modulation monitors for AM, FM, FM stereo, FM SCA and TV aural; AM loop antennas.  
Circle (480) [See ad page 308](#)

**Belden Communications** (1640)  
Introductions  
• Lee electronic HMI lights.  
Product line  
Lighting equipment, accessories.  
Circle (481)

**Belden Electronic Wire & Cable** (166)  
Product line  
Audio, video and data cables, wire; connectors.  
Circle (482) [See ad page 111](#)

**Beyer Dynamics** (426)  
Introductions  
• HM-560: headset/ribbon mic combo.  
• M-560 ribbon mic: boom mic design, usable with DT-100 and DT-102 headphones.  
Product line  
Microphones: headsets; headphones.  
Circle (484) [See ad page 289](#)

**Bird Electronic** (1625)  
Introductions  
• 8572: 25kW dry load resistor, cooled by forced air.  
• 4030 element: Relative field-strength plug-in for Thruline meters.  
Product line  
RF load resistors, termination, dummy loads; wattmeters; calorimeters; RF power monitors, alarms.  
Circle (485)

**Black's Communications** (657)  
Product line  
Equipment spec database; distributor video, audio equipment; system designs.  
Circle (486)

**Bogen Photo** (1705)  
Introductions

• Tripods: black anodized finish on tripod and fluid head products.  
• Mini-clamp system.  
Product line  
Camera support products; quartz lighting equipment; video accessories; transportation cases; gaffing equipment.  
Circle (487)

**Bogner Broadcast Equipment** (1319)  
Product line  
TV transmitting antennas; SMR, cellular radio base station antennas.  
Circle (488) [See ad page 309](#)

**Robert Bosch** (1603)  
Introductions  
• MCS-2000: master control switcher; assignable control system for stereo broadcasting.  
• FGS-4000: computer graphics system, software improvements.  
• TAS/TVS-2000: routing switcher system.  
• QuarterCam.  
Product line  
TV cameras; monochrome, color TV monitors; routing switching; edit controllers; character generators; sync generators; signal distribution equipment.  
Circle (489) [See ads pages 65-68](#)

**Bowen Broadcast Service** (1770)  
Introductions  
• Isolator: optical isolation board for TCR-100 machines, reduces errors generated on remote control lines.  
Product line  
Engineering designs; consultant services; quad VTR repairs.  
(Circle (490))

**Bradley Broadcast** (186)  
Product line  
Distributor of audio, RF, test equipment, cable and equipment cases.  
Circle (491)

**Bretford Manufacturing** (183)  
Introductions  
• VTRC90: video security center.  
Product line  
TV/VCR cabinets, stands; mobile equipment tables; wall, ceiling TV mounts; tape storage.  
Circle (492)

**Broadcast Audio** (319)  
Introductions  
• Modular audio console, with rear-mounted peak overload indicator using high intensity focused LEDs; optional active balanced mic input.  
Product line  
Stereo audio consoles; monitor amps; phone pre-amps; audio DAs.  
Circle (493)

**Broadcast Cartridge** (611)  
Product line  
Audio cartridges; cart reloading; cartridge storage systems; alignment tapes, tools; accessories.  
Circle (494)

**Broadcast Electronics** (303)  
Introductions  
• TZ-30: TV aural stereo generator.  
• AX-10: AM stereo exciter.  
• 160 series: 5-, 8- and 10-mixer





# STABILITY

With ten years of service and dedication to quality, Centro has provided the production and broadcast industries with the ultimate in television facilities and mobile systems.

Innovative concepts, attention to detail and competitive pricing has identified Centro as the leader in facilities planning, systems integration and project implementation.

Our experienced disciplines can provide you with a single point of contact and responsibility for the design and construction of television facilities and remote units.

Centro's longevity during a time of rapid technological growth is a testimonial to our creative approach to telecommunications facilities.

Our goal for the future is to continue to provide our present and future clients with innovative solutions for tomorrow's challenges.

In order to achieve this goal, we will continue to provide you with our most valuable asset: stability.



San Diego, California (619) 560-1578

Circle (134) on Reply Card

Come see us at booth number 1101 at NAB in Las Vegas.



#### Broadcast Electronics, continued

- audio consoles.
- 260 series: 5-, 8- and 10-mixer audio consoles.

#### Product line

Cartridges tape recorders, reproducers; audio consoles; turntables, tone arms; FM exciters, stereo generators, transmitters; AM, TV stereo products; program automation equipment.

Circle (495)

See ad page 25

#### Broadcast Microwave Services (1749)

##### Introductions

- GCA-4: helicopter microwave system

with two independently LORAN-controlled 16dB antennas.

- BMA-1000: steerable antenna system, mounts on towers, trucks, tripods.
- BMA-2000: tower-mounted steerable antenna with radome.
- BMA-3000: antenna pedestal, available as steerable or auto-tracking, for variety of antenna sizes and frequencies; tower or pole mounted.
- BMA-4000: auto-tracking pedestal for antennas to 8-foot diameters; dual axis tracking available.

##### Product line

Portable, rack-mounted ENG transmitters,

receivers; ENG antennas; vehicular and helicopter antennas and controllers.

Circle (496)

See ad page 279

#### Broadcast Programming Int'l.

##### Introductions

- Oldies: radio music programming service.

##### Product line

Radio program services.

Circle (497)

#### Broadcast Supply West

(112A)

##### Introductions

- CD20, CD40LS: compact disc wall, carousel racks.
- Series C40: audio cartridge carousel racks.
- W20, W300: audio cartridge wall racks.

##### Product line

Distributors of audio and radio products.

Circle (498)

#### Broadcast Systems

(1500)

##### Introductions

- DC-10: ½-inch Betacam automatic video cart machine.
- DC-20: auto network delay system, audio and video.

##### Product line

Automated video cart systems; machine control systems; prewired patch panels; equipment consoles.

Circle (499)

#### Broadcast Video Systems

(1328)

##### Introductions

- D-1000: decoder; NTSC in; YIQ, Y/R-Y/B-Y, and RGB out.
- Model 663: translator, component video in, RGB out.
- Cox 203CV: video encoder, component video inputs.
- Cox 600: color corrector, time-code control, with event memory.
- VIC-900: transmission of ID, date, time, control data in vertical blanking.
- SA-102: portable safe area generator.

##### Product line

Waveform/vectorscopes; component video correction, monitoring equipment; safe area generators.

Circle (500)

See ad page 308

#### Brüel & Kjaer Instruments

(511A)

##### Introductions

- Studio microphones: available in pairs with sensitivity, self-noise and response curves matched within 1dB, in carrying case.

##### Product line

Audio test equipment; precision microphones.

Circle (501)

#### Bryston

(517)

##### Introductions

- Phono pre-amplifier: in 1¼-inch-high 19-inch rack mount, for broadcast use.

##### Product line

Audio amplifiers.

Circle (502)

#### CAT Systems

(1014B)

##### Introductions

- CAT 3200: security system with color CRT display.
- CAT 4200: facility monitor system, parameters and RF switching display.

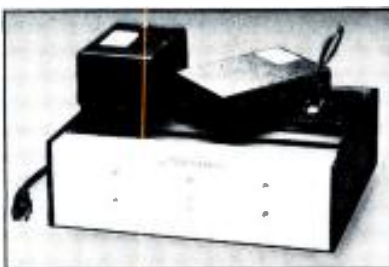
SEE US  
AT BOOTH 1714,  
NAB SHOW

WHAT  
A  
SMART  
ALEX!

#### Charge Video Battery Packs the Smart Way. With the Alexander Smart Charger

How smart is it? This smart. The Alexander Smart Charger utilizes a unique micro-processor to sense the full charge point of a nickel-cadmium battery. Then it goes to trickle. Ordinary chargers operate on a timer and continue to charge even when the job is done. And that's dumb.

The Alexander Triplex Smart Charger will work with up to three packs in the 12-14.4 volt range. Each pack is brought to full charge in less than two hours. Automatically. Without monitoring. And that's smart.



ASK FOR THE NAME OF YOUR  
ALEXANDER BATTERY DISTRIBUTOR



**ALEXANDER**

Alexander Mfg. Co., Box 1645, Mason City, IA 50401  
515-423-8955

Circle (135) on Reply Card



# High Tech

Eleven hundred feet above Memphis, Tennessee this Andrew TRASAR™ transmitting antenna employs the latest concept in UHF-TV broadcasting...elliptical polarization. This feature significantly increases the quality of coverage in markets where the higher start up and operating costs associated with full circular polarization can't be justified.

The antenna pictured radiates 20% of its energy in the vertical plane. This component reaches 4/5 the distance of the horizontally polarized mileage contours. In addition to providing improved signal strength and reduced reflections it shares the features of all TRASAR antennas. Exclusive traveling wave slotted array design. Heavy null fill.

Low VSWR. Up to 2.5° beamtilt without gain loss. High power rating and reserve capability. Totally protected in a pressurized fiberglass radome.

Broadcasters worldwide look up to Andrew UHF-TV antennas. For the TRASAR antenna best suited to your application write for Bulletin 1083 or call your Andrew Sales Engineer. Andrew Corporation, 10500 West 153rd Street, Orland Park, IL 60462. Telephone (312) 349-3300. Telex: 25-3897.

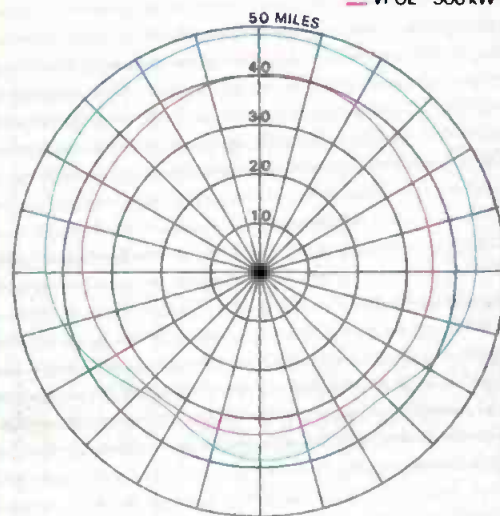


## ANDREW

Our concern is communications.

### FCC Grade B Contour 64 dBu 1000' HAAT

HPOL 2500 kW  
VPOL 500 kW





CAT Systems, continued

- CAT 7200: multisite control system with multiple control points, color display.
  - CRT status display.
- Product line \_\_\_\_\_  
 Remote control systems for earth stations, transmitters; computer system and station planning consultants.  
 Circle (503)

**CBS Radio News Service (606)**  
 Product line \_\_\_\_\_  
 Program services for radio.  
 Circle (504)

**CBX**  
 Product line \_\_\_\_\_  
 Facilities planning, design consultants for mobile units, radio/TV stations.  
 Circle (505)

**CCI**  
 Introductions \_\_\_\_\_  

- Commercial insertion systems.
- Automated programming systems.

 Circle (949)

**CMC Technology (1425)**  
 Introductions \_\_\_\_\_  

- Videomax TD-600: tape eraser for 1/2-inch to 1-inch videotape; automatic system for complete erasure.
- DPT head: dynamic parallel tracking video head for C-format recorders.

 Product line \_\_\_\_\_  
 Replacement video heads for C-format and quad VTRs; audio heads; VTR accessories.  
 Circle (507)

**CMX Systems (1639)**  
 Introductions \_\_\_\_\_  

- Updated CMX 3400.
- CMX 330XL editing controllers.
- Motion memory: editing accessory for CMX 340XL series.
- I<sup>2</sup> Interface: multiple unit control feature, shown with three VTR I<sup>2</sup> and one switcher I<sup>2</sup> in single chassis.
- Large scale editing system with super slow motion and motion memory features.

 Product line \_\_\_\_\_  
 Editing control systems; editing accessories.  
 Circle (508) See ad page 97

**CRL Audio (300)**  
 Introductions \_\_\_\_\_  
 Stereo modulation equipment.  
 Product line \_\_\_\_\_  
 Audio processing for AM, FM, television; stereo; SCA generators.  
 Circle (510)

**CSI Electronics (507)**  
 Product line \_\_\_\_\_  
 AM, FM radio transmitters.  
 Circle (511) See ad page 314

**Cablewave Systems (108)**  
 Product line \_\_\_\_\_  
 Transmission line; coaxial products  
 Circle (512) See ad page 207

**Calvert Electronics (125)**  
 Product line \_\_\_\_\_  
 Transmitting tubes; vacuum ca-

pacitors, RF transistors; camera tubes.  
 Circle (513) See ad page 101

**Calzone Case (1179)**  
 Introductions \_\_\_\_\_  

- Additional models to Escort Proline II and Convoy case products.

 Product line \_\_\_\_\_  
 Equipment transport cases for audio, video products.  
 Circle (514)

**Cambridge Products (1328)**  
 Introductions \_\_\_\_\_  

- BNC and TNC flush-mounted wall plates.

 Product line \_\_\_\_\_  
 BNC and UHF connectors.  
 Circle (515)

**Camera Mart (1018)**  
 Product line \_\_\_\_\_  
 Distributor and rental for video, audio, film production.  
 Circle (516) See ad page 281

**Canare Cable (1732)**  
 Introductions \_\_\_\_\_  

- L-V61: coaxial cable; 75Ω video; in 10 colors.
- L-V77: Dual, shielded RG59 type cable; 75Ω; in 10 colors.

 Product line \_\_\_\_\_  
 Audio cables and wire; high-grade, low-noise mic cables; low-noise video cables; cable reels.  
 Circle (517)

**Canon USA (1012)**  
 Introductions \_\_\_\_\_  

- P12x18BIE, P14x16.5BIE, P18x15BIE, PV12x14BIE, PV14x12.5BIE, PV18x11BIE, PV40x13.5BIE, J15x9.5B, J20x8.5BIE, J15x8.5BIE: studio lens systems.
- J13x9BIE-II: ENG lens system.
- J25x11.5BIE, P40x18BIE: field lens systems.
- Lens accessories.

 Product line \_\_\_\_\_  
 Camera lens assemblies; accessories.  
 Circle (518) See ad pages 108-109

**Capitol Magnetics (206)**  
 Product line \_\_\_\_\_  
 Audio cartridges, mastering recording tapes.  
 Circle (519) See ad page 250

**Capitol Production Music (165)**  
 Product line \_\_\_\_\_  
 Production music library.  
 Circle (520)

**Catel**  
 Product line \_\_\_\_\_  
 CAFM, CATV headend systems; FM, TV modulators; CATV channel processors; bandpass filters.  
 Circle (521)

**Dwight Cavendish Company (442)**  
 Introductions \_\_\_\_\_  

- Copymaster 250: videocassette duplicators systems.
- Remote machine control systems for duplicators.
- Modules: audio, video distribution amps.

Product line \_\_\_\_\_  
 Tape duplication systems.  
 Circle (522)

**CeCo Communications (313)**  
 Introductions \_\_\_\_\_  

- EIMAC tubes: 4CX15000A, 4CX35000C, 4CX10000D, 4CX5000A, 4CX1500A, B; 5CX15000A.
- RCA camera tubes; industrial, broadcast, solid-state devices.

 Product line \_\_\_\_\_  
 Distributor for Amperex, GE power tubes.  
 Circle (506)

**Celestial Mechanics (441)**  
 Product line \_\_\_\_\_  
 Marketing, promotional programs for radio stations.  
 Circle (523)

**Celwave RF (202)**  
 Product line \_\_\_\_\_  
 Transmission line and components; FM antennas; harmonic filters; signal couplers; custom rigid coaxial assemblies.  
 Circle (524) See ad page 75

**Central Dynamics (1409)**  
 Introductions \_\_\_\_\_  

- Series 80 ICK: ISO key system for Series 80 switchers, with new design RGB and encoded chroma-keyers.
- PGM PROC: program processors for Series 680 and 1080 switchers, analog key borders, soft-color wipe borders.
- MC 4000: Master control switcher.
- EIFS: Serial editor interface.

 Product line \_\_\_\_\_  
 Master control, production, routing switcher, stereo audio capable; switcher automation; video, audio DAs; sync decoders; downstream title keyers.  
 Circle (525)

**Centro (1101)**  
 Introductions \_\_\_\_\_  

- ENP trucks: electronic news production vehicle, includes 1 1/2-inch and U-matic formats, microwave transmitter with mast, dual power generators; available at the show.

 Product line \_\_\_\_\_  
 Facility planning consultants; architectural designs; construction; turnkey systems; remote production vehicles.  
 Circle (526) See ad page 191

**Century 21 Programming (204)**  
 Introductions \_\_\_\_\_  

- Music rotation computer software for selecting music.

 Product line \_\_\_\_\_  
 Radio programming on cartridges and reel-to-reel tape formats.  
 Circle (527)

**Century Precision Optics (1781)**  
 Introductions \_\_\_\_\_  

- V16: periscope design lens for 3/8-inch TV and 16mm film cameras; f/3.2, 1/1 relay optics; interchangeable camera mount.
- Wide angle set: 0.7x and 0.5x attachments for video zoom lens systems.

 Product line \_\_\_\_\_  
 Wide angle, telephoto lens systems for video cameras.  
 Circle (528)





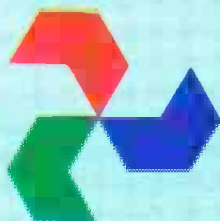
# KEY PERFORMANCE



## Performance and Design simplicity enhance Command Decisions.

Horizon International introduces System Four, a computer assisted video editing system that combines creative engineering and user experience to produce a unique video editing system. System Four offers a five year warranty, is user compatible with CMX, ISC and Mach 1, has edit list for 850 events, includes a printer, and has provision for optional paper tape. It controls a combination of video and dual audio tracks from keyboard or track ball. The Horizon's System Four has bi-lingual capability in Spanish or English. This straight line approach to performance editing provides a key decision for a realistic investment.

See us at NAB/85  
Booth 2351, Hilton



Select  
Representative Territories  
Available

HORIZON international • 3837 East Wier Avenue, Ste. 1 • Phoenix, Arizona 85040 • Phone 602/437-3800 • Telex 322043



**Cetec Antennas (509)****Introductions**

- JSDP: "The Broadcaster" broadband FM community antenna.
- JBTv: CP LPTV antenna for highband VHF and UHF.

**Product line**

CP and HP antennas for FM and TV; filters; diplexers; combiners.

Circle (529)

See ad page 79

**Cetec Vega (1401C)****Introductions**

T-36: hand-held wireless mic using Electro-Voice BK-1 condensor element.

- 67A: Portable diversity wireless mic receiver, operates from +10.5 to +18Vdc,

with DYNEX II processing.

- T-87: hand-held wireless mic, using Shure SM-87 element.
- T-84: hand-held wireless mic, using Beyer 500 ribbon element.

**Product line**

Wireless mic systems.

Circle (530)

See ads pages 210/232

**Channelmatic (328)****Product line**

Videocassette changer/library systems; random access VCR automation system; audio, video routing switchers; satellite receiver controllers; audio, video DAs; time, tone remote control systems.

Circle (532)

**Chemigraphic Products****Product line**

Equipment transport carts.

Circle (533)

**Chester Cable**

(1320A)

**Introductions**

Turnkey cable services, connectors installed.

**Product line**

• Earth station pedestal cables. Video, audio cables; ENG cable systems; cable design consultants.

Circle (534)

**Christie Electric**

(1607B)

**Introductions**

- CASP: Charger, analyzer, sequencer and programmable power supply for all ENG/EFP batteries.

**Product line**

Battery packs; battery chargers; tape degaussers.

Circle (535)

See ad page 44

**Chroma Digital Systems**

(2260)

**Introductions**

- Chromafex 776: production effects system.

Circle (536)

**Chyron Telesystems**

(1610)

**Introductions**

- Software enhancements for Chyron IV EX, graphics generation system.
- Third input channel for Chyron IV system.
- Low-cost, stand-alone paint system.

**Product line**

Character generators, titlers; video graphics equipment.

Circle (537)

See ad page 209

**Cine 60**

(1423)

**Introductions**

- Modular on-board battery: replacement for OEM conventional on-board camera batteries; requires no cables, adapters or modifications for charging or camera operation.
- Betacam battery: replacement offers three times the power available from Sony NP-1; special bracket for Betacam clears mic and line connections on camera unit recharge with Cine 60 systems.

**Product line**

Battery belts, paks for video, lighting equipment; voltage reducer; multi-rate chargers; camera lights.

Circle (538)

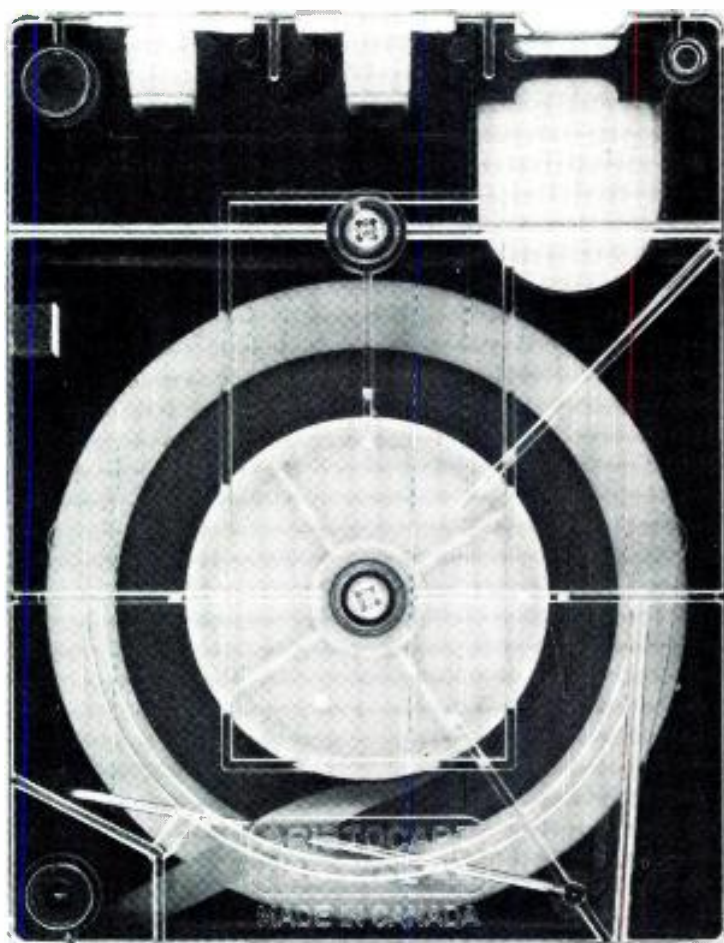
See ad page 274

**Cinema Products**

(1301)

**Introductions**

- Mini-Mote: remote control pan-tilt head for 16mm/35mm film and EFP video cameras.
- Camera-lens control system.
- Cinevid Plus: image enhancer for film camera video assists.
- CP Co-Ax: digital remote control for Ikegami HL-79E.
- Steadigate: film gate conversion for Rank Cintel film-to-tape transfers.
- CP/Tiltplate: balance/tiltplate, for most geared or fluid heads, 16mm/35mm film and video cameras.
- WRC-3A: wireless lens control system.
- Steadicam: adjustable load capacity arm.
- Mini-Worrall: cable-drive geared head



ARISTOCART

## no other NAB cartridge meets these exacting standards

We designed the ARISTOCART cartridge 10 years ago. Its features have been widely copied but it continues to outperform competing products because we alone take the trouble to check each unit we ship for phase stability and frequency response in conformity with NAB specifications.

**our guarantee**

If any ARISTOCART cartridge should fail to meet NAB AM/FM performance specifications on a properly aligned cart machine, we will replace it at our sole expense.



MANUFACTURED BY ARISTOCART DIV. WESTERN INTERNATIONAL COMMUNICATIONS LTD.  
505 BURRARD STREET, VANCOUVER, B.C., CANADA V7X 1M6 TEL: (604) 687-2844 TELEX: 04-54639

Circle (138) on Reply Card



# 'The ITC-730A and the new ITC-730AP Plumbicon® version will keep us out in front of the action.'

Mike Shanahan, Vice President Sport View TV, Detroit, Michigan

Your winning tickets to great broadcast quality productions every time are the Ikegami ITC-730A and the ITC-730AP (Plumbicon® version) low cost/high performance 3-tube prism-optics color cameras.

Both cameras offer second to none value in their class and feature high sensitivity, resolution and S/N ratio; with low power consumption, registration error and weight. In addition, the ITC-730AP provides superior highlight handling capabilities.

Keeping you out front with new standards for cost effectiveness, special features of both cameras include: dynamic beam stretch, a 2-H vertical detail correction, and wide dynamic range. For EFP, a small CCU can be operated up to 1,000 feet away in the A/C power mode and up to 300 feet using DC power at the camera head or CCU.

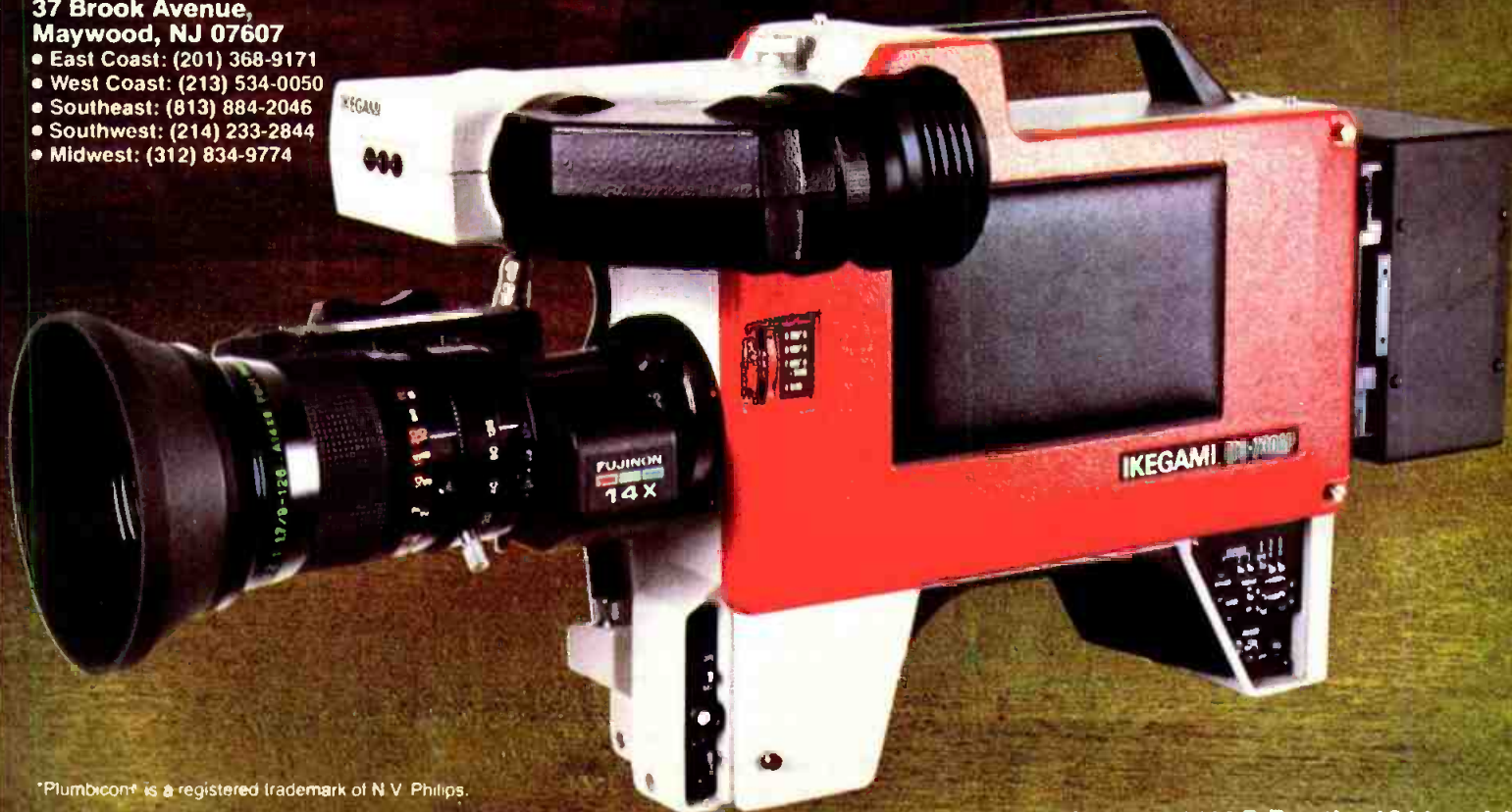
With an Ikegami ITC-730A or 730AP, you play to win.

For a complete demonstration of the ITC-730A and AP and other Ikegami cameras and monitors, contact us or visit your local Ikegami dealer.

## Ikegami

Ikegami Electronics (U.S.A.), Inc.,  
37 Brook Avenue,  
Maywood, NJ 07607

- East Coast: (201) 368-9171
- West Coast: (213) 534-0050
- Southeast: (813) 884-2046
- Southwest: (214) 233-2844
- Midwest: (312) 834-9774



\*Plumbicon® is a registered trademark of N.V. Philips.

See us at NAB Booths 1011 and 1012

Circle (139) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



with 360° pan.

**Product line**

Camera support systems; film and video camera prompters; lighting equipment; camera control systems; filter and matte box equipment.

For information write: Cinema Products, 2037 Granville Ave. Los Angeles, CA 90025

**Cinemills (1140)**

**Introductions**

- 12kW Sunburst HMI lighting system.

**Product line**

Lighting instruments; lighting kits, systems; filters; batteries, chargers.

Circle (540)

**Cipher Digital (1606)**

**Introductions**

- 716A: Time code generator, continuous jam sync,  $\pm 30$ -frame offset.
- 710A-100: Time code reader for total regeneration of code.
- 700A: Time code reader with four keyer character inserter.

**Product line**

Time code systems for LTC and VITC formats; high resolution color displays.

Circle (541)

See ad page 244

**Clear-Com Intercom Systems (1502)**

**Introductions**

MS-808: Mainframe to accommodate eight intercom channels and eight IFB channels plus one dedicated line.

- IFB series: 1-way IFB system, sends

one of two programs to talent, permits multiple intercom station users to interrupt program and access talent.

- PIC-4/820019: enables daisy-chaining two IFB program controllers, provides eight channel outputs to talent.
- KB-112: remote intercom station, installs in mixing console, counter-top, wall, etc.
- TW-12: rack-mountable interface, ties Clear-Com systems to RTS type systems.

**Product line**

Intercom systems.

Circle (542)

See ad page 206

**Colorado Video (1222)**

**Introductions**

- Model 950: Digital color image communications system, based on IBM-PC/XT, four full-frame memories (512x512x8); Winchester disc bulk storage for 40 to 500 images.

**Product line**

Slow-scan TV transmission equipment for teleconferencing communications; video test equipment.

Circle (543)

**ColorGraphics Systems (1116)**

**Introductions**

- ArtStar II: full-color graphics paint system with character generator and still-store.
- NewStar: news system introduces automated tape rolls, character generator and still-store graphics with Utah Scientific advanced machine control.

- ArtStar upgrades: multifunction paint system, with fonts and font generation, animation techniques, background generator and wipes; up to 250,000 colors and hard copy output.
- Weather Central upgrade: news graphics depicting top news stories received by Live-Line system.
- Development: real-time 3D graphics animation system.

**Product line**

Automated newsroom systems; weather display systems; animation and video graphics systems.

Circle (544)

See ad page 31

**Colortran (1205)**

**Introductions**

- 192 Dimension: lighting dimmers.
- Dimension 5: dimmer controller.
- Fresnel lights.

**Product line**

Lighting instruments; dimmers, dimmer controllers; lamps.

Circle (545)

**Columbine (118,1323)**

**Product line**

Radio business automation based on IBM mainframe and personal computer systems.

Circle (546)

**Comark Communications (1217)**

**Introductions**

- CTT-U-60RE: 60kW UHF TV transmitter, fully redundant, stereo-ready, with Marconi B7500 modulator.

# "Flexibility and ease of operation; two reasons why KCPT automated with Alamar."

John Long  
Chief Engineer



KCPT Channel 19, Kansas City



- Station Automation
- Commercial Insertion
- Cart Machine Replacement
- Timed Remote Control
- Remote Monitoring
- Delayed Programming
- Movie Playback

**ALAMAR ELECTRONICS**  
Affordable Automation<sup>SM</sup>

Alamar Electronics USA, Inc.  
36 Railway Avenue  
Campbell, CA 95008  
408/866-9373

See us at NAB, Booth #1507B

Circle (304) on Reply Card



# M/A-COM MAC, INC.

## Microwave Systems

### For Broadcasters Around the World



Over the past 25 years, Microwave Associates Communications has been installing communications links and Electronic News Gathering (ENG) equipment around the world. We are now the

#### Continuous Product Innovation

Beginning with the first solid-state portable transmitter in 1964, B-line fixed and portable equipment in 1967, G-line terrestrial radio in 1970 and up to present day with a complete line of ENG equipment, M/A-COM MAC has been the technological innovator. We have delivered the most advanced and reliable equipment spanning both local broadcasters and major networks around the world. To further our role as product innovators, we introduced a new series of portables, a new central receiver and a helicopter skypod system in 1983. In 1984, we introduced the 40 GHz portable system, multiband radios and a state-of-the-art ENG receiver.



#### Commitment To Service

As part of our commitment to total customer satisfaction, we now have two dedicated domestic service and support centers: Eastern region – Massachusetts (800) 343-3006 and

Western region – California (714) 538-3772. Plus, for product information, write to me, Duke Brown, M/A-COM MAC, Inc., 63 Third Avenue, Burlington, MA 01803 or call (617) 272-3100, Ext. 4331.

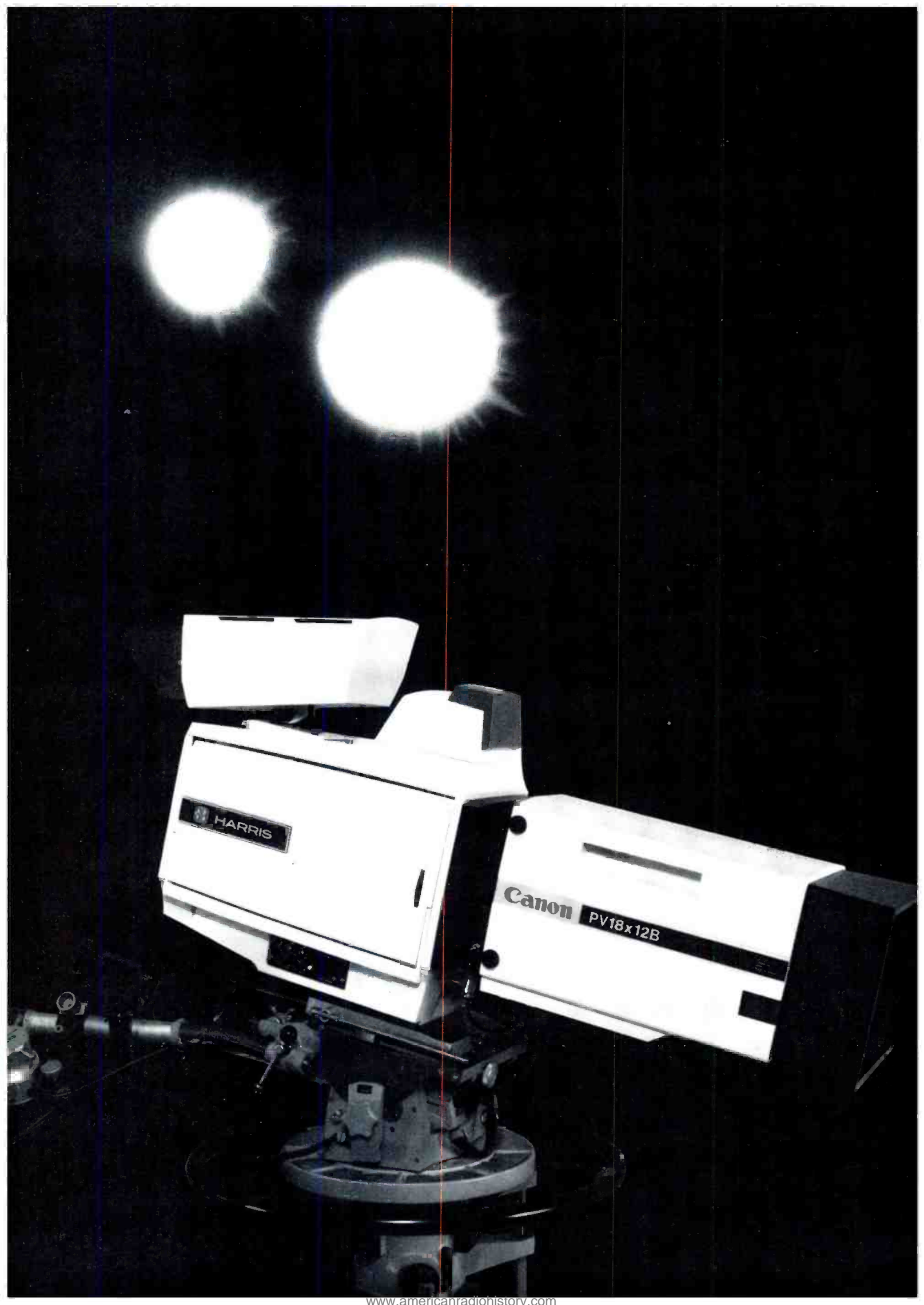
See us at the N.A.B. Show in Las Vegas, April 14 to 17, 1985 (Booth 1004)



Circle (309) on Reply Card

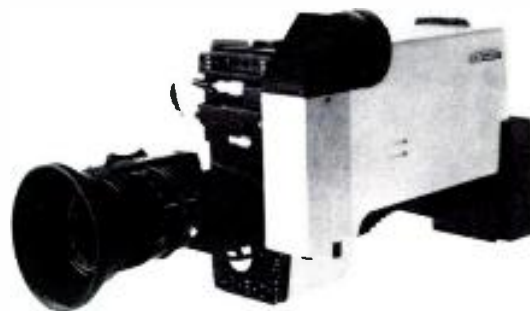
Microwave innovations for a changing world.







# 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 func-

tions 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.

Circle (310) on Reply Card

March 1985 *Broadcast Engineering* 201



Comark, continued

- B7536: 25kW VHF TV transmitter (Marconi).
- B6525: FM transmitter (Marconi).
- B7500: TV modulator with ED and ICPM precorrection.

Product line

AM, FM, UHF, VHF transmitters; RF systems; RF transmission line and components; turnkey RF installations.

Circle (547)

See ads pages 3/113

**Comex** (1724)

Introductions

MCD/4: Conifer MMDS 4-channel down-converter and antenna system.

Product line

MMDS systems.

Circle (555)

**Communications Graphics** (214)

Product line

Promotion materials.

Circle (548)

**Comprehensive Video Supply** (1145)

Product line

Interface products; production aids; computer software for production applications; lighting equipment.

Circle (549)

**Compucon** (1405D)

Product line

Frequency coordination; consultant services.

Circle (551)

**Compu-Prompt** (1728)

Introductions

- CP Junior: lightweight camera-mounted prompter system for ENG use.
- CP2000: color computer prompter, provides infinite text length; editing during scrolling.
- Uninterruptible power supply.
- Deluxe podium prompter, monitor system.

Product line

Prompter systems for film, video, public speaking applications.

Circle (550)

**Computer Broadcast** (624)

Product line

Music programming software.

Circle (552)

**Computer Concepts** (404)

Introductions

- PC-based software: traffic, music management, sales management systems.
- Automated copy department: on-air or production copy at word processing terminal; automatic printout of ANA tearsheet for billing.

Product line

Broadcast computer systems for business, program, co-op management, rate-card automation.

Circle (553)

**Computer Graphics Labs** (1143)

Introductions

- Single frame animation package for Images II: includes remote control for the VTR.
- Reel-Time Grab: gets a single frame from videotape with proper NTSC mapping components; full color.

Product line

Animation, electronic graphics equipment software.

Circle (554)

**Comrex** (400)

Introductions

- Complete line of telephone couplers, meets FCC regulations specifically for broadcast; modular connectors.

Product line

Audio bandwidth extenders; noise reduction systems; telephone interfaces.

Circle (556)

**Comtech Antennas** (314)

Product line

Satellite communications antenna systems.

Circle (557)

**COM-TEK Communications** (1122B)

Product line

Wireless microphones; wireless cueing systems.

Circle (509)

See ad page 168

**Concept Productions** (423)

Product line

Radio program services.

Circle (558)



500 Series



## ONLY THE MICRON CNS 500 SERIES WIRELESS GIVES YOU NOISE SUPPRESSION ...WITHOUT THE NOISE

Micron, the long established world leader is joined by the Micron 500 Series, featuring the substantial enhancement of *Complementary Noise Suppression*. The first and only wireless microphone with a totally transparent noise suppression system, the CNS Microns offer the professional user:

- wider dynamic range (115dB)
- enhanced low signal performance
- extended operating range
- increased immunity from interference
- improved multi-channel performance

**Micron...for those who hear the difference**

For further information, write or call:



**MICRON AUDIO PRODUCTS, LTD.**

210 Westlake Drive-Valhalla, NY 10595 • Tel: (914) 761-6520

Circle (142) on Reply Card





# THE '1500' CHOICE



PHOTO OF  
ACTUAL TV  
RASTER

The new model 1500 by Laird Telemedia is setting the standard in high-quality, low-cost Character Generators of the future. At the heart of the 1500 is a dual microfloppy disk-drive system for quick and easy access to character font and page information. The basic unit includes 35 nsec character resolution, 21 disk-loadable fonts (with an optional 50-font library), and over 65 thousand resident colors. Both page and line information can be centered, and characters can be italicized (forward or backward) at many angles. Edging in the 1500 includes four quadrants of drop shadow, as well as character outline and full character edging.

The 1500 features proportional spacing, roll, crawl, and insert/delete editing capability. The unit also accommodates upgradable options. These along with a truly affordable price of under **\$7000** make the



**MODEL 1500**  
**YOUR  
BEST  
CHOICE!**

**LAIRD TELEMEDIA INC.®**  
2424 SOUTH 2570 WEST • 801 972-5900  
SALT LAKE CITY, UTAH 84119

**See us at NAB  
Booth 1721**

Circle (143) on Reply Card

March 1985 *Broadcast Engineering* 203



**Connect-Air (1764)**

Product line \_\_\_\_\_  
 Cable assemblies for broadcast, data, camera communications.  
 Circle (559)

**Connectronics (608)**

Introductions \_\_\_\_\_  
 • SECK 62, 122: portable mixing consoles.  
 • VX1, VX2: video cable.  
 Product line \_\_\_\_\_  
 Wire, cable; audio signal processors; connectors; audio mixers.  
 Circle (560)

**Conrac (1401)**

Introductions \_\_\_\_\_  
 • 2600 series: monochrome monitor in 9-, 15- and 19-inch diagonal sizes.  
 Product line \_\_\_\_\_  
 Color, monochrome video monitors for composite and RGB component displays.  
 Circle (561) [See ad pages 86-87](#)

**Continental Electronics (101)**

Product line \_\_\_\_\_  
 FM broadcast transmitters, exciters, antennas; AM transmitters, dummy loads; related RF equipment.  
 Circle (562) [See ad page 106](#)

**Control Concepts (1751A)**

Introductions \_\_\_\_\_  
 • ISAFIL: magnetic isolation transformer, combined with active transient filter.  
 Product line \_\_\_\_\_  
 Power line conditioners; isolation transformers; electronic filters.  
 Circle (563) [See ad page 296](#)

**Control Video (1100)**

See ADDA.

**Convergence (1430)**

Introductions \_\_\_\_\_  
 • ECS-195: A/B roll editing control system, based on expanded ECS-90, with modified features from ECS-204.  
 • ECS-205: upgraded, expanded ECS-204 for twice as many source VTRs.  
 Product line \_\_\_\_\_  
 Editing controllers; editing accessories; switcher interfaces; time code products; switcher effects generator.  
 Circle (563)

**Cool Light (1329)**

Introductions \_\_\_\_\_  
 • L-13: battery belt.  
 • L-20: battery belt.  
 • Mini-cool: heat-free light; ac or ac/dc models.  
 • Accessories for Mini-cool light.  
 Product line \_\_\_\_\_  
 Lighting instruments, stands; accessories.  
 Circle (564)

**Corporate Comm. Consultants (1161)**

Introductions \_\_\_\_\_  
 • System BM: component video system; automatic operation reduces time required for color correction.  
 • System 60XLB-3: automatic system for color correction from CCD and flying spot scanners.  
 Product line \_\_\_\_\_  
 Telecine color, video correction systems.  
 Circle (565)

**Countryman Associates (1720)**

Introductions \_\_\_\_\_  
 • Wireless microphones for broadcast.  
 Product line \_\_\_\_\_  
 Microphones; tube mics.  
 Circle (566)

**Crest Audio (204C)**

Product line \_\_\_\_\_  
 Audio power amplifiers.  
 Circle (567)

**Crosspoint Latch (1321)**

Introductions \_\_\_\_\_  
 • 6150BK: master control switcher.  
 • 6116: component and encoded video switcher.  
 • 6112AK: 6112 switcher incorporating microprocessor operation.  
 • 8000: time base corrector, for A/B editing systems, locks two source VTRs to one another.  
 Product line \_\_\_\_\_  
 Video production switchers; computer controllers for switchers; audio mixers.  
 Circle (568) [See ads pages 45/326](#)

**Crown International (428)**

Introductions \_\_\_\_\_  
 • Micro-Tech 1000: miniaturized stereo power amplifiers.  
 • FM-3 Tuner.  
 • PCC 160: phase coherent cardioid microphone, surface mount supercardioid.  
 Product line \_\_\_\_\_  
 Audio power amplifiers; PZM microphones.  
 Circle (569)

**Cubicomp (235)**

Introductions \_\_\_\_\_  
 • Polycad/10V: computer graphics system with 3-D modeling and 2-D paint software, gen-locks to NTSC or PAL line rates.  
 Circle (570)

**Custom Business Systems (317)**

Introductions \_\_\_\_\_  
 • The System PC: station business automation system using PC computer.  
 Product line \_\_\_\_\_  
 Radio business and music library automation systems.  
 Circle (571)

**Cybernetics (1134A)**

Product line \_\_\_\_\_  
 Information displays driven by encoded data on subcarriers.  
 Circle (572)

**dbx (107A)**

Introductions \_\_\_\_\_  
 • 166: three dynamic processors in one package; noise gate; compressor/limiter; peak clipper.  
 Product line \_\_\_\_\_  
 Audio processing equipment.  
 Circle (573)

**Data Communications (609, 1014)**

Introductions \_\_\_\_\_  
 • BIAS Newsroom: IBM PC-based computerized newsroom system.  
 • BIAS MCA: master control automation ties traffic to engineering, using 8086 processor.

**Product line**

Computerized automation systems for traffic, business, library management.  
 Circle (574)

**Datatek (1428)**

Introductions \_\_\_\_\_  
 • D-524: audio preliminary/line amp.  
 • D-525: dual channel/stereo audio DA.  
 • D-664: video DA.  
 • D-2300: video/audio routing system, standard frame 120inx4out, expandable.  
 Product line \_\_\_\_\_  
 Video, pulse, audio DAs; audio/video routing switchers; audio, dual-channel audio, time code, preliminary/line amps; audio monitor amps.  
 Circle (575) [See ad page 267](#)

**Datatronix (1504)**

Introductions \_\_\_\_\_  
 • N/T4: programmable telephone interfaces.  
 • N/T3: audio distribution amplifiers.  
 Product line \_\_\_\_\_  
 Audio processors, amplifiers, DAs; intercom systems; routing switchers; telephone interfaces; patch panel equipment.  
 Circle (576)

**Dataworld (315)**

Product line \_\_\_\_\_  
 Comprehensive database of AM, FM, television.  
 Circle (577)

**Datum (1708)**

Introductions \_\_\_\_\_  
 • 9550-689: video data encoder, inserts data into video at maximum capacity, remains transparent to viewer.  
 • 9200-401: video data reader.  
 Product line \_\_\_\_\_  
 Time code generators, readers for SMPTE, LTC and VITC; source ID encoders; decoders; TC character generators.  
 Circle (578)

**DeSisti Lighting/Desmar (1131)**

Introductions \_\_\_\_\_  
 • 310, 320, 350: 1kW, 2kW and 5kW fresnel lights.  
 • 2020: 2.5kW HMI softlight.  
 • 2120: 4kW tungsten softlight.  
 • 2230: 1.2kW HMI PAR 64 light.  
 • 2200: 200W CID sungun, daylight.  
 • 2205: electronic ballast for 2200.  
 Product line \_\_\_\_\_  
 Location lighting kits; rigging; tungsten, HMI lights; stands; grip equipment; cyscs, draperies; hardware.  
 Circle (579)

**Dielectric (455)**

Product line \_\_\_\_\_  
 FM antennas, transmission line, RF switching, patch equipment, diplexers, filters, combiners, directional couplers, dehydrators, waveguide.  
 Circle (581) [See ad page 294](#)

**Digital Entertainment (600)**

Introductions \_\_\_\_\_  
 • DEC VCO: interface between X-80 series recorders and synchronizer systems.  
 Product line \_\_\_\_\_  
 Digital audio recording systems, dis-





# Eastman Professional Video Cassette

U-matic

KCS  
20 min. **20**  
Broadcast Quality  
EB-930

## THE NEW NAME IN VIDEO WON'T DISTORT THE NEWS.

The new three-quarter-inch EASTMAN Professional Video Tape gives your news crews the reliability needed to deliver the story accurately every time. With high signal-to-noise ratio and the lowest of dropouts. With consistency, cassette after cassette.

This broadcast-quality video tape is designed

to work with today's state-of-the-art recording and editing equipment. It's available in all popular sizes of standard and mini cassettes.

Ask your dealer or Kodak sales and engineering representative about the complete line of EASTMAN Professional Video Tape.

Eastman Kodak Company, Motion Picture and Audiovisual Markets Division

Atlanta: 404/351-6510 • Chicago: 312/654-5300 • Dallas: 214/351-3221 • Honolulu: 808/833-1661  
Hollywood: 213/464-6131 • New York: 212/930-7500 • Rochester: 716/254-1300 • San Francisco: 415/989-8434  
Washington, D.C.: 703/558-9220 • Montreal: 514/761-3481 • Toronto: 416/766-8233 • Vancouver: 604/926-7411.





Digital Entertainment, continued  
 tributor of CD players, audio mixers.  
 Circle (582) [See ad page 37](#)

## Digital Services/DSC (1302)

### Introductions

- ISS100: still-store option to illusion effects system, various drive configurations to increase storage capacity, all stored frames available for effects system.
- ILN4000: illusion multichannel video effects system.

### Product line

Digital video effects system.

Circle (583)

## DigiVision (1602A)

### Introductions

- FV-170: fluorovision video processor.
- VT-100: videotape encryption system.

### Product line

High-resolution video processors.

Circle (584)

[See ad page 274](#)

## Dilor Industries

### Introductions

- DGM 48/40 0: computerized memory and grouping lighting control console.

### Product line

Lighting dimmers, dimmer control systems.

Circle (585)

## Di-Tech (1221)

### Introductions

- 5850 routing switcher: expandable

40 x 20 AFV system with up to three levels of audio per input.

### Product line

Audio, pulse, video DAs, routing switchers, parallel and serial interfaces.

Circle (580)

## Dolby Labs (1311)

### Introductions

- Digital Audio System: processor for audio signals for DBS, cable, broadcast.

### Product line

Audio noise reduction equipment.

Circle (586)

[See ad page 155](#)

## Dorrough Electronics (312)

### Introductions

- 80-B: stereo generator for FM broadcast.

### Product line

Audio processor systems for AM, FM, television in mono and stereo loudness meters.

Circle (587)

[See ad page 240](#)

## The Droid Works

### Introductions

- EditDroid: film, video post-production system.
- SoundDroid: digital audio editing, mixing for television and film post-production.

Circle (588)

## Dubner Computer Systems (1628, 1630)

### Introductions

- Texta: character generator with 37ns

resolution, hardware anti-aliasing, font compose, animation capability.

- 10-K: character generator with animation capability, for professional video.
- Chroma: full-color video paint system.
- CBG-2 enhancements: automated election system, advanced weather graphics, third plane capability.
- CCC-12 enhancements: video signal processor for color corrector computer.

### Product line

Color correction equipment, electronic graphics systems, character generators.

Circle (589)

[See ad page 89](#)

## Dynair Electronics (1404)

### Product line

Routing switchers, machine control system, distribution equipment controls.

Circle (590)

[See ad page 183](#)

## ECD Industries (229)

### Product line

Distributor, Electron II products.

Circle (591)

[See ad page 318](#)

## EECO (1314)

### Introductions

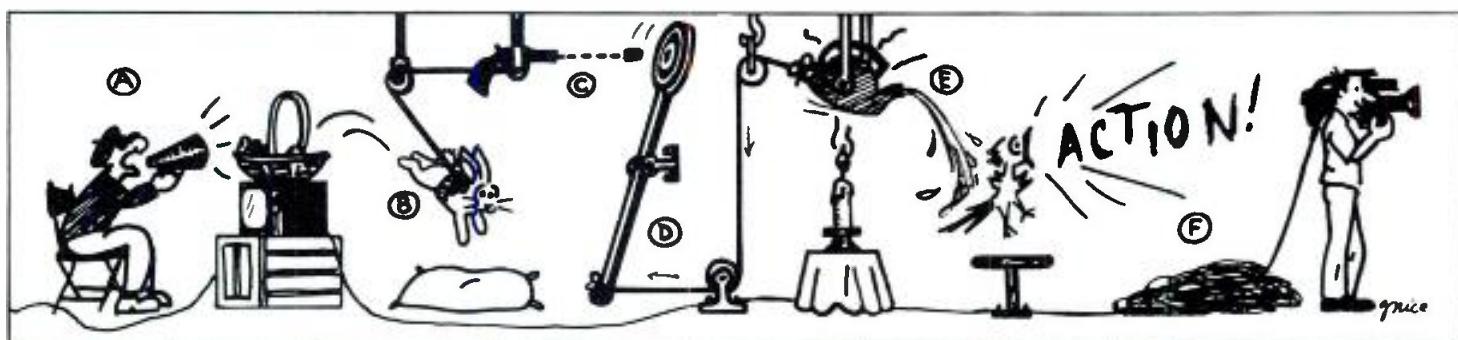
- Cinemagraphic editing workstation: plug-in control center for EMMÉ editing controller, offers mouse and on-screen menus for all edit and control functions.

### Product line

Editing controllers, videodisc audio storage systems.

Circle (592)

# Does Your Home-Made Intercom Work This Well?



**If so, consider yourself lucky. If not, consider Clear-Com.**

Many studios concoct their own intercoms because of budget restrictions, or they believe that no "brand-name" system satisfies their special needs. . . they don't know that Clear-Com has reasonably-priced intercoms & accessories designed specifically for video production & broadcasting.

## The "Kludge" System

- no schematics
- works alone (if at all)
- inflexible
- high failure rate
- crosstalk & AC hum pick-up

## The Clear-Com. System

- ✓ instruction manuals, parts lists, full documentation
- ✓ reliable interfaces for TELCO, TV cameras, wireless, & RTS-type systems (kludge systems too)
- ✓ all units compatible; easy to add stations/channels, IFB, Stage Announce, & Priority Override
- ✓ no-fail® intercoms, all with circuit-breaker & short-circuit protection, & 1-year warranty
- ✓ crystal-clear, stable signal at any level, even when you add stations

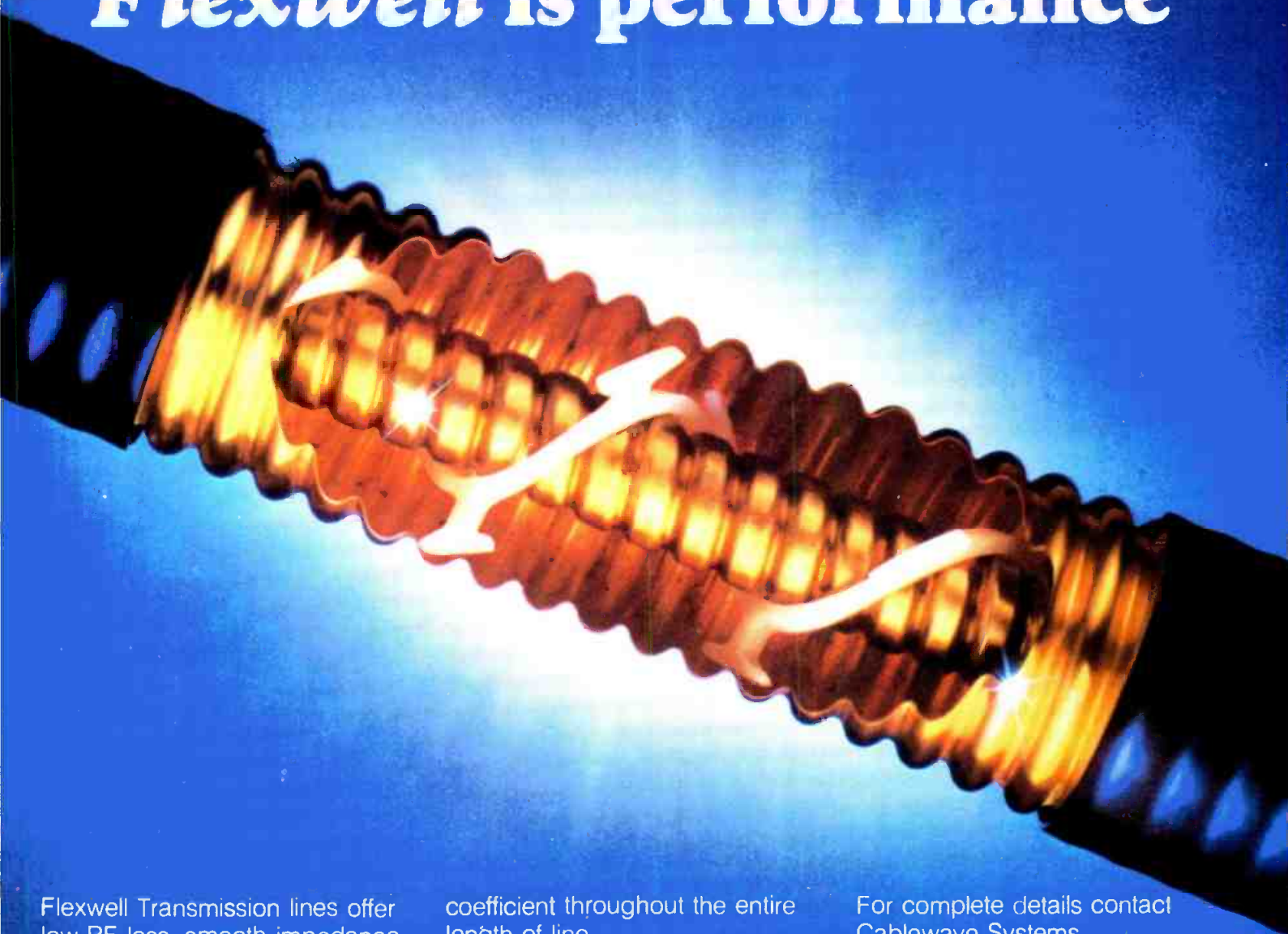
## The Day of the Kludge is Over!

Call or write for catalog: Clear-Com Intercom Systems • 1111 17th St. • San Francisco, CA 94107 • (415) 861-6666 • TWX 910-372-1087  
 Export Division: P.O. Box 302 • Walnut Creek, CA 94596 • (415) 932-8134 • TELEX 176340 CLEAR COM WNCK

Circle (145) on Reply Card



# The inside story on *Flexwell* is performance



Flexwell Transmission lines offer low RF loss, smooth impedance coefficient, and conservatively rated power handling capability. Flexwell utilizes a copper corrugated outer conductor, solid or corrugated inner conductor (depending on size), and a tough, durable, corrosion resistant polyethylene jacket suitable for burial and prolonged life. A low loss foam version called Cellflex is also available in 1/2", 7/8" and 1 5/8" sizes.

Air dielectric Flexwell in smaller diameters (1/2" and 7/8") offer a field proven, fixed helix design called Spirafil II, a single, continuous extrusion which locks the center conductor coaxially within the outer conductor, resulting in a linear impedance

coefficient throughout the entire length of line.

Larger diameter air dielectric Flexwell Cables, (1 5/8", 3", 3 1/2" and 4 1/2") feature a unique vertebra helix design to achieve optimum crush and tensile strength. Its "pillar effect", using less volume of dielectric, provides lower loss and higher average power handling capability due to the more rapid dissipation of heat from the center conductor.

Flexwell has it all: low loss, low VSWR, high power handling, smooth impedance coefficient, and rugged, long dependable life.

Cablewave System's Flexwell is type accepted for sampling systems in accordance with FCC Part 73.68.

For complete details contact  
Cablewave Systems  
60 Dodge Avenue  
North Haven, Connecticut, 06473  
Phone (203) 239-3311 or  
P.O. Box 310 Claremont  
North Carolina, 28610  
Phone (704) 459-9762

In Canada: LeBlanc & Royle  
Communications, Inc.  
514 Chartwell Rd., Oakville  
Ontario, Canada L6J 5C5  
Phone (416) 844-1242.

**Cablewave Systems**

Member of Radio Frequency Systems Group



Circle (146) on Reply Card

See Us At NAB Booth #108



**EEG Enterprises (1155)****Introductions**

- TE510: NABTS teletext video data bridge.
- TE521: Line 21 to NABTS teletext transcoder.

**Product line**

Closed-captioning equipment; VBI network alert communications.

Circle (593)

**EEV (1335)****Introductions**

- P8474: 3/4-inch mixed-field Leddicon for Sony BVP-30, BVP-360 cameras.
- P8164: 3/4-inch hybrid Leddicon for Hitachi FP-22, JVC KY-320E, etc.

**Product line**

UHF TV Klystrons, Leddicon, vidicon camera tubes, AM/FM transmitting tubes, liquid crystal displays.

Circle (594)

See ad page 115

**EG&G (1327)****Introductions**

- SS-125: StrobeGuard flashhead, narrow vertical beam, self-activating monitoring system, exceeds 200,000 candela effective intensity for daylight operation.

**Product line**

High-intensity strobe tower lighting products.

Circle (595)

**EMCEE Broadcast Products (1621)****Introductions**

- TTU-100SR: 100W UHF LPTV transmitter.
- TTU-1000: 1kW UHF LPTV transmitter.
- TTS10GA: 10W ITFS MMDS transmitter.
- TSA-100B: 100W ITFS MMDS amplifier.
- TTU-500: 5kW UHF TV transmitter.

**Product line**

Transmitters for LPTV, VHF, UHF, ITFS and MMDS applications.

Circle (596)

See ad page 265

**E-N-G (1022)****Product line**

Mobile production vehicles.

Circle (597)

**ESD (Environmental Satellite) (1509A)****Introductions**

- Color Connection: weather display software, based on IBM PC; 8-plane graphic option gives 256 simultaneous colors, accesses ESD, Zephyr, Global Weather Dynamics, AccuWeather, RRRWDS, LPATS and Doppler radar.
- ESD-1: weather data service via SATCOM 3R satellite.

**Product line**

Weather data displays.

Circle (598)

**ESE (116,1757)****Introductions**

- ES262: VITC reader/translator.

**Product line**

Digital, programmable clocks, timers;

time code products, master clock

systems, phone patch, time calculator, audio level indicators.

Circle (599)

See ads pages 317/319

**Eastman Kodak (1214)****Introductions**

- Eastman EB-930/FP-930: 3/4-inch video tape, increased coercivity (680 oersteds) and retentivity (1300 Gauss), greater RF output, improved luminance, chroma S/N ratios.

**Product line**

Imaging products, including video tape in 1-, 3/4- and 1/2-inch formats; negative, print photographic films.

Circle (600)

See ad page 205

**Econco Broadcast Services (1759)****Introductions**

- 4CV50000E: Rebuilt vapor water cooled power tetrode.

**Product line**

Rebuilt power transmitting tubes.

Circle (601)

**Elcom-Bauer (412)****Introductions**

- SS-20: synthesized 20W FM exciter.
- 601C: 800W FM transmitter.
- 6015C: 1.5kW FM transmitter.
- 603C: 3kW FM transmitter.
- 605C: 5kW FM transmitter.
- 610C: 10kW FM transmitter.
- 630C: 30kW FM transmitter.
- SS250AM: solid-state AM transmitter.
- 610A: 10kW FM amplifier.

**Product line**

AM, FM transmitter systems.

Circle (602)

**Elector (1707)****Introductions**

- Barco large screen projector system.

**Product line**

Master control video monitors; monitor receivers; video projection equipment; video decoders.

Circle (603)

**Electro Impulse (117)****Product line**

Dry, forced-air cooled FM loads; RF calorimeters; wattmeters; attenuators.

Circle (604)

**Electrohome Ltd. (1744)****Introductions**

- ECD-1904, -2504: 19-, 25-inch medium resolution color display monitors.
- EVM series: high-resolution monochrome video monitors with Autoscan; available in 9-, 12-, 15-, 17- and 23-inch diagonals.

**Product line**

Monochrome and color video display monitors.

Circle (605)

See ad page 276

**Electronic Research (105A)****Introductions**

- Series 205-1AE: side-mount CP FM antenna.
- Series 940: constant impedance diplexer.

**Product line**

FM multiplex panel, omnidirectional cogwheel and side-mount CP antennas.

Circle (606)

**Electronic Systems Labs (406A)****Introductions**

- EELA: audio mixers and special processing units.
- C-O/V-O: newly designed torque-tester.

**Product line**

Distributor of audio and radio products, audio mixers, test devices, specialized audio systems.

Circle (607)

**Electro-Voice****Product line**

Audio mixers, microphones and accessories, speakers, equalizers.

Circle (608)

See ad page 61

**Elicon****Introductions**

- IPK200: programmable keyboard.
- Model 525: overhead gantry.
- SARA: camera motion control system.

**Product line**

Motion control systems.

Circle (609)

**Emcor Products (429)****Introductions**

- Emission control cabinetry: EM1/RFI enclosure systems.
- EM-COR I: conventional cabinetry with contemporary soft radiused appearance.

**Product line**

Equipment racks, cabinetry.

Circle (610)

See ad page 64

**Eventide (323)****Introductions**

- H969: harmonizer pitch change, effects unit, with delays, musical intervals, flanging, reverse, repeat audio.
- Generation II: software for SP2016 effects processor, includes stereo room, loop edit, flanging, chorus.

**Product line**

Digital audio delay, reverb products, time compression equipment, audio effects systems.

Circle (611)

**Evertz Microsystems/Amtel (1745)****Introductions**

- Chaser: synchronizer system, allows synchronous operation of ATRs with video equipment in editing system by emulating a VTR.
- SC/H phase meter: measures subcarrier to H-sync phase, H-timing of two sources, reads time code and checks placement of code with respect to 4-frame NTSC or 8-frame PAL signals.

**Product line**

Time code systems.

Circle (613)

**Excalibur Industries (1108)****Introductions**

- Custom Cases: interlocking 19-inch rack-style cases.

Circle (612)

**Farrtronics (1505)****Product line**

Intercom systems and system packages, audio and video patch panels, audio DA packages, IFB systems.

Circle (614)



# THE NEW CHYRON IV MAKES MAGIC



The electronic magic of the new CHYRON IV is at your fingertips: 512 color choices...animation...multi-color characters...independent background graphics...advanced camera font compose...digital drawing tablet...special effects...as well as the widest assortment of font styles and sizes available. And you don't have to be a magician to work the magic. CHYRON IV is still easy to use, totally versatile, and provides unsurpassed resolution.

Perhaps best of all, earlier models of CHYRON IV

can be retrofitted to provide all of the features of the new CHYRON IV.

So, isn't it time to bring a little magic into your television production? Call or write for all the details on today's most sophisticated and versatile electronic graphics system. CHYRON IV. The magician's choice.

Follow the Leaders with

**CHYRON**  
TELESYSTEMS

A DIVISION OF CHYRON CORPORATION  
265 Spagnoli Road, Melville, New York 11747  
• 516-249-3296 • Telex: 144522 Chyron Melv  
Ampex International is exclusive distributor for  
Chyron Graphics Systems outside the U.S.A.

Circle (147) on Reply Card

See Us At NAB Booth 1610



**Fenwal** (198)  
Product line \_\_\_\_\_  
Halon 1301 fire protection products, systems.  
Circle (615)

**Fiberbilt Cases** (232)  
Introductions \_\_\_\_\_  
• Series 808: molded plastic shipping case, recessed latches, key lock, gasket seal, in 11 stock sizes with a choice of foam filling or empty.  
Product line \_\_\_\_\_  
Carrying and shipping cases for broadcast equipment.  
Circle (616)

**Ficon/Broadcast** (202A)  
Introductions \_\_\_\_\_  
• The Broadcasters: radio station traffic manager software.  
Product line \_\_\_\_\_  
Software for radio automated business.  
Circle (617)

**Fidelipac** (411)  
Introductions \_\_\_\_\_  
• CTR100: NAB record/play cartridge machines, with SMPTE time code, auto stereo/mono switching, variable speed.  
Product line \_\_\_\_\_  
Cartridge machines, test, calibration tapes, cart machine gauges, cart racks, on-air warning lights, bulk audio, videotape, erasers.

Circle (618) See ad page 85

**Film/Video Equipment** (1153)  
Introductions \_\_\_\_\_  
• Modified CP J6 zoom control for video lens systems.  
Product line \_\_\_\_\_  
Wide-angle lens attachments, battery systems, solar chargers, rental production vehicles, sales, service, rental.  
Circle (619)

**Flash Technology** (1619)  
Introductions \_\_\_\_\_  
• SC105: Tower-mounted obstruction light system controller.  
• FTB-205-3: Obstruction lighting beacon.  
Product line \_\_\_\_\_  
Obstruction, tower lighting products.  
Circle (620)

**John L. Fluke Company** (227)  
Introductions \_\_\_\_\_  
• CRC option: asynchronous signature analysis hardware package for 9010 automated test system, operates independent of equipment microprocessor, includes transitions counting and waveform capture, to 25MHz.  
• 80186/80188: interfaces for automated test system to Intel 80186 and 80188 microprocessor-based equipment.  
• IBM-PC troubleshooting software; aids repair of system, monochrome and disc controller boards.

Product line \_\_\_\_\_  
Digital volt-ohm meters, automated test systems, test equipment.  
Circle (621) See ad page 129

**FOR-A** (1308)  
Introductions \_\_\_\_\_  
• Component switcher: production switching system; handles any component format and allows mixing between them.  
• Component TBC/Freeze frame: time-base correction, provided to the input signal, which may be any component format, output is selectable as any format.  
• Frame synchronizer: video synchronizer with auto video level control.  
• VITC system: combination generator reader and character inserter system for vertical interval time code.  
Product line \_\_\_\_\_  
Color correction equipment, character generators, titlers, time code equipment, ENG vehicles, sync and video signal generators, TBCs, frame stores, VTR slow motion systems.  
Circle (622)

**Fortel** (1409B)  
Introductions \_\_\_\_\_  
• TBC32DE: timebase correction combined with digital effects for use with ¾- and 1-inch VTRs, live video.  
• Digitest: Updated digital test generator, produces both audio and video test signals.  
Product line \_\_\_\_\_

## Your best value in wireless.



Cetec Vega's R-31 PRO is your best value in a wireless-microphone receiver. When you compare the price, compare the performance too. And the size. And the features:

- **"Infinite gain" receiver technology.** Improved performance in the critical threshold region, superior accommodation of multipath conditions, better signal-to-noise ratio, and constant receiver audio level output.
- **High signal-to-noise ratio and wide dynamic range.** 97 dB (103 dB A-weighted) with DYNEX® II; 77 dB (83 dB A-weighted) non-DYNEX.

- **DYNEX® II, a new standard in audio processing.** Can be switched in and out, to accommodate transmitters with or without DYNEX® II.
- **Power-source flexibility.** Dual 115/230 Vac, 50-60 Hz operation, and external +12 to +24 Vdc for vehicular and portable use.
- **Attractive, compact case.** Only 7.15 inches wide, 1.72 inches high, and 8.25 inches deep.
- **True helical-resonator front-end filter.** Plus all of the other standard features expected in Cetec Vega's professional

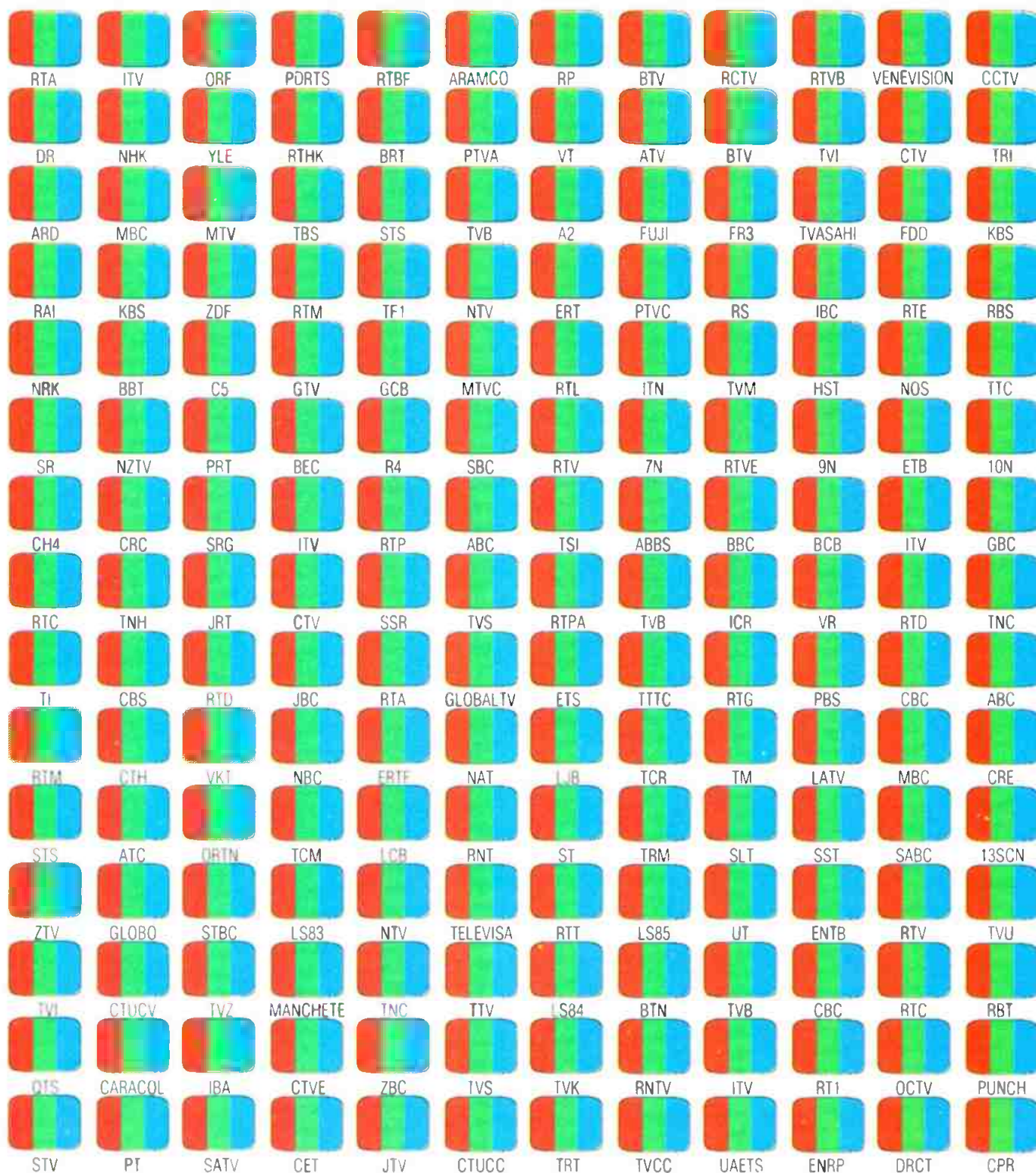
wireless equipment, famous for quality and reliability.

Write or call for further information on the R-31 PRO wireless-microphone receiver, and for the location of your nearest dealer: Cetec Vega, P.O. Box 5348, El Monte, CA 91734. (818)442-0782. TWX: 910-587-3539.

**Cetec Vega**  
the professional's wireless

Circle (148) on Reply Card





# MAXIMUM TRANSPARENCY, STABILITY, AND RELIABILITY ASSURED

Make sure that the monitors in your studio show the signals from your valuable video sources exactly as they are. The BARCO INDUSTRIES CTVM 4 series of master control monitors do just that, because they are stable, reliable and fully transparent.

The CTVM 4 series precision instruments have been developed and are manufactured by experts who:

- understand the monitor needs of your TV station;
- have been supplying you with state-of-the-art monitors for more than ten years;
- help you to cut costs for realignment and maintenance;
- allow your staff to concentrate on production, by making non-transparent and unreliable screens a thing of the past.

Ask for the detailed brochure telling you all about how the CTVM 4 series meets your highest standards.

Or get in touch with the people who really care:

- your local BARCO INDUSTRIES distributor or directly from the world's vision electronics expert:

BARCO INDUSTRIES, INC. 2211-B Executive Street  
Charlotte, North Carolina 28208 704/392-9371 Telex: 802-019

BARCO INDUSTRIES N.V. Sevenslaan 106, 8500 KORTRIJK Belgium  
Phone 32/56 23 32 11 or telex 85842 barind b or FAX 56/20 04 18  
BARCO INDUSTRIES is a member of the ACEC-group.

**BARCO**  
INDUSTRIES

Circle (149) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



Fortel, continued

Time base correctors, effects systems, video noise reduction equipment.  
Circle (624) [See ad page 277](#)

**Fort Worth Tower (1010)**

Product line  
Guyed, self-supported towers, aluminum, fiberglass equipment buildings.  
Circle (623) [See ad page 225](#)

**Fostex (1765)**

Introductions  
• B16M: 16-track recorder with dedicated monitor package.  
• PT-15: audio test-tone oscillator.  
Product line  
Audio recorders, audio mixers.  
Circle (625) [See ad page 254](#)

**Frezzolini (1107)**

Introductions  
• Mini-Fill enhancement: dual configured 12V and 30V lighting systems.  
• Compact nicad fast chargers/power supplies.  
• Bracket: allows battery or power supply to be mounted on Betacam system.  
Product line  
ENG lighting equipment, batteries, chargers, video accessories.  
Circle (626) [See ad page 302](#)

**Fujinon (1411)**

Introductions  
• Wide-angle lens for 1½-inch cameras.  
• Compact 44X zoom system for ⅔-inch cameras.  
• P20x14: Studio lens, widest angle system available for length.  
• 16x9.5: ENG lens, features F/1.8 maximum aperture.  
• Hand controls for lens systems.  
• Controllers for teleconferencing systems.  
Product line  
TV camera lens systems, lens accessories.  
Circle (628) [See ad page 73](#)

**Fuji Photo Film USA (1413)**

Product line  
Videotape, reel and cassette, photographic films.  
Circle (627)

**G & M Power Products**

Product line  
Battery systems, power supplies.  
Circle (629)

**GEC-McMichael/Marconi (1514)**

Introductions  
• SNG: satellite news gathering system using drive-away/fly-away terminals, system operable from Econoline van, transportable in station wagon.  
• GM 9050 series: transportable T/R satellite terminals, trailer mounted, for Ku-band frequencies, towed by domestic vehicle, air transportable in 747.  
• B3410: line array telecine with Vari-speed.  
• GM 2020: ACE digital 4-field standards converter.  
• GM 4002: NTSC comb filter decoder using digital circuitry; PAL model

available.

Product line  
Color, monochrome video monitors, clock, logo video generator, video recorders, teleconferencing systems, satellite communications equipment.  
Circle (630) [See ad pages 258-259](#)

**GTE Spacenet (1339)**

Product line  
Satellite communications services for program distribution.  
Circle (631)

**Garner Industries (1233)**

Product line  
Audio, video and computer tape erasers.  
Circle (632) [See ad page 91](#)

**General Electric (1007)**

Product line  
Quartz-halide and incandescent lamps for TV and film lighting.  
Circle (633)

**Generic Computer Systems (308)**

Product line  
Apple and IBM-XT traffic and billing software for radio, television, CATV.  
Circle (634)

**Gentner Engineering (636)**

Introductions  
• Switchers: passive audio or control signal routing systems: 10x2 10-in, 2-out (stereo), 20x1 20-in, 1-out (mono); remotable.  
• TC-85: telephone coupler with auto-answer, auto-disconnect, tone-based remote control.  
Product line  
Telephone interfaces, prewired audio patch panels, accessories.  
Circle (635) [See ads page 58/60](#)

**Gerstenslager (1347)**

Product line  
Custom mobile TV vans, trailers.  
Circle (636)

**Giese Electronics (327)**

Product line  
Editing controller systems, time code synchronizers, time code readers, generators in LTC, VITC formats.  
Circle (637)

**Global Systems (1123A)**

Introductions  
• RTTB-24: ITFS response transmitter.  
• GaAs FET-A1: low noise microwave pre-amp.  
• GaAs 01/7M: GaAs FET downconverter.  
Product line  
ITFS, MMDS TV systems, transmitters, filters, downconverters.  
Circle (638)

**Alan Gordon (1726)**

Product line  
Camera support products, wireless microphones, portable lighting.  
Circle (639)

**Gorman Redlich (506)**

Product line  
EBS encoders, decoders, NOAA weather

receivers, digital AM directional array monitors.

Circle (645)

**Gotham Audio (509A)**

Introductions  
• EMT 448: digital audio spot recorder, Winchester removable disc memory.  
• SYSTEX: digital audio storage for commercials, news actualities, music libraries; uses host computer control.  
Product line  
Microphones, phono turntables, audio processors, metering products, audio/coustic analyzer, audio monitors, audio cables, audio consoles, speakers, audio delay systems.  
Circle (640)

**Graham-Patten (1227A)**

Introductions  
• 616, 620: 16- and 20-input post-production audio mixers.  
• 652-660: series of programmable audio EQ systems for post-production.  
Product line  
Audio mixers, DSK video keyers, audio, video DAs, custom equipment.  
Circle (641) [See ad page 318](#)

**Grass Valley Group (1207)**

Introductions  
• Enhancements for fiber-optic, routing and production switchers and digital effects systems.  
Product line  
Video processing amps, TV automation, fiber-optic systems, video effects, sync and test generators, master control, routing, production switchers.  
Circle (642) [See ad pages 13/182/188/213](#)

**Gray Communications (1618A)**

Introductions  
• Remote production van.  
Product line  
Distributors of audio, video and RF equipment mobile production systems.  
Circle (643)

**Gray Engineering (1755)**

Product line  
SMPTE LTC, VITC generators, readers video reticles, other time code products.  
Circle (644) [See ad page 60](#)

**Great American Market (1335)**

Introductions  
• ShowPlot: computer-aided drafting and scheduling system for lighting designer, including voice-command vocal computer control.  
Product line  
Lighting gobos, effects systems, strobes, dimmer controllers, electronic light chasers, sequenced battery charger, lighting fixtures, lighting accessories.  
Circle (646)

**David Green (417)**

Product line



# The Party's At Your Place; Leave A Key Under The Mat!



The Grass Valley Group Model 100 production switcher, introduced at NAB '84, is the 'old timer' of a new family of products.

Now available—exclusively for the Model 100—KEY-MEM™ effects memory system. Similar in concept to our E-MEM™ system introduced in 1978, the KEY-MEM system stores up to 16 switcher setups in a single removable, portable EEPROM 'key'. When you're done, file it safely, or slip it in your pocket and use it with a KEY-MEM system in another location. The data is locked in until you erase it, and you can use as many keys as you want.

And the KEY-MEM system isn't all. See the Model 100CV component color production switcher, and the versatile AMX-100 stereo audio mixer.

Thank you for your enthusiastic acceptance of the Model 100. As you can see, we've only just begun.

**Grass Valley Group®**  
A TEKTRONIX COMPANY

PO Box 1114, Grass Valley, CA 95945 USA  
Telephone (916) 273-8421 TRT 160432

OFFICES: Edison, NJ (201) 549-9600; Atlanta, GA (404) 321-4318; Elkhart, IN (219) 264-0931; Arden Hills, MN (612) 483-2594;  
Fort Worth, TX (817) 921-9411; Woodland Hills, CA (818) 999-2303; Palo Alto, CA (415) 968-6680.

Circle (150) on Reply Card

March 1985 **Broadcast Engineering** 213



David Green, continued

Radio business automation systems, recording accessories, distributor of audio products.

Circle (647)

**Grosch Scenic Studios (1631B)**

Product line \_\_\_\_\_

Cyclorama tracks, studio rigging.

Circle (648)

**Grumman Aerospace**

Introductions \_\_\_\_\_

- AIS-5000: automatic commercial insertion system.

Product line \_\_\_\_\_

Machine control systems, sync generators, video processing systems.

Circle (649)

See ad page 241

**James L. Grunder/CEL (1762/4)**

Introductions \_\_\_\_\_

- P-148: video effects controller.
- P-147-20: digital effects TBC, synchronizer, frame store.
- P-147-12 SXT: PAL-NTSC translator.
- P-169: 8x4 routing switcher, digitally controlled.

Circle (650)

**HEDCO (1225)**

Introductions \_\_\_\_\_

- SVS-340, SAS-341: HEDLINE video/audio routing switcher 4x1.
- SAA-320: HEDLINE audio DA, 1x6.
- SAA-330: HEDLINE remote gain audio

DA, 1x6.

- SVA-300: HEDLINE video DA, 1x8.
- SVA-302: HEDLINE video equalizing amp, 1x8.

Product line \_\_\_\_\_

Intermediate. small routing switchers, monitoring switchers, audio, video routing switchers, precision terminators.

Circle (651)

**HM Electronics (1130)**

Product line \_\_\_\_\_

Hand-held, lavalier wireless microphone systems, studio receivers, cabled, wireless intercom systems.

Circle (652)

**Hallikainen & Friends (208)**

Introductions \_\_\_\_\_

- DRC190 updates: software, disk drive, status panel, SCA boards and TRL equipment, multiple site control, for AM, FM, TV combos, multihop microwave.

Product line \_\_\_\_\_

Digital telemetry upgrade kits for analog remote control audio mixers.

Circle (653)

**Harris Corporation (401)**

Introductions \_\_\_\_\_

- Phase Fixer: audio time base device, corrects stereo phase error, wow, flutter on any tape source.
- Gold Medalist: 12-channel audio console.
- Ulti-Mate 91: tri-band AGC system.

- IRIS C: compact still-store.
- HDE series: digital special effects units.
- SXA series: medium wave transmitters, 1kW, 2.5kW.
- STM-1B: AM stereo modulation monitor.
- STX-1B: AM stereo exciter.
- FM-3.5K: FM transmitter, 3.5kW.
- SignalStar: FM antenna.
- TV-30H: highband VHF transmitter, 30kW.
- TVE-60S: 60kW UHF TV transmitter.
- Challenger: microwave receiver.
- TV stereo demonstrations.

Product line \_\_\_\_\_

ENG and studio TV cameras, TBC, synchronizers, audio pre-amps, radio automation system, audio consoles, satellite antenna control systems, teletext data bridges, AM, FM, TV transmitters, antenna systems, microwave transmitters, receivers, still-stores, video effects systems, TBC/synchronizers, video noise reducers, TV cameras.

Circle (654)

See ads pages 55/71/145/  
164/200-201/285

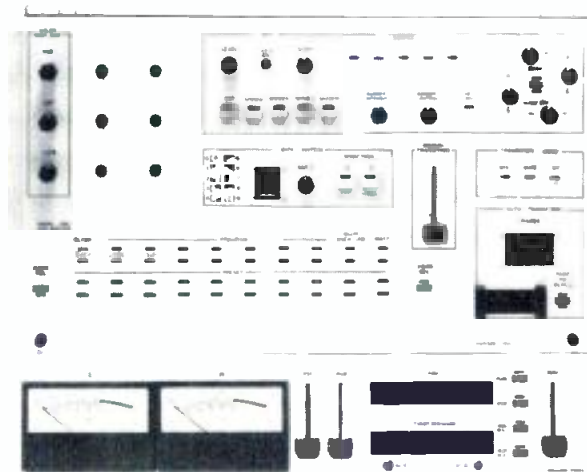
**Harrison Systems (214, 1324)**

Introductions \_\_\_\_\_

- HM4: front-of-house live sound mixer, to 32 inputs, mono/stereo.
- SM4: live sound stage monitor mixer, to 32 inputs, mono mics, eight main mono outputs; four auxiliary send groups, EQ and

# RELIABILITY AND EXCELLENCE

## OMICRON MODEL 506 EDIT-MASTER SWITCHER



## OMICRON MODEL 410 SYNC GENERATOR

Gen-lock, RS170A, 4 black burst output

MODEL 200/210 VIDEO DA MODEL 240/250 AUDIO DA works as Video Data Pulse Sc DA 12 output, +25dBm in/out range 8 output with +/- 5V output range, VCA and MIX submodule.

## MODEL 500 SERIES VIDEO/AUDIO UTILITY SWITCHER

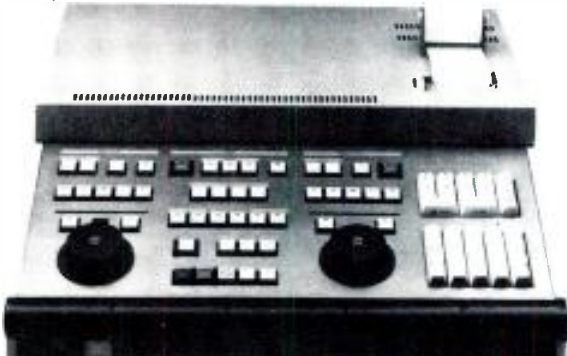
Remote controllable, configured as 5x1 to 20x4, video or audio only, audio follows video with audio break away,

EXHIBITING AT  
NAB BOOTH #1748

# OMICRON VIDEO

## Elecon EM-7100 VTR EDITING SYSTEMS

A/B roll up to 4 tape machines, 192 event memory with optional 8" floppy disk for editing list. Interface to most 1/2", 3/4" & 1" VTR including component VTR.



## Elecon U.VAS US-5500 SERIES, TAPE SYNCHRONIZER

Modularized system, event memory/editing by Up to 5 VTR/ATR combinations SMPTE time code.



9700 OWENSMOUTH AVE CHATSWORTH, CA 91311  
(818) 700 0742 FAX (818) 700 0313

Circle (151) on Reply Card



# "I can describe Ikegami monitors in one word: beautiful!"

Ed Dooley, Chief Engineer WLWT, Cincinnati, Ohio

Beautiful performance is only one reason why Ikegami's 9 series and 10 series broadcast color monitors and 3H series monochrome monitors continue to capture the attention of more and more video monitor buyers.

It's hardly surprising.

Designed to incorporate the latest advancements in picture technology with precision engineering detail, Ikegami monitors are something to behold.

The features are equally impressive: The 9 series broadcast television monitors utilize In-Line Gun self converging cathode ray tubes with American standard matched phosphors and are available in a 20, 14 and 10 inch model.

The 10 series high resolution broadcast television monitors utilize Delta-Gun tubes to achieve maximum brightness and exceptional convergence and are available in 20 and 14 inch versions.

The 3H series broadcast television monitors feature high quality monochrome displays suitable for sophisticated broadcast studio applications and are available in 9, 14, single and dual 3 inch monitors.

Ikegami monitors: Poetry in motion.

For a complete demonstration of Ikegami monitors and cameras, contact us or visit your local Ikegami dealer.



## Ikegami



**Ikegami Electronics (U.S.A.), Inc., 37 Brook Avenue, Maywood, NJ 07607**  
• East Coast: (201) 368-9171 • West Coast: (213) 534-0050 • Southeast: (813) 884-2046  
• Southwest: (214) 233-2844 • Midwest: (312) 834-9774

Circle (152) on Reply Card

See us at NAB Booths 1011 and 1013



Harrison Systems, continued

- filtering.
- RM-8: rack-mounted mixer, for stand-alone mixer or pre-mix input expander; DIN Eurocard design.
- Audio routing switcher: electronic patchbay.

Product line

Audio consoles for production, on-air in radio or television, routing systems, edit controller interface to audio mixers.

Circle (655)

See ad page 23

**Heie Engineering/Gaminc (508)**

Introductions

- Commander: on-air mixing board for radio stations.

Circle (656)

**Karl Heitz (1737)**

Introductions

- 564LM: GITZO compact mic, 5-section fishpole, fits in briefcase, extends from 1.5 feet to 7 feet.
- 122,222,322: GITZO mono-tripods, integral 4-section monopod forms one leg.
- Mini-collimator: Kinoptik portable unit, tests video, cine, photo lens systems.

Product line

Tripods, leveling balls, fluid, simple and counterbalanced heads, monopods, mic fishpoles, dollies, light stands.

Circle (657)

**Hipotronics (1779)**

Introductions

- Peschel auto voltage regulator, stabilizes ac power into broadcast transmitters and studios.

Product line

Filament, plate and beam power supplies.

Circle (658)

See ad page 264

**Hitachi Denshi (1402)**

Introductions

- SK-110D: full auto set-up computer controlled studio camera.
- HDTV system.

Product line

TV cameras, VTRs.

Circle (659)

See ads pages 5/237

**Holaday Industries (206A)**

Product line

Isotropic broadband field strength meters.

Circle (660)

**Hotronic (1331B)**

Product line

Time base correctors.

Circle (661)

See ad page 305

**Howe Audio (321)**

Introductions

- 9000 series: modular audio consoles, 8- to 22-channel, 3-input/channel, three outputs include mix-minus on all channels, optional 3-band EQ.

Product line

Audio mixers, phono pre-amps, telephone couplers, monitor amps, audio phase corrector.

Circle (662)

See ad page 238

**Hungerford & Company (310)**

Product line

Services for broadcast accounting.

Circle (663)

**IBM (1607)**

Product line

Computer product.

Circle (664)

**ICM Video (1766)**

Introductions

- VC-2500P: automatic video processor.
- VM-3000P: RF modulator.

Product line

Video processors, audio and video DAs, satellite receivers, RF modulators.

Circle (665)

See ad page 234

**IGM Communications (403)**

Introductions

- IGM-SC: system controller for full or part time unattended operation with live assist; audio switcher uses IBM-PC container.
- Custom systems: design, manufacturing service for custom systems, includes hardware, software per request.



**Introducing...**

**The Shoulder Case** and a full line of PORTA-BRACE® products to fit your BETACAM® system, no matter how you carry it. Our Shoulder Case, Quick-Draw Beta Case, Hip-carried Recorder Case, and Field Player Case are produced with the same sensible design and high-quality materials and workmanship that have made PORTA-BRACE® the leader in the field.



**K and H Products, Ltd.**  
Box 246, North Bennington  
Vermont 05257 (802) 442-9118

See us at NAB Booth 1746

Circle (153) on Reply Card



Circle (301) on Reply Card



Circle (300) on Reply Card

Circle (302) on Reply Card

# Optimod / op'-tə-mod /

**Op-ti-mod** *n* [ > Early Orbanian; deriv. of *optimum modulation* ]

1. A broadcast audio processor built by Orban Associates to the highest standards of quality and reliability, incorporating patented circuitry to achieve a cleaner, brighter, louder airsound.

2. OPTIMOD-AM, Model 9100A; a high fidelity stereo or mono processor which achieves extraordinarily natural audio quality along with high loudness, remarkable source-to-source consistency, and FM-like brightness.

3. OPTIMOD-FM, Model 8100A/1 compressor/limiter/stereo generator; the industry's dominant choice for optimum FM processing, with or without the optional Studio Chassis and Six-Band Limiter Accessory Chassis.

4. OPTIMOD-TV, Model 8182A; a stereo processor that brings TV audio processing into the '80's by combining Orban's artifact-free multiband gated compressor with our clean "Hilbert Clipper" peak limiter and the commercial-taming CBS Loudness Controller. Teams with the 8182A/SG stereo generator Accessory Chassis to produce highly accurate and stable BTSC stereo transmissions.

5. OPTIMOD; a registered trademark.

**Orban Associates Inc.**, 645 Bryant Street, San Francisco, CA 94107,  
Toll Free (800) 227-4498, In California (415) 957-1067, Telex: 17-1480.

**orban**

ORBAN PROCESSING KEEPS YOU COMPETITIVE



IGM Communications, continued

**Product line**

Automated cartridge playback systems, manual assist remote controllers, instant access cart systems.

Circle (666)

See ad pages 133-138

**Ikegami Electronics**

(1011/1013)

**Introductions**

- ITC-730AP: upgrade to ITC-730A camera for Plumbicon pickup tubes.
- SC-500: low-cost  $\frac{3}{4}$ -inch camera, provides extensive auto-setup features.
- HL-95: upgrade package includes additional accessories to UniCam system.

- Series 10: production models in 13V, 19V delta-gun monitors.

- Film island: includes TKC-990 telecine camera, projectors, multiplexers.

**Product line**

TV cameras, HDTV equipment, monochrome and color video monitors.

Circle (667)

See ads pages 41/81/105

118-119/197/215

**Image Video Ltd.**

(1341)

**Introductions**

- Stereo master control switchers: three configurations.
- Master control switcher automation system.
- Wide bandwidth routing switcher with computer control.

- Conventional bandwidth routing switcher with computer control.

**Product line**

Master control switchers, routing switching systems, video keyers.

Circle (668)

**Industrial Acoustics**

(322)

**Product line**

Acoustic structures and complete studio for radio and television.

Circle (669)

**Information Transmission**

(1734A)

**Introductions**

- ITS-231: 1kW UHF standby exciter transmitter.
- ITS-235: 5kW UHF standby exciter transmitter.
- ITS-11: lowband aural VHF exciter, multichannel sound retrofit.
- ITS-16: highband aural VHF exciter, multichannel sound retrofit.

**Product line**

UHF TV exciters, transmitters, ITFS/MDS transmitters, ITFS/MMDS amplifiers.

Circle (670)

**Innovative TV Equipment**

(1215)

**Introductions**

- H30/T30: fluid head and tripod system, for cameras to 15 pounds, quick release adaptor, one handle, tripod elevator column.
- H40: fluid head for loads to 25 pounds, quick release system, one handle, ENG type tripod, weighing 12 pounds.
- P1 pedestal: pneumatic design with H100 camera head, for loads to 260 pounds; head with two handles, wedge plate, shipping case, smooth fluid drag in pan/tilt, pneumatic action with compressed air or nitrogen.

**Product line**

Camera support systems, tripods, pedestals, pan/tilt heads, accessories.

Circle (671)

**Inovonics**

(304)

**Introductions**

- Model 260: multifunction FM, TV stereo audio processor.
- TVU: export version of TVU on-screen audio level display, PAL/SECAM compatible.

**Product line**

Audio processing systems, OEM and replacement recording electronics, audio signal instrumentation.

Circle (672)

**Interactive Motion Control**

(138)

**Product line**

Computer controlled animation products.

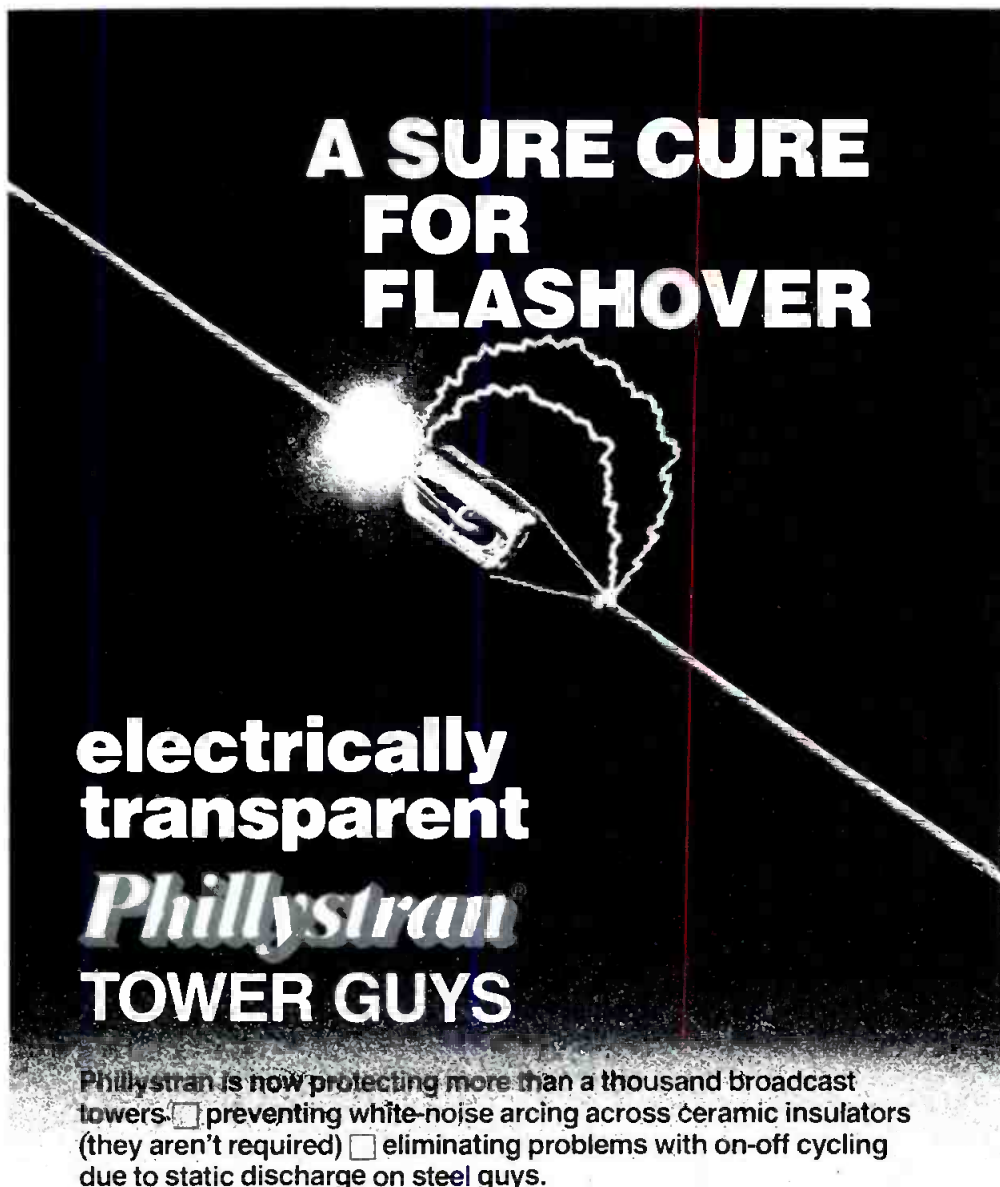
Circle (673)

**Interactive Systems/GVG**

(1167)

**Introductions**

- System 51: editing control system with expanded RS-422 capabilities standard, edit decision list interchange features and geared toward simplified editing.
- Upgrade packages: retrofits to bring



**A SURE CURE  
FOR  
FLASHOVER**

**electrically  
transparent**

**Phillystran<sup>®</sup>**

**TOWER GUYS**

Phillystran is now protecting more than a thousand broadcast towers. ☐ preventing white-noise arcing across ceramic insulators (they aren't required) ☐ eliminating problems with on-off cycling due to static discharge on steel guys.

With Phillystran HPTG, tower-guy maintenance and costly re-guying are problems of the past.

For all the Facts—including "Electrical and Mechanical Analysis of Synthetic Tower Guys"—call/write

**Phillystran**

PHILADELPHIA RESINS CORP., P.O. Box 454, Montgomeryville, PA 18936  
(215) 855-8450

Circle (155) on Reply Card





# TRADITIONAL SPANISH QUALITY

Spain has long been recognized as a world leader. Explorer of the globe. Home to great masters from El Greco to Picasso. And producer of some of the world's finest wines, cigars, leather crafts, and of course, what martini is complete without a Spanish Olive?

Spain is also home of world class broadcast equipment. The Spanish manufacturer, PESA, is a leader in the European broadcast industry. PESA equipment has been selected for use at many world class events such as the 9th PanAmerican Sports Games, World Cup Soccer and the 1984 Summer Olympics.

PESA is the epitome of dependability and quality. Continuing with the tradition of Spanish craftsmanship, PESA produces only top of the line character generators, monitors, distribution equipment, mobile vans and transmission equipment. PESA holds a prestigious position in Europe and is now introducing its outstanding product line to America.

PESA America Inc.  
6043 N.W. 167th Street  
Miami, Florida 33015  
305-556-9638



 **PESA**

CHARACTER GENERATORS • MONITORS • TERMINAL EQUIPMENT • MOBILE VANS • TRANSMISSION EQUIPMENT

Circle (156) on Reply Card

March 1985 **Broadcast Engineering** 219



**Interactive Systems, continued**  
previous systems to System 51 level.

- RS-422 direct control interfaces for Betacam, VPR-6, other VTRs and switchers.
- Super-Edit software enhancements.

Product line \_\_\_\_\_  
Editing controller systems.  
Circle (674) See ad page 245

**Interand (1016)**  
Introductions \_\_\_\_\_  
• Discon 725: compact, modular teleconferencing system, combines full color, high resolution transceiver of FastScan with 7-color annotation capability of Discon 500, allowing camera, computer or drawing pad images to be sent via Telco lines.

Product line \_\_\_\_\_  
Teleconferencing systems, still-store systems.  
Circle (675)

**Intercommunications/Peter Gray**  
Introductions \_\_\_\_\_  
• VSF-3000: fluid head, tripod system.  
• VSF-2000: fluid head, tripod system.  
• #764, 754: tripods for video use.

Product line \_\_\_\_\_  
Camera support products, pan/tilt heads, dollies, carts.  
Circle (676)

**Interface Electronics (1405A)**  
Introductions \_\_\_\_\_  
• 200-B: portable battery-operated audio mixer.

- 550: 32-input TV position audio mixer.

Product line \_\_\_\_\_  
Auto mixing systems for radio, television, theater.  
Circle (677)

**Intergroup Video Systems (ISI) (1232)**  
Introductions \_\_\_\_\_  
• 905: video production switcher system.  
• Mini-Master Control: master control switcher system for smaller formats.

Product line \_\_\_\_\_  
Routing switchers, video switching systems.  
Circle (678)

**International Tapetronics/3M (311)**  
Introductions \_\_\_\_\_  
• OMEGA series: audio cartridge record, playback machines, mono and stereo, with 150Hz tone standard.

Product line \_\_\_\_\_  
Audio cartridge recorder and playback systems, cartridge tape.  
Circle (679) See ad page 299

**Itelco S.P.A. (1338)**  
Introductions \_\_\_\_\_  
• FM transmitters: 5W to 55kW.  
• TV transmitters: UHF, VHF, 10W to 40kW.  
• TV transposer/translators: any VHF/UHF combination with precision offset.  
• Microwave radio links: audio, video and data capable.

Circle (680)

**JB/UREI (615)**  
Product line \_\_\_\_\_  
Audio consoles, audio monitor systems.  
Circle (681) See ad page 43

**JVC Company (1234)**  
Introductions \_\_\_\_\_  
• KY-210U accessories: C-mount, Nikon lens adapters, KA-500U quick release tripod plate.  
• BY-100U accessories: C-mount, Nikon lens adapters, quick release plate, HZ-110MD motorized zoom lens, RM-110MD remote control unit.  
• SS-M208U: portable or desktop mixer with eight inputs, balanced on XLR connectors; peak LED indicators for all inputs with fluorescent meters on outputs.

Product line \_\_\_\_\_  
TV cameras, U-matic, 1/2-inch video recorders, editing controllers, video monitors, monitor receivers, video effects/switchers, professional audio products, digital audio mastering system.  
Circle (682) See ad page 83

**Jefferson Data (1629)**  
Introductions \_\_\_\_\_  
• JDS-2000: Instation broadcast management system, IBM-based sales.  
• Financial management system: software for general ledger, accounts payable, POs, balance sheets, multistation corporate financial consolidations.

## You'll meet your match with our EDITING CONSOLES

No matter what VTR equipment you use, Winsted offers Editing Consoles to match your requirements! Our designs are based on consultations with professional users like yourself.

You've chosen your VTR equipment carefully, to meet your specific needs. Now choose the Editing Consoles that fit your equipment - quality consoles from Winsted.

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# Winsted

9801 James Circle  
Minneapolis, MN 55431



Circle (311) on Reply Card

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LOW COST  
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UP TO 99 MACHINES  
GROUP ASSIGNMENTS  
GANG ROLL FUNCTION  
TRUE TALLY FEEDBACK  
OPT. ROUTING SWITCHER CONTROL

THE M-40 IS A LOW COST CONTROL SOLUTION FOR SMALL TO MEDIUM SIZE VIDEO TAPE DUPLICATION SYSTEMS. IT OFFERS SERIAL CONTROL DISTRIBUTION ON COAX OR TWISTED PAIR. A MICROPROCESSOR PROVIDES INTELLIGENT CONTROL OF MASTER PLAYBACK AND RECORD VTRs. A UNIQUE OPERATOR INTERFACE UTILIZING A VIDEO DISPLAY AND MOUSE ALLOWS THE OPERATOR NEARLY INSTANT CONTROL OF ANY OR ALL VTRs BY SIMPLY POSITIONING THE DISPLAY'S CURSOR. THE M-40 WILL INTERFACE WITH ANY DEVICE THAT CAN ACCEPT CONTACT CLOSURES. A SYSTEM WILL TYPICALLY COST LESS THAN \$300 / MACHINE.



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Landy Associates  
NAB, BOOTH  
1747A

**INTERPHASE**  
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(412) 367-3775

Circle (158) on Reply Card



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**First prize:** A pair of tickets to the big fight.

**Second prize:** Videotape of *GONE WITH THE WIND*  
as released by MGM/UA. Drawings twice daily.

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# we present on NAB'85 Booth No. 1524 a new Generation of Digital TV Standards Converters

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Circle (161) on Reply Card

Jefferson Data, continued  
expense analysis.

- Program management system: computer tracking system for all syndicated programs, film amortization for full financial analysis of titles.
- Auto-Select System: music rotation for radio stations.
- BreakOut System: demographic and proposal system for ARB and Birch rating analysis tapes.
- Electronic news processing: news automation interfaces with wire services, script archives.
- DARTS system: IBM-PC software, sales, traffic, general accounting.

Circle (683)

## Jensen Tools (1747B)

Introductions

- JTK-47: zipper tool kit for carrying instruments.

Product line

Kits designed for electronic technicians.

Circle (684)

See ad page 304

## Johnson Electronics (229)

Introductions

- STS-II: signal test set, portable, for signal analysis—reviews channel and signals in field (SCA), 88-108MHz (FM band) with two subcarriers available, shows microvolts of signal, injection of subcarrier, 8-hour operation without recharge.
- DTR: desktop SCA receiver self-contained unit, listening device for visually impaired or schools (announce systems).
- AT-IVA: addressable tuner, allows

tuner to be searched out and turned on/off, for business or industrial plant.

Circle (685)

## K & H Products (1746)

Introductions

- Nylon cases and covers for Betacam system.
- Nylon recorder case for Sony VO6800 recorder.

Product line

Equipment cases and bags for VCRs, cameras and carts.

Circle (686)

See ad page 216

## Kahn Communications (625)

Introductions

- STR-84: AM stereo exciter, for improved loudness and lower distortion for mono reception, dc-coupled square wave L+R, L-R signals.
- LP-2B: low, high audio frequency extender.

Product line

AM exciters, audio bandwidth extenders, audio processors.

Circle (687)

## Kaman Sciences/KBS (1607)

Introductions

- Software: demographics, search and sales proposals.
- Software: films program, encompassing entry of all programming with control of amortization and payables.

Product line

Business automation systems.

Circle (688)

# MINUSCULE.

Until you use it.



NOW AVAILABLE  
IN FLESH TONE.

SHOWN ACTUAL SIZE

The job of a good lavalier microphone is to be heard and not seen. So we're introducing the new MKE 2 micro-miniature electret lavalier mic—our smallest ever. It comes with a variety of clothing attachments and can even be taped to the wearer's skin. So whether your talent is fully costumed for an epic or scantily clad, they'll hardly know it's there.

You'll know it's there, though. Thanks to Sennheiser back-electret technology and an extremely thin, low-mass diaphragm, the MKE 2 gives you uncanny transient response, and frequency response from 40 to 20,000 Hz, all with low sensitivity to mechanical noises. Which means you hear clear voices, not ruffled clothing. See the MKE 2 for yourself, but be prepared to look closely.

**SENNHEISER®**

Sennheiser Electronic Corporation (N.Y.)  
48 West 38th Street • New York, NY 10018 • (212) 944-9440  
Manufacturing Plant: D-3002 Wedemark, West Germany

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Circle (160) on Reply Card



# Maintain network-quality color performance with B&K-PRECISION NTSC video test instruments

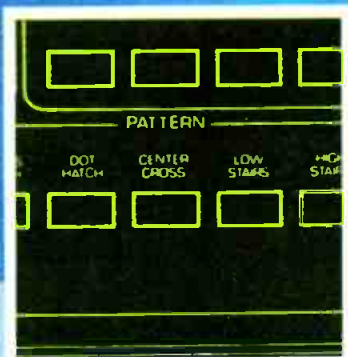
Model 1270 NTSC Vectorscope \$1995

Model 1265 Waveform Monitor \$1995



## 1260 FEATURES:

- RGB OUTPUTS
- GEN LOCK
- INTERLACED OR PROG. SCAN
- BUILT-IN MODULATOR
- MULTI-BURST TO 7.0 MHz
- TCXO STABILITY
- BLACK BURST

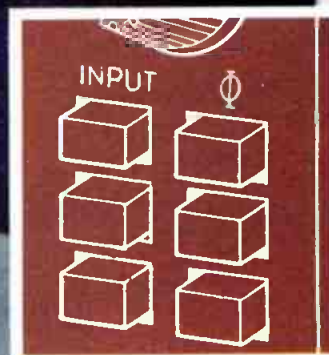


1260 generates 12 patterns, including circle, bar and crosshatch patterns

Model 1260 NTSC Generator \$1695

## 1265/1270 FEATURES:

- 12 KV ACCELERATION POTENTIAL
- ALL CONTROLS ARE FRONT-PANEL MOUNTED
- STANDARD HALF-RACK MOUNTING
- BUILT FOR CONTINUOUS DUTY OPERATION
- SPLIT FIELD VIEWING OF LINES 13-22 ON 1265



1270 offers simple set-up and selectable inputs

For the complete picture on these new video test instruments, see your local distributor or call B&K-PRECISION at 1 312 889 9087.

**B&K PRECISION** DYNASCAN CORPORATION

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Canadian Sales, Atlas Electronics, Ontario

South and Central American Sales, Emple Exporters, Plainview, NY 11803

**Come See Us at  
NAB Booth 2357.**

Circle (162) on Reply Card

www.americanradiohistory.com



**Kangaroo Video Products (1151)****Introductions**

- Super-Tough: top-loading, aluminum reinforced camera case, various sizes handle video cameras or camera recorder units.
- KVP-18s: case designed for Sony BVV-1 recorder with VA-1 or VA-1V unit, access to cable ports, external battery attachment, wireless mic connections.
- KVP raincover: for Sony BVW-3, BVP-3.

**Product line**

Equipment cases for video, audio and accessory units.

Circle (689)

**Kavouras**

(1635)

**Product line**

Weather data displays, weather graphic arts systems, character generator, radar weather displays.

Circle (690)

**Kay Industries**

(122)

**Introductions**

- T-series: power phase converter.

**Product line**

Power control and conditioning products.

Circle (691)

**Keylite Production Services**

(1220)

**Introductions**

- Handilight: folding 2kW modulight soft light.

**Product line**

Lighting fixtures, grip equipment.

Circle (692)

**Kinematics/Truetime**

(1134C)

**Introductions**

- Universal clock upgrade: driver option.

**Product line**

Time and frequency instrumentation.

Circle (693)

**Kings Electronics**

(1623)

**Product line**

RF coaxial and triaxial connectors, video patch panels and patch cords.

Circle (694)

**George Kleinknecht**

(1769)

**Product line**

Engineering consulting services, facilities designing.

Circle (695)

**Kliegl Brothers**

(1604)

**Product line**

Lighting instruments, dimmers, dimmer controllers.

Circle (696)

See ad page 262

**Knox Video**

(1511)

**Introductions**

- K-100 upgrade: additional font package.
- K-40 prototype: character generator.

**Product line**

Character generators, titlers, color processors, correctors.

Circle (697)

**L-W International**

(1662)

**Product line**

Telecine projectors, systems.

Circle (698)

See ad page 302

**LEA/Dynatech**

(302)

**Introductions**

- Surge eliminators: high current, high power unit, handling 1kA, 1.5kA, 2kA and 4kA peaks.
- CleanLine: additional models for power line filtering to 1kA, 1.5kA, 2kA.

**Product line**

Power line protection, conditioning systems, surge and transient elimination, reduction systems.

Circle (699)

See ad page 300

**LEMO**

(1334)

**Product line**

Audio, video connectors, including miniatures, subminiatures, coaxial, triaxial, multipin and mixed forms.

Circle (700)

**LPB**

(405)

**Introductions**

- Benchmark series: on-air audio consoles, VCA control, electronic switching, integral monitor amp. 4-, 6-, 8-, 10-channel, stereo.

**Product line**

Audio mixers, low power AM transmitters, tone arms, audio DAs.

Circle (701)

**LTM of America**

(1518)

**Introductions**

- Microphone pole.

# Performance Plus...

... from



No, this is not an advertisement for a computerized news room. But if you are interested in what the talent sees, at a really affordable price,\* then read on!

Listec Prompting Systems include the new Memory ScriptWriter with a capacity of over 6,000 lines of formatted text — equivalent to over 1½ hours of reading time — in clear, clean, easy to read reversible black on white characters.

Entry is made easy with a "Query" type keyboard, and there are no computer codes to unscramble. The Remote Control Module allows Variable Speed, Forward and Reverse, Pause, Next Story, Previous Story and Story Reset.

Listec offers the latest in Wide Angle Mirror Assemblies, for our new on-camera monitor display. This concept is in keeping with the News Room Sets popularly used, and completely eliminates shading... even when pulling back on the latest wide angle zoom lenses!

SEE IT AT BOOTH 1406 N.A.B.

\* \$6,500. for system

Less optional Monitors and Large Character Printer

CALL OR WRITE FOR OUR ALL NEW '85 BROCHURE!



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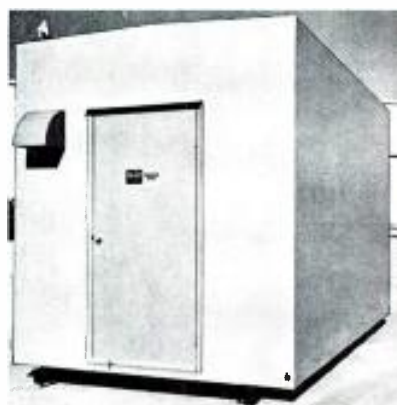
Circle (163) on Reply Card



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**LIFE+®**

You may never need to purchase another magnetic head again when you choose LIFE+®.

\*LIFE+® heads last up to ten times longer than other metal faced long-life heads.

## EXPERIENCE QUALITY OF LIFE

**LIFE+®**

You may never want to choose another magnetic head when you try LIFE+®.

\*LIFE+® heads offer outstanding electrical performance characteristics compared to conventional heads.

The key difference between a LIFE+® head and a conventional head is the patented structure of our core.

\*1½ mil stress free laminations uniquely bonded to give superior LIFE+® wear and electrical performance.

\*Specially processed during fabrication to restore ideal magnetic properties found only in unhandled virgin magnetic materials.

A HEAD OF THE TIMES

**LIFE+®**



**MINNEAPOLIS MAGNETICS, INC.**  
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Circle (165) on Reply Card

LTM, continued

- Line of studio quartz lighting.
- LUXARC: 12,000 HMI light.

Product line

Lighting fixtures.

Circle (702)

**Laird Telemedia**

(1721)

Introductions

- 1500: character generator/titler, featuring 35ns resolution, 64k resident colors, 70-font library, dual-disc drives, centering, italics, proportional spacing.

Product line

Character generators, film chain multiplexers, slide projectors.

Circle (703)

See ad page 203

**Lake Systems**

(1165)

Introductions

- LA-Kart Beta: ½-inch LA-Kart system based on Beta format, stereo or bilingual capabilities, SMPTE time code, 1000 events with 68000 processor.

Product line

Automation systems based on U-matic VCRs.

Circle (704)

See ad page 230

**Landy Associates**

(1747A)

Introductions

- M-40: Interphase machine control system for small format tape duplicator, serial bus connection for up to 100 VTRs, CRT status display.

Product line

Distributor, cameras, monitors,

## This new portable UHF Field Strength Meter gives you accurate readings across the entire band.

Someone once said that "Certainty is Security." That is the main idea behind field strength measurements. They verify the signal level and rf environment at the point of reception. You know for certain what's out there.

It is now easy for UHF stations to achieve this certainty. With the new FIM-72 from Potomac Instruments.

### Tune the entire UHF band

From 470 to 960 MHz. The received signal strength is shown in volts and dB, with a 140 dB measurement range. Select peak or averaging detection; wide or narrow IF bandwidth. Seven 20dB logarithmic ranges assures precise readings. Internal demodulators (AM and FM) provide audio monitoring of the selected signal.

### It is easy to use

Find the desired signal on the spiral dial. Calibrate the meter using the internal generator, then read the signal strength from the mirrored meter. The field strength is easily determined from the supplied calibration data.

### Laboratory applications

The FIM-72 includes a precision rf generator that tracks the tuned frequency. Typical measurements include insertion loss, VSWR, and filter response.

### Call Potomac Today

Place your order for this new UHF field intensity meter. Put it to work. And then you will know for certain.



**POTOMAC INSTRUMENTS**  
932 PHILADELPHIA AVE. SILVER SPRING, MD 20910  
(301) 589-2662

Circle (166) on Reply Card



## NTSC DIGITAL TEST GENERATOR DTG-1010N

# the multitasking machine...

Dual feeds of 40 test signals to FIVE different locations with complete remote control.

Two new test signals for chroma noise measurements and transmitter power calibration.

Three VITS packages.

Full range of trigger signals.

Variable H and V blanking.

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RS170A ... of course.

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Plus  
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Don Mills, Ontario M3B 1V5  
Tel.: (416) 445-9640  
Telex: 06 986 241

Circle (167) on Reply Card



Landy Associates, continued  
audio mixers, lighting fixtures,  
batteries, safe area generator.  
Circle (705)

#### Lang Video Systems (1780)

##### Introductions

- Super-Vax: automatic 2x1 video switcher with audio follow.
- Two-Shot (rack mount).

##### Product line

ENG audio, video switching systems.

Circle (706)

See ad page 308

#### Larcam Comm. Equipment (1626A)

##### Introductions

- FMT-25L: 25kW FM transmitter, in-

corporating FME-30L 30W exciter.

- TTC-250LH: 250W TV transmitter for highband VHF, total solid-state design.
- TTC-30LH: VHF TV transmitter, highband, rated 30kW demo, TEC1V multi-channel sound TV exciter.

##### Product line

FM and TV transmitters, exciters.

Circle (707)

See ad page 288

#### Laumic

(1771)

##### Introductions

- CCX Edge: for use with BetaMax, computer assisted editing program.

##### Product line

Distributor of audio and video equipment, tape, test equipment, vans,

used equipment, system design.

Circle (708)

#### Leader Instruments

##### Introductions

- LCG-420: NTSC sync/test pattern generator with plug-in modules.
- LBO-5825: digital storage oscilloscope.
- LAG-126S: low distortion audio generator with balanced output.
- LBO-552BH1: stereo oscilloscope.

##### Product line

NTSC, PAL waveform monitors, vectorscopes, sync/test generators for all color standards, oscilloscopes, AF, RF generators, wow/flutter meter, voltmeters, audio analyzers.

Circle (709)

#### LeBlanc & Dick Communications (1149)

##### Product line

Towers to 2000 feet, broadband FM, TV antennas, high power combiners for FM, television.

Circle (710)

#### Leitch Video

(1021)

##### Introductions

- DFP-3000N: digital frame processor.
- CSD-530: master clock driver.
- DCD analog clock; SMPTE/pulse analog clocks.
- DTG-1010N: digital test signal generator.
- CTG-240N: calibrated test signal generator.
- VPA-331N: video processor amplifier.
- ADA-660: audio distribution amplifier.

##### Product line

Sync generators, video processor amps, digital, analog test generators, video, equalizing, clamping, pulse, switchable delay, audio DAs, master clock systems, vertical interval processors and VID generators.

Circle (711)

See ad page 227

#### Lenco

(1419)

##### Introductions

- PVS-430: videoscope for SC/H measurements.
- PVS-435P: videoscope for PAL SC/H measurements.
- PAA-100: 100W/channel stereo amplifier.
- PSG-313: sync generator for 300 series, RS-170A.
- PSG-410: RS-170A sync generator, 1-rack height unit.
- PCE-4662: encoder gen-lock option.

##### Product line

Video terminal equipment, DAs, test/sync, signal generators, noise meters, encoders, decoders, monochrome, color monitors.

Circle (712)

See ad page 7

#### Lerro Electrical

##### Product line

Facilities design, engineering services, van construction.

Circle (713)

See ad page 17

#### Lexicon

(1139)

##### Introductions

- Model 1200C: digital audio time compressor, expander, stereo system possible using units with matrix interface.

##### Product line

Digital audio delays, reverb systems.

**CONCEPT TO COMPLETION**

From initial design to installation and service...

**VICTOR DUNCAN, INC.**

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**Victor Duncan, Inc.** has the experience and equipment your systems demand.

Whether it's a single item, a mobile unit, or a complete production/post-production studio, Victor Duncan, Inc. is the key to your systems.

Circle (168) on Reply Card



# WHAT'S IMPORTANT TO YOU WHEN BUYING an A/B ROLL VIDEO TAPE EDITOR?

**ACCURACY • ECONOMY • SMPTE T/C AND CTL  
EXPANDABILITY • QUALITY • SIMPLE, FAST EDITING  
CONSULTATION • CUSTOMER CARE • INSTRUCTIONAL**



If any, or all, of the features listed above are important to you, check into United Media and it's Mini-Comm Editor; they do it all. The new A/B Roll Mini-Comm Video Tape Editor, the powerful, expandable, miniature version of the Commander II, is a sophisticated editor capable of handling up to eight machines and automatic switcher.

The unbelievably low price of **\$9200**, includes these features:

- 2 or 3 Machine Capable
- 2 or 3 Time Code Readers
- 2 or 3 Interfaces for 3/4" or 1" VTR
- 250 Events Internal Memory
- Auto Assembly with Reel Number Control
- Variable Search Jog
- Source and Record VTR Delegation
- Record Slave Capability
- List Scroll/List Recall
- RS-232 Output Port
- Detachable Keyboard
- Uncomplicated Keyboard Layout
- List Management w/Ripple
- SNS Mode
- CRT Display Layout
- Auto Assembly
- Commonly-used Default Settings
- Lighted Keycaps
- Manual List Entry
- Prices start at \$9200
- Event/Replace
- Mark One/Mark All
- Auto Display
- Multi-function User Definable Key
- Manual Slow Motion Control
- Manual VTR Motion Control
- Special Readout of Mixer Parameter
- Other Operation of Status Indicator
- Up-gradeable to Commander II
- Go-To Mode
- Separate Keyboard Input Display
- Full Range of Frame Editing
- Automatic Color Framing
- Automatic Switcher Control
- Automatic Backtiming of Edits

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Circle (169) on Reply Card  
[www.americanradiohistory.com](http://www.americanradiohistory.com)



Lexicon, continued  
audio effects processors, audio syn-  
chronizers.  
Circle (714)

## Lighting Methods (182)

### Introductions

- PD-1200: dimmer pack, 24 10A circuits.
- PD-2400: dimmer pack, 12 20A circuits.
- PD-6000: dimmer pack, 5 50A circuits.

### Product line

Manual, computer lighting control sys-  
tems with analog or digital outputs.  
Circle (715)

## Listec TV Equipment (1406)

### Introductions

- A-2100: electronic scriptwriter for digital prompting system.
- A-4000: portable prompter, acetate, typewritten scripts.
- 2019W: 19-inch on-camera prompter with wide-angle hood.
- Microswift 200: digital remote control system for cameras, pedestals.

### Product line

Camera support products, pedestals, pan/  
tilt heads, jib-arms, prompter systems.  
Circle (716) [See ad page 224](#)

## Logitek (613)

### Introductions

- BPA-2000: Balanced-input phono pre-amp, low noise circuit with high RFI immunity.
- Perfectionist-12: 12-channel audio console.

- Monitor-10: Monitor/meter system for any of 10 switch-selected stereo inputs.

### Product line

Audio consoles, audio DAs, phono pre-amps, audio power amps, timers, audio level displays, speakers.

### Circle (717)

[See ad page 272](#)

## Pam Lontos (120A)

### Introductions

- Course: "Basics of Broadcast Selling," VHS cassette package.
- Course: "Tune into Broadcast Selling," 8-hour audio course.

### Circle (718)

## Lowel-Light (1309)

### Introductions

- Frame-up sets.
- Molded cases.

### Product line

Location lighting systems for film, video, still photography.

### Circle (719)

## Lyon Lamb Video (1632A)

### Introductions

- ENC VI: color encoder, converts RGB to NTSC signal.

### Product line

Animation controller systems.

### Circle (720)

## M/A-COM MAC (1004)

### Product line

Microwave transmitters, receivers,

antenna systems.

### Circle (725)

[See ad page 199](#)

## M.B.I./Allen & Heath-Brenell

### Product line

Audio mixing consoles.

### Circle (726)

## MCG Electronics (167)

### Product line

Transient suppressor, power line protection equipment.

### Circle (727)

[See ad page 16](#)

## MCI/Quantel (1631)

### Introductions

- Henry: digital video recorder, animator, editor.
- Harry: digital video recorder, animator, editor (son of Henry).
- Morph: shape-generating software for the Mirage system.

### Product line

Digital video effects equipment, still-store systems; character, title, caption generators, standards converters, TBC, frame synchronizers.

### Circle (728)

## MPCS (1121)

### Introductions

- Complete self-contained and portable editing system plus production capability.

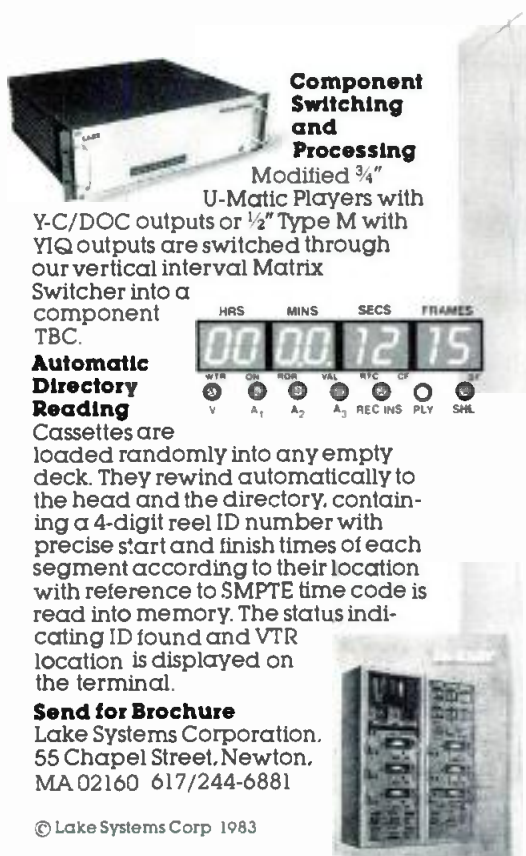
### Product line

Production house, facilities design engineering, mobile vehicle construction.

### Circle (729)

# Affordable Random Access Video Cart Systems

Cost effective, modular, and expandable

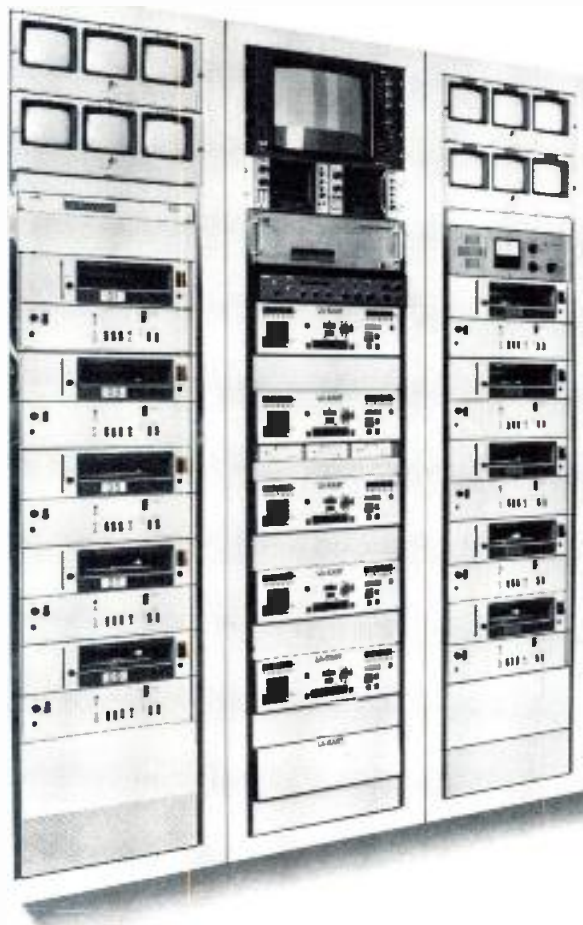


**Component Switching and Processing**  
Modified 3/4" U-Matic Players with Y-C/DOC outputs or 1/2" Type M with YIQ outputs are switched through our vertical interval Matrix Switcher into a component TBC.

**Automatic Directory Reading**  
Cassettes are loaded randomly into any empty deck. They rewind automatically to the head and the directory, containing a 4-digit reel ID number with precise start and finish times of each segment according to their location with reference to SMPTE time code is read into memory. The status indicating ID found and VTR location is displayed on the terminal.

**Send for Brochure**  
Lake Systems Corporation,  
55 Chapel Street, Newton,  
MA 02160 617/244-6881

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### Any Tape Format

Choose from 1" Type C, 3/4" U-Matic, 1/2" Type M, or any combination.

**1000 EVENTS**

Or more with 68K Multi-Event Programmer and Disc Drive.

The computer identifies, searches out, and activates tape segments to be cued and aired in the order scheduled.

Lease Plans Available

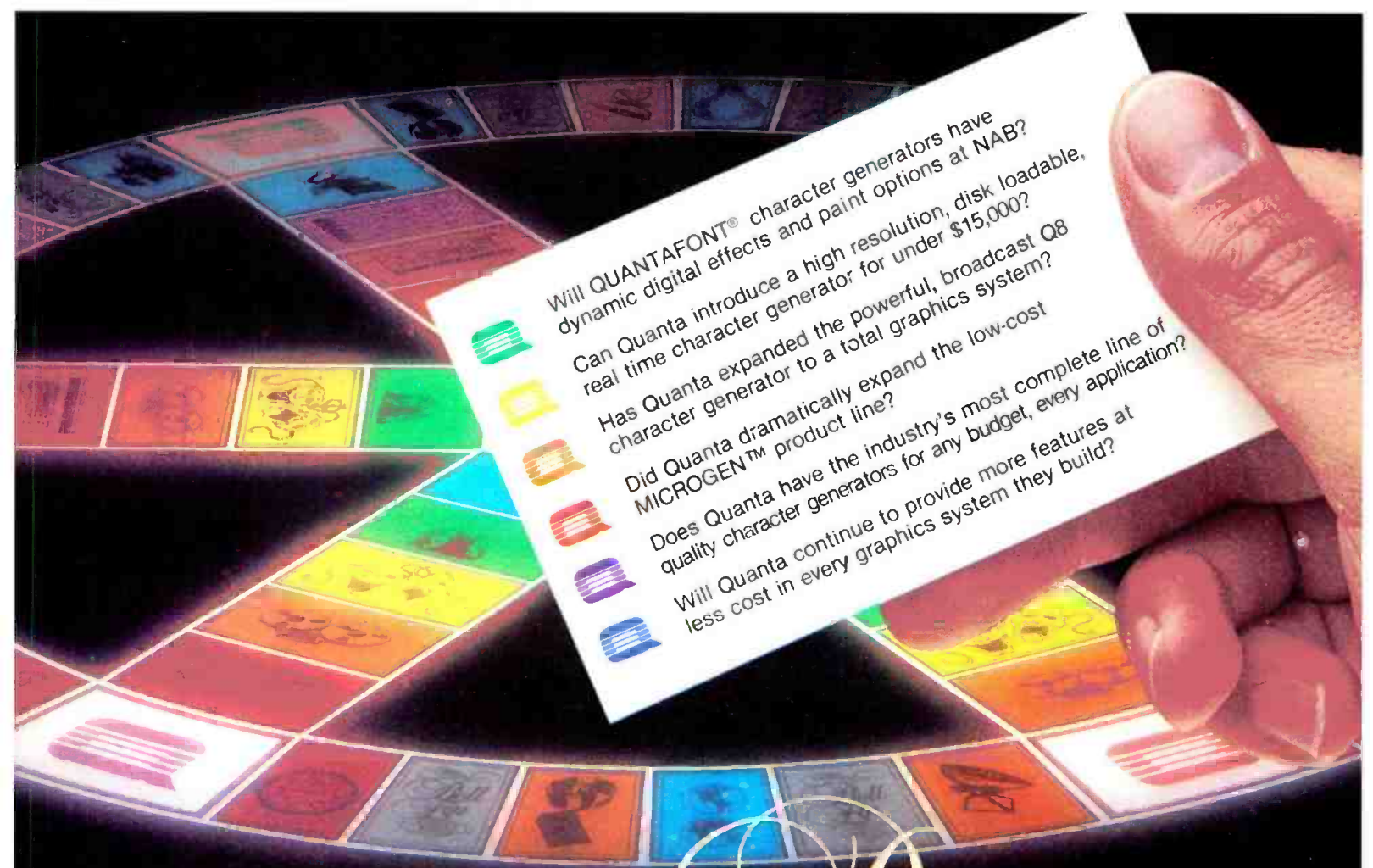
**LA-KART**  
LAKE SYSTEMS CORPORATION

Prices Start at \$89,900

See Us at Booth 1165

Circle (170) on Reply Card





Will QUANTAFONT® character generators have dynamic digital effects and paint options at NAB?

Can Quanta introduce a high resolution, disk loadable, real time character generator for under \$15,000?

Has Quanta expanded the powerful, broadcast Q8 character generator to a total graphics system?

Did Quanta dramatically expand the low-cost MICROGEN™ product line?

Does Quanta have the industry's most complete line of quality character generators for any budget, every application?

Will Quanta continue to provide more features at less cost in every graphics system they build?

# Creative Pursuit

...the "game" of creating superior television graphics without paying outrageous equipment prices ...

You've probably guessed the answers to these questions. But, there'll be no guessing at NAB — you'll see the answers in *action* — lots of it!

For instance, we've put dynamic digital effects and paint with Q8 — our high resolution graphics and titling system. Effects like flip, spin, zoom and rotate with the kind of paint you'll appreciate — easy, professional, affordable.

And, we've added a new QUANTAFONT® system. It creates high resolution characters and graphics, loads from disk, and operates in real time, at an unbelievable price.

Then, to make sure every player has a chance to win with Quanta, we've added three new, low-cost, high-performance production titlers to our line — smarter, more powerful MICROGENs.™

**See us at NAB - Booth 1432.** Find out how Quanta can help you win the Creative Pursuit game.



## QUANTA®

Circle (171) on Reply Card

Quanta Corporation • 2440 So. Progress Drive, Salt Lake City, Utah 84119 • (801) 974-0992 TWX 910-925-5684

[www.americanradiohistory.com](http://www.americanradiohistory.com)



**MZB & Associates****Introductions**

- 4x4 ENG: Jimmy TV mobile vehicle.
- IVECO-12: 12-foot mobile production vehicle in Iveco chassis.

**Product line**

Distributor of audio, video and RF equipment, construction of production vehicles.

Circle (730)

**Macrotel****Product line**

Broadcast teletext equipment.

Circle (731)

**Magnasync/Moviola**

(1331A)

**Product line**

Telecine system; film-to-tape transfer systems.

Circle (732)

**Magnum Towers**

(119)

**Product line**

Towers for AM, FM, television, microwave; tower installation, services.

Circle (733)

**The Management**

(612)

**Introductions**

- Co-Operator: co-op management system, aids managing co-op clients and account information.
- Sales Manager: tracks performance and projections of sales people and

customers.

**Product line**

Software programs for radio station business automation.

Circle (734)

**Marcom**

(304/306)

**Introductions**

- 710: TV stereo generator
- 720: FM stereo generator.

**Product line**

Distributor of audio, video equipment, tape, radio transmitters, antennas, system design.

Circle (735)

**Marconi Electronics**

(1514)

See GEC-McMichael.

**Marconi Instruments**

(1615)

**Introductions**

- Model 2022: signal generator covering 10kHz to 1GHz spectrum, AM, FM, PM modulation, GPIB programmable option; RF levels from -127dBm to +6dBm.
- 2923: TV signal generator/insertor.
- 2955: radio communication test set.

**Product line**

Modulation monitors, RF and AF test equipment.

Circle (736)

**Mark Electronics**

(1227)

**Introductions**

- Audio-monitoring system.
- Small master control switcher.

**Product line**

Character generators, rack, cabinet products, switching systems.

Circle (737)

**Marshall Electronics**

(1331)

**Introductions**

- BNC312-TBR: Tajimi Hi-Tek BNC receptable, integral 75Ω termination switch.
- BNC301BR: Tajimi male BNC isolated panel-mount, solder type.
- BNC307BA: Tajimi BNC-to-BNC isolated panel-mount connector.
- 2799: Mogami mini-quad, high-definition, low noise cable.

**Product line**

Standard, miniature cable for audio, video, instrumentation, test equipment; mic cable; control wiring; BNC, triaxial, sub-miniature coaxial connectors.

Circle (738)

**Marti Electronics**

(501)

**Introductions**

- AR-10: mobile repeater receiver.
- CR-10: rack-mount base receiver with monitor speaker.
- STL booster amplifier.
- Computer controlled remote control system.

**Product line**

Remote pickup systems, dual, mono STL systems, compressor, limiter amps, SCA equipment; telemetry links.

Circle (739)

**Matthews**

(1209)

**Product line**

Camera support systems, cranes, dollies.

# "Gauss. The Best Unknown Speakers in The World."

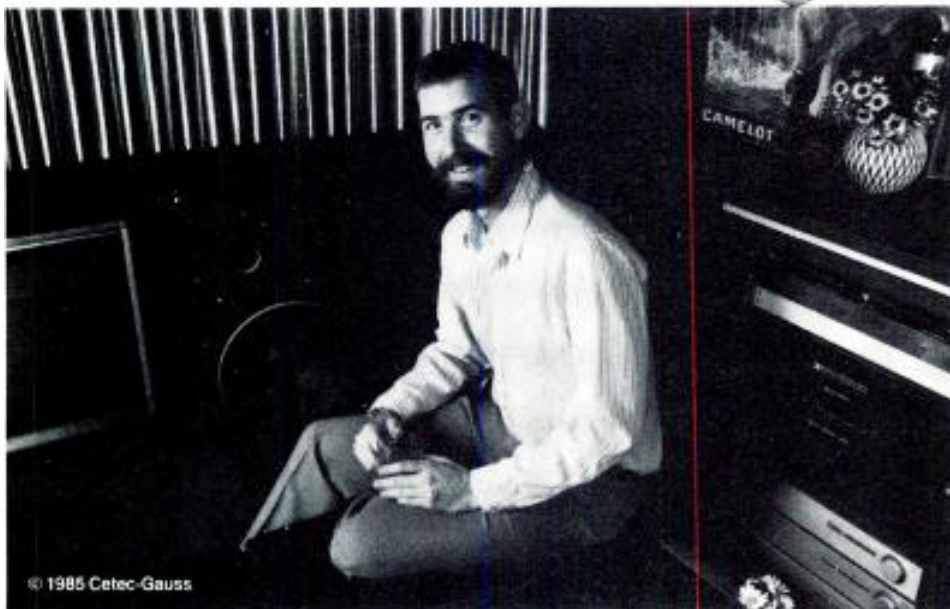
"Most people don't even know Gauss speakers exist," says Jim Martindale, Engineering Manager of Aphex Systems Ltd. "I live with sound at work and at home. At Aphex, we specialize in products that make sound better. So, I'm really critical of sound quality and demand dependability. That's why I like and use Gauss speakers."

"With Gauss, you always know you're getting a professional loudspeaker," Martindale continued, "with XXX (the three letter company), you never know whether the speaker was developed for hi-fi or pro use. The quality just varies all over the place. For my money, Gauss speakers are by far the best speakers I can use."

These comments were unsolicited and made by Mr. Martindale who purchased the Gauss speakers he uses in an elaborate sound system which supports Cinemascope movies, VHS Hi-Fi video, compact discs, stereo TV and "normal" stereo.

There's a Gauss loudspeaker to fit every professional need from 10" to an 18" that handles 400 watts and a range of high power compression drivers with response to 20 kHz. For information on the entire Gauss line, see your authorized Gauss dealer or write Cetec Gauss, 9130 Glenoaks Boulevard, Sun Valley, CA 91352, (213) 875-1900, Telex: 194 989 CETEC.

**Choice of the Pros**  
**gauss**  
by Cetec



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Circle (172) on Reply Card



# ANNOUNCING FORTY YEARS OF BROADCASTING EXCELLENCE... SWITCHCRAFT.

That statement should come as no surprise to anyone in broadcasting. For over forty years, we have been supplying broadcast engineers and technicians, studios and stations with efficient, durable audio components of every shape, size and design. As a broadcast professional you already know, and probably use, our products.

Just look around your studio for a moment. From the simplest audio connectors and patch cords to more sophisticated jack field and impedance matching transformers, Switchcraft products are an integral and basic part of the broadcasting and recording industries.



As you have grown, so have we. Our commitment to quality and excellence has led us to technological advances such as the "QG" Quick Ground connectors, a product innovation that has yet to be surpassed. All of our components are designed for convenience, durability and perfect sound transmission to insure broadcast and recording excellence.

Today, our product line encompasses thousands of standard and miniaturized components serving the full spectrum of audio requirements. Call us or your Switchcraft Representative today for complete details on all of our components and plug into forty years of experience.

**Switchcraft**

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5555 N. Elston Avenue • Chicago, IL 60630 • (312) 792-2700

Circle (173) on Reply Card



Matthews, continued

remote camera control systems, specialized camera mount products, grip equipment.

Circle (740)

# Maxell Professional (1624)

## Introductions

- Videotape: 1-inch tape material offers consistent RF output level, high chroma-to-noise ratio, low dropout rate; resists heat, humidity for reduced striction; scratch resistant surfaces.

## Product line

Recording media for audio, video and data.

Circle (741)

See ad page 221

# McCurdy Radio (207)

## Introductions

- 9000 series: digitally controlled intercom.
- Century series: audio-routing switchers.
- Video and audio follow video switchers.
- ADU 10: digital audio delay unit.
- 8800 series: console with all electronic switching.

## Product line

Audio mixers, routing switchers, audio amplifiers, intercoms.

Circle (742)

# McGraw-Edison Power Systems (124A)

## Introductions

- 37/5: stereo compatible communica-

tions and control system for AM-SCA to transmit digital data for commercial and utility applications.

## Product line

Utility load management systems for AM-SCA operation.

Circle (743)

# McMartin Industries (701)

## Introductions

- 5-channel SCA system.
- Television and stereo equipment.

## Product line

AM, FM transmitters, audio processors, subcarrier generators and demodulators, modulation monitors, remote pickup systems, audio mixers.

Circle (744)

# Media Computing

## Introductions

- Software for news and music playlist, IBM/PC and compatibles.
- Wire service interface: ties station to wire news services.

## Product line

Computer software for station program automation.

Circle (745)

# Merlin Engineering (1023)

## Product line

VTR, VCR, video equipment modifications.

Circle (746)

# Micro Communications (1014A)

## Introductions

- MMDS: Multichannel stereo TV diplexer system.

## Product line

Circular, rectangular waveguide, MDS, ITFS multichannel combiners, diplexers, ITFS antennas, RF components, systems, FM antennas, ENG antennas.

Circle (747)

# Micro Controls (104)

## Introductions

- MCI 2001: TSL system, 450MHz, 2W to 10W.
- MCI 2002: remote pickup equipment, 450MHz, 2W to 45W.
- MCI Galaxy: subcarrier paging system.

## Product line

STL microwave system, remote control equipment, subcarrier systems.

Circle (748)

# Microdyne (1612)

## Introductions

- 1100HDR: C-/Ku-band LNC-type video receiver.
- 1100PCDR(5): SCPC demodulator, frequency agile with selectable transmission setup switches.
- PR23K: 7-meter Ku-band antenna, for receive or transmit.
- MAPSIII: motorized polar mount for 5- and 7-meter antennas.

## Product line

Satellite video receivers, SCPC uplink/downlink systems, antenna mounts, order wire and IFB systems.

Circle (749)

# THE VC-2500P

## AUTOMATIC VIDEO CORRECTION

The VC-2500P automatically corrects the video output of satellite receivers, VCR's, TV cameras, and other video sources. The AGC circuit will automatically hold the video level at IVP-P. The VC-2500P also completely regenerates the synchronizing and blanking signals. Problems such as jitter, bending, rolling, and satellite receiver flicker are solved in most cases.

The VC-2500P prevents over/under modulation level problems on video modulators in CATV and MATV systems and solves downstream stability problems as well. The unit is invaluable for maintaining levels and stability in video tape duplicating systems. CCTV surveillance systems are benefitted by maintaining each camera at the same level and stability.

Available in NTSC or PAL. The NTSC price is only \$495.

Call or write for literature.

ICM VIDEO  
10 NORTH LEE • P.O. BOX 26330  
OKLAHOMA CITY, OK 73126  
(405) 232-5808

See Us At  
NAB Booth 1766



Circle (174) on Reply Card



# STANTRON VIDEO CENTER

MODULAR DESK CONSOLES • VTR/VCR RACKS • CABINET CONSOLES • DUBBING RACKS



for  
VIDEO  
• PRODUCTION •  
• POST PRODUCTION •  
• DUBBING •  
• EDITING •



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.

MAILING ADDRESS: **P.O. Box 9158VC • No. Hollywood, CA 91609 U.S.A.**

**STANTRON**

Unit of Zero Corporation

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Northern Calif. — Toll Free 1-800-821-0020  
Southern Calif. — Please call 1-213-875-0800  
Factory: TWX: 910-499-2177  
6900-6918 Beck Ave. • No. Hollywood, CA 91605



Circle (175) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



**Micron Audio Products (1122C)****Introductions**

- CTR-501: mobile wireless mic system with CNS noise suppression.
- TX-503: hand-held CNS transmitter.
- MDS-2: modular multichannel space diversity receiver with CNS.
- MDR-540: modular space diversity plug-in with CNS.
- CM-1: wireless mic camera mount.

**Product line**

Wireless microphone systems.

Circle (750)

See ad page 202

**Microprobe (331)****Introductions**

- Controller and tone generator for mastering tape.

**Product line**

Programmers and controllers, including satellite programming services.

Circle (751)

See ad page 309

**Microtime (1230)****Introductions**

- Genesis I: video special effects system.

**Product line**

Time base correctors, frame synchronizers.

Circle (752)

**Midwest (1710/1710A)****Product line**

Mobile production vehicles, dis-

tributor of audio, video and RF equipment.

Circle (753)

See ad pages 1/76-77

**Minolta (1113)****Product line**

TV color analyzers, light meters.

Circle (754)

**Mitomo (1509)****Introductions**

- Computerized laserdisc random-access changer.

Circle (755)

**Modulation Associates****Introductions**

- SR-13: frequency synthesized, agile satellite subcarrier demodulator system for stereo TV sound or data transmission above video.
- E-SAT: SCPC satellite receiver.

**Product line**

SCPC satellite receiver systems, solid-state satellite uplink products.

Circle (756)

**Modulation Sciences (204B)****Introductions**

- TSG(STV-784): stereo generator for television with audio processing and loudness controller.
- TV Sidekick (TSCA-189A): second audio program generator with processing and integral dbx.
- Pro Sidekick (SCA-186): professional channel generator with processing and dbx.

- Data-Pro: data distribution for pro channel on television.

**Product line**

Signal processors for audio, data and composite signal processing for FM subcarrier use.

Circle (757)

See ad page 295

**Mole-Richardson (1006)****Introductions**

- Type 4271: motorized Molepar.
- Type 2981: mini Softlite.
- Type 5321: 2.4kW dc Moleelectron-ic dimmer.
- Type 5361: 12kW ac to dc Moleelectron-ic dimmer.
- Type 2901: 2-inch Tiny-Mole Solarspot.
- Type 6281A: 6kW HMI Mole Solar-Arc light.

**Product line**

Lighting instruments, lamps, dimmers, controllers, lighting packages.

Circle (758)

**Montage Computer (2330)****Introductions**

- Picture Cutter: for finishing on film, does 3:2 tape-to-film pulldown, syncs audio, picture to clap board, prints negative cutting list by edge numbers on film.
- Picture Processor: updated editing control system, allows assignment of labels to audio and video for editing to finish on film.

**Product line**

Editing control systems.

Circle (759)

# LIGHTS! CAMERA! HANNAY!

Fast pick-up. Increased safety. Greater mobility. You get it all with Hannay Cable Reels. Available

in portable or stationary models, these dependable reels safely handle electrical cable.

Count on them for time-saving rewind. Easy storage. And all the behind-

the-scenes operating convenience you'll ever need. Send today for more information

on the full line of Hannay Cable Reels, available in a wide selection of sizes, shapes and capacities.



**Send Today For Free Literature Packet.**



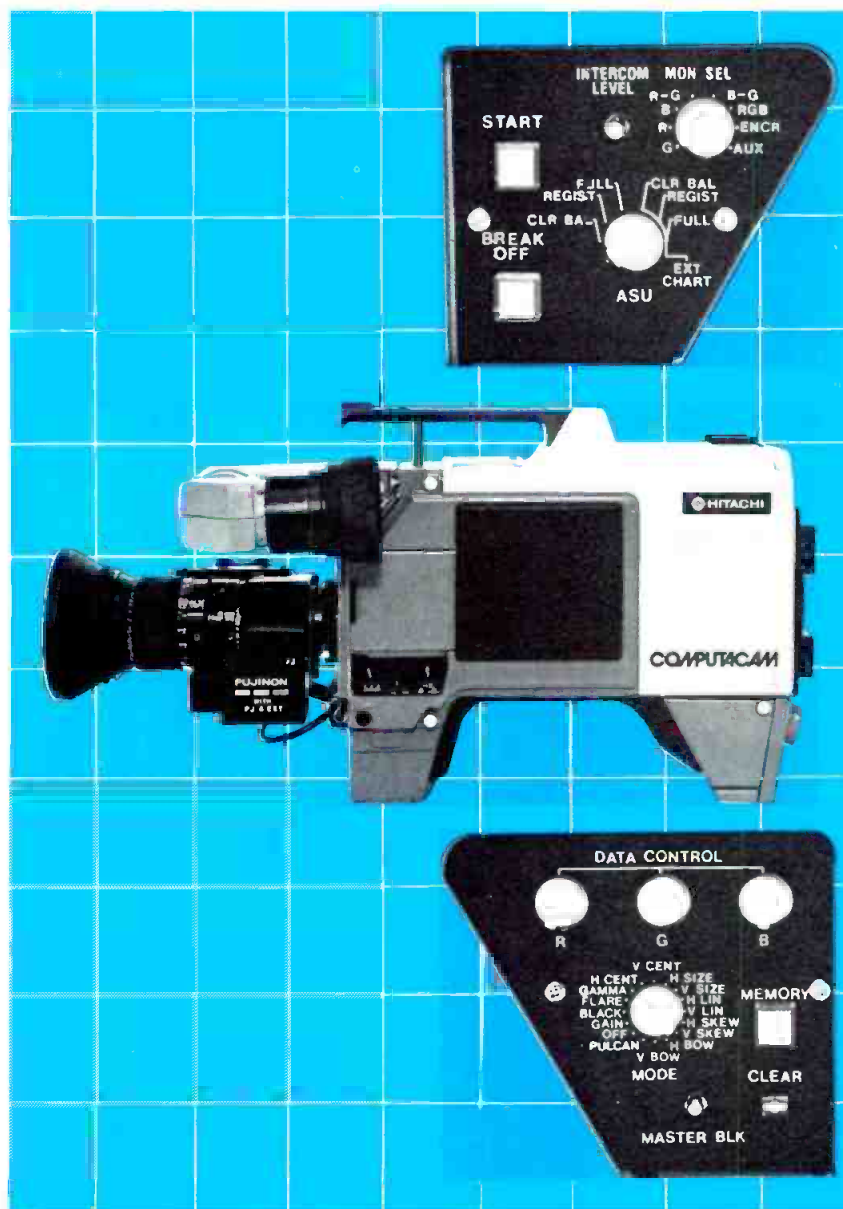
**HANNAY REELS**

CLIFFORD B. HANNAY & SON, INC., 600 EAST MAIN STREET  
WESTERLO, NEW YORK 12193 • TELEPHONE (518) 797-3791

Circle (176) on Reply Card



# We designed-in features the competition couldn't.



Get the competitive edge with our new family of field/studio cameras. The SK-97 and SK-970 combine on-board computers and advanced technology to provide the maximum flexibility and control available today.

No competitive video camera automatically sets up full color balance and full registration, including the green channel, in just two minutes.

No other video camera in its class has a full function, "smart" Remote Control Unit offering more capability in less space.

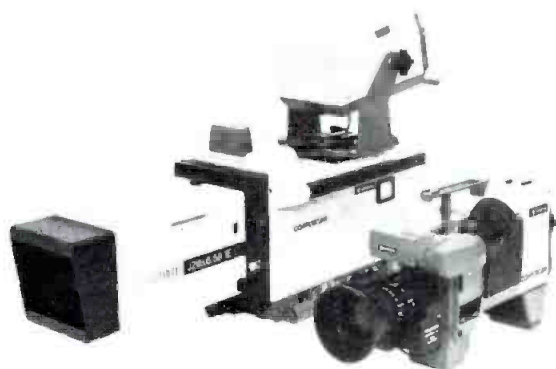
No other competitive video camera offers real time registration correction during lens zooming and focusing.

No other camera in its class offers automatic corner registration correction as part of its automatic registration set-up.

No other video camera has a prism heat sensor and pre-programmed ROM to ensure correct registration in real time.

Each camera contains an on-board computer that allows simultaneous set-up of up to 42 cameras within two minutes. Plus only one camera is affected in case of auto set-up failure.

## Hitachi's SK-970 and SK-97 Computacams.



Our SK-970 and SK-97 Computacams offer superior noise-free video (59 dB signal-to-noise-ratio)

Combine all this with other advanced features such as 700 horizontal lines of resolution, high gain in 3 dB steps from 0-21 dB, completely interchangeable boards, and built-in auto diagnostics, and you can see why our SK-970 and SK-97 Computacams stand alone!

Get the features the competition couldn't design in. For descriptive literature, technical information, or a personal demonstration, contact Jack Breitenbucher, National Sales Manager, Hitachi Denshi America Ltd., Broadcast and Professional Division, 175 Crossways Park West, Woodbury, N.Y. 11797 (516) 921-7200 or (800) 645-7510.



Circle (177) on Reply Card



**Moseley Associates (301)****Product line**

Aural STL systems, multiplexed data links, remote control equipment, stereo and subcarrier generators, demods, telemetry equipment, audio processors.

Circle (760)

See ads pages 15/291

**Motorola (309)****Product line**

AM stereo exciter, modulation monitor, receivers, IC decoder, portable, mobile 2-way communication equipment.

Circle (761)

**Multi-Track Magnetics (1712)****Product line**

Recording head replacements, recorder motor replacements.

Circle (762)

**The Musicworks (209)****Product line**

Radio music program services.

Circle (764)

**Mycro-Tek (1752)****Product line**

Character generator/titler, information display systems.

Circle (765)

**NEC America (1415)****Introductions**

- SP-3A: CCD camera, using improved

imaging devices.

- E-Flex system: upgraded software and control devices.
- TV transmitters: UHF and VHF.

**Product line**

FM transmitters, frame synchronizers, video multiplex systems, ENG microwave equipment.

Circle (766)

See ads pages 57/70

**NETCOM (1516)****Product line**

Satellite program transmission, distribution service.

Circle (767)

**NTI America (1014D)****Introductions**

- VFCG-2: still-store system with 5640 frame Winchester memory, high resolution character generator, video digitizer, graphics, sports scoring, election packages.

**Product line**

Still-store systems.

Circle (768)

**Nady Systems (1133)****Introductions**

- 501 VHF: 601 VHF: highband VHF wireless microphone systems.
- 701 VHF: highband VHF wireless microphone system with diversity reception.

**Product line**

Wireless mic systems, wireless intercom systems.

Circle (769)

See ad page 290

**Nagra Magnetic Recorders (1213)****Introductions**

- T-Audio: production models with time code synchronizer.

**Product line**

Portable audio recorders.

Circle (770)

**Nalpak Video Sales (1124)****Introductions**

- TP1S, TP2B, TP2R: tripak tubular cases, designed for tripods, lighting equipment.
- RT19: Rack-TOTE: rack case for transportation of 19-inch rack-mounted equipment.
- ACC-PK pocket version of Accu-chart test chart system.

**Product line**

Cable reels, transportation cases, tape winders, camera test charts.

Circle (771)

See ad page 308

**Nautel Maine (126)****Introductions**

- AMPFET 50: 50kW AM broadcast transmitter, based on high-power MOSFET devices, solid-state with 48 1.25kW power blocks, on-air replaceable.

**Product line**

Solid-state AM broadcast transmitters.

Circle (772)

**Neotek (408)****Introductions**

- The Elite: multitrack audio recording console.

**Simply  
Reliable**



# We Have Your Console!

the  
Sound  
Solution

**Expandable**  
... at any time



**7000**

Our premier consoles are designed for simplicity and reliability. The **7012** and **7012A** consoles continue to be today's choice, allowing broadcasters excellent sound quality with efficient VCA control, all at a cost well below what others charge for less. 12 channels, 22 inputs, full stereo, with your choice of metering functions. Clearly an excellent console for today's broadcast needs.



**7512A**

This console continues the **Howe** tradition of simple-to-operate, reliable products, but adds features to make the operator's job even easier. These include: remote control for machines, a clock and timer, 2 talkback circuits, and much more. Comprehensive operator control and superior sound quality make the **7512A** an exceptional choice.

**9000**

The latest in the legacy of quality consoles from **Howe**, the **9000** is available from 8 to 22 channels tailored to your needs. There is no costly mainframe, but full modular capability is built in. 3 inputs per channel, mix-minus on all channels, sealed membrane switches for channel and machine control, and unmatched audio performance. These features and more combine to give the broadcaster outstanding flexibility.

See us at NAB  
Booth 321



## howe audio productions, inc.

2300 Central Avenue • Suite E • Boulder, CO 80301 (303) 444-4693 • For more information (800) 525-7520

Circle (178) on Reply Card





## GET THE PICTURE

### With the Schwem Gyrozoom 60/300™ Image Stabilizer Lens



**Now, truly stabilized optics.** The new Schwem Gyrozoom 60/300 Image Stabilizer Lens fits most  $\frac{2}{3}$ " ENG cameras and eliminates virtually all image vibration. Smooth footage is obtained when shooting from any moving vehicle—helicopter, truck, boat, motorcycle—even on foot—whether the camera is hand-held or on a tripod. The image is stabilized optically—not with braces or brackets.



**Zoom from 60mm to 300mm.** This lens enables you to shoot close-up from 1000 feet with a perfectly steady image. It is ideal for newsgathering and sports coverage.

**Compact and lightweight.** The Gyrozoom weighs in at approximately 6 lbs. Power drain is only 1 additional minute/hour.

**Easy to operate.** There's no special training required. It is as easy as 1. Attach 2. Aim 3. Shoot.

**American quality backed by a full warranty.** Fully warranted for 6 months with an optional service contract after warranty period.

To get the picture, you have to see the picture. Call Schwem Technology today to arrange a free demonstration.  
3305 Vincent Road, Pleasant Hill, CA 94523, Call Collect (415) 935-1226.  
Circle (179) on Reply Card



**SCHWEM**  
TECHNOLOGY

See us at NAB, Booth No. 2258



Neotek, continued

Product line \_\_\_\_\_  
Audio mixing consoles.  
Circle (773)

### Network Production Music (1138)

Introductions \_\_\_\_\_

- Sound effects library: 3000 sound effects on 887 stereo records, catalogued.

Product line \_\_\_\_\_

Program music libraries.

Circle (774)

### Rupert Neve (1410)

Introductions \_\_\_\_\_

- Necam 96: 36-input production console with NECAM moving fader auto-

mation.

- 5116/36: 51 series stereo console, with 16 to 60 inputs, two to 48 outputs.
- 5432, 5452: 542 series stereo consoles, with eight, 12 or 16 inputs and two or four outputs; video editor interfacing.

Product line \_\_\_\_\_

Audio automation systems, audio consoles, audio limiting, compressor processors.

Circle (775)

See ad pages 146 147

### Nisus Video

Introductions \_\_\_\_\_

- N59E: stop action camera based on the Ikegami HL-79E ENG camera.

Product line \_\_\_\_\_

Shutter-modified TV cameras for stop action use.

Circle (776)

### Nordic Software (622)

Product line \_\_\_\_\_

Computerized logging, billing system.

Circle (777)

### Norpak

Introductions \_\_\_\_\_

- TDS 3: NABTS teletext delivery system.
- TMS 3: NABTS teletext management system.
- TTX 6: teletext decoder module.
- IPS 3: NAPLPS information provider system.
- TTX 5: NABTS teletext terminal.

Circle (778)

See ad page 148

### Nova Systems (1345)

Introductions \_\_\_\_\_

- Nova 490: digital TBC for 1/2-inch and 3/4-inch VCRs, 32-line storage, heterodyne operation, 8-bit 4xfsc sampling, 1-rack unit high.
- Nova 510: digital TBC, heterodyne or subcarrier feedback, 32-line storage, full-feature, 1-rack unit high.

Product line \_\_\_\_\_

Time base correctors, synchronizers.

Circle (779)

### Nurad (1426)

Introductions \_\_\_\_\_

- SQ6-series: receive antenna system, 6-foot version of SuperQuad II, with quad polarization, high gain, low sidelobes.
- 130CT1: compact 22-channel transmitter for 13GHz; for 'window links.'
- 130OR1: compact antenna for 130CT1 system, 14.5-inch parabolic; detachable offset feed/waveguide assembly.
- 120CT1: compact transmitter and 20PA15(A) mast-mount amplifier, supplements 2GHz Silhouette remote transmit systems.
- Logic-Track: helicopter auto tracking receive systems; Loran C-aided heading determination.
- 20CA1: compact antenna with same gain as comparable sized disc, rod or helical antenna but with improved axial ratio and sidelobe characteristics.
- SuperTrack System: auto tracking option for SQ6, SuperQuad II, and Silhouette antenna systems.
- AT-series: rack-mounted frequency agile transmitters in 2GHz, 2.5GHz, 6GHz, 7GHz, 13GHz spectra.
- 130AR2: 13GHz frequency agile rack-mounted receiver; 22 channels available.
- AR2-series: central ENG/EJ receivers; improved signal-to-noise and adjacent channel rejection performance.

Product line \_\_\_\_\_

ENG microwave systems; microwave antenna systems; STL, intercity relay systems.

Circle (780)

### Nytone Electronics

Introductions \_\_\_\_\_

- VSS-1: video-slide scanner systems.

## The Dorrrough Loudness Monitor



Dimensions: 8 1/4" X 2 7/8" X 6 1/2"

Model 40-A

Simultaneous display of  
Peak and Persistence functions.  
With AM, FM, and TV  
It's not just a third standard;  
It's becoming the standard.

Each day more broadcasters and production houses discover how accurate this visual display can be for achieving uniform loudness from source to source. Available as a single unit complete with power supply, dual or single rack mount, or small console mounting.

## The Discriminate Audio Processor



Model 610

FM's Hottest  
A complete processing package  
including its own stereo generator.

Beyond a doubt the most transparent, yet still the loudest processor developed.  
The most technologically advanced unit on the market today.

## DORROUGH ELECTRONICS

5221 Collier Place  
Woodland Hills, California 91364  
(818) 999-1132

Or a Dorrrough Distributor

Circle (180) on Reply Card



**HUMAN ERROR  
HAS JUST BEEN  
ELIMINATED FROM  
BROADCAST OPERATIONS.**

No more "make goods"!

And a vast improvement in operational reliability are just the beginning with the Grumman Machine Control System—computer control of virtually any of your studio equipment.

Machine Control System does away with antiquated manual cuts and insertions so that the right video rolls at exactly the right time. With the Grumman Machine Control System, every piece of expensive hardware in your facility is put to work more efficiently.

Consider the greater productivity with real-time statusing and diagnostics—not just switching.

Consider the cost savings. No matter what your machine mix—serial or parallel—the Grumman Machine Control System provides

off-the-shelf-compatibility. So you can automate right now.

The entire system, hardware and software, is modular. It can be customized to your own studio requirements. Whether you are controlling two machines or 200. And over time, you can upgrade Machine Control System as you find more for it to do.

This expandability makes Grumman Machine Control System an ideal investment for broadcasters, production houses, cable companies and industry giants.

Even the first step towards total automation can visibly improve any operation. A Grumman specialist can show you how. Call us at (516) 435-6001. Grumman Aerospace Corporation, Broadcast Group, Great River, L.I., New York 11739.



Circle (181) on Reply Card



- VSS-2: slide transparency or slide transfer system provides RGB or NTSC composite video signals. Random-access capability.

Product line \_\_\_\_\_  
Slide scanner, telecine equipment.  
Circle (781)

**O'Connor Engineering Labs (1103)**  
Introductions \_\_\_\_\_

- System 105HD: camera support system for large video cameras; 100HD heavy-duty fluid head, side-loading, adjustable platform; dual extendable handles; claw-ball leveling tripod with internal spreader.

Product line \_\_\_\_\_  
Optimized camera support products, pan/tilt heads, tripods, support systems, dollies.  
Circle (782)

**Oleson (1307)**  
Product line \_\_\_\_\_

Studio packages including lighting, dimming, distribution grids, curtains, tracks.  
Circle (783)

**Omicron Video (1748)**  
Introductions \_\_\_\_\_

- 516: video production switcher.
- ElePac-90: replacement for Sony BP-90 battery.
- Elecon/Eiden 465: stereo television

modulator.  
Product line \_\_\_\_\_  
Video, audio DAs, video switchers, sync generators.  
Circle (784)

See ad page 214

**Orban (607)**  
Introductions \_\_\_\_\_

- 8182A/SG: Stereo TV generator, demonstrations.
- 700: Absolute loudness meter.
- 414A: Stereo compressor/limiter.
- ACC-11: Security covers for all products.

Product line \_\_\_\_\_  
AM, FM, TV stereo generators, production audio processors, delay/reverb products, stereo synthesizer.  
Circle (785)

See ads pages 123/217/253

**Otari (601)**  
Introductions \_\_\_\_\_

- EC-101: edit code synchronizer for MTR-90 multichannel recorder.
- CB-121: remote controller for EC-101.

Product line \_\_\_\_\_  
Multichannel audio recorders, machine resolvers, controllers, tape duplication equipment.  
Circle (786)

See ads pages 124-125/169

**PAG America (1747)**  
Introductions \_\_\_\_\_

- Speedcharge 6000: charger system, provides automatic determination of proper charging voltage and current for any NiCad and many lead acid batteries.

- Sequencer 6000: charger accessory; allows sequential charging of eight assorted batteries or battery belts.
- Mastercharger: fast/slow microprocessor-controlled ENG charger, accommodates four batteries or belts ranging from 10-15V, 2-12AH.

Product line \_\_\_\_\_  
Batteries, chargers, battery belts, portable lights.  
Circle (787)

**PEP (1408)**  
Introductions \_\_\_\_\_

- AS64/800: alternate VHS edit source with interface to BVU800; push-button changeover from professional VHS deck on 3/4-inch machine to 3/4-inch recorder.

Product line \_\_\_\_\_  
Battery chargers, batteries, power supplies.  
Circle (788)

**Pacific Recorders & Engineering (113)**  
Introductions \_\_\_\_\_

- BMX-III: modular on-air radio console.
- Newsmixer: compact, modular dual-bus mixer, routing and monitoring system for radio newsrooms.
- AMX: modular on-air/production console.
- Micromax: NAB cartridge reproducer.

Product line \_\_\_\_\_  
Audio consoles, cartridge recorders, reproducers, audio distribution systems, routing switchers; line selectors, phono pre-amp.  
Circle (789)

## Beaveronics, Inc.

Stand-alone Downstream Keyers  
To Upgrade Your Total System



DSK-6-DL  
&  
DSK-4-DLB

Especially  
Designed  
for  
Character  
Generators

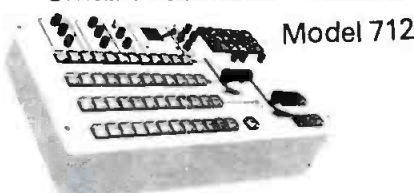
Various Other  
Models  
Offered

### FEATURES

- Independent stand-alone keyer
- Built-in Edge Border, Shadow, and Outline, variable from black to white
- Built-in Matte Generator
- Key can be inserted or removed by cut or automatic mix at any of four rates
- "Cut" or automatic Fade to Black at any of four rates
- Edge Border variable from black to white
- Key may be filled with either key video or matte
- Can select up to four key sources either individually or simultaneously

### STUDIO PRODUCTION VIDEO SWITCHING SYSTEMS

For Remote, ENG, and  
Small Production Facilities



Model 712

For Moderate Size Facilities  
Model B1-154



For Sophisticated Facilities  
Model B1-156



(Also Available in PAL  
and PAL-M Versions)

### OPTIONAL FEATURES

Write or phone for details.

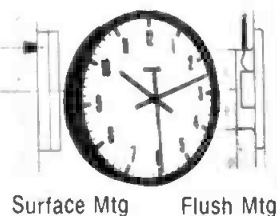
Beaveronics, Inc. 8 Haven Avenue • Port Washington, New York, 11050 • Tel: (516) 883-4414

8 HAVEN AVE.  
PORT WASHINGTON, NEW YORK 11050  
516/883-4414

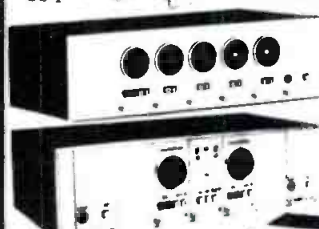
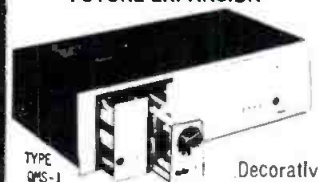
### FAVAG Master Clock Systems

Minute or second impulse

6 DIGIT DIGITAL  
DISPLAYS AVAILABLE



MASTER CLOCK SYSTEMS  
MODULAR DESIGN FACILITATES  
FUTURE EXPANSION



2QMS-2 Dual Unit  
with Auto-Changeover

NUMEROUS SECONDARY CLOCKS  
ARE AVAILABLE INCLUDING THOSE  
WITH SILENT OIL-BATH MOVEMENTS

See Us At NAB Booth 1313



# SERIES 2500 AMPLIFIER SYSTEM

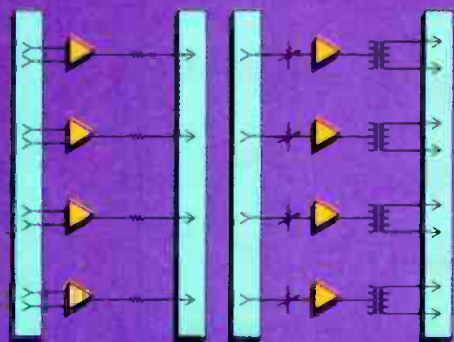
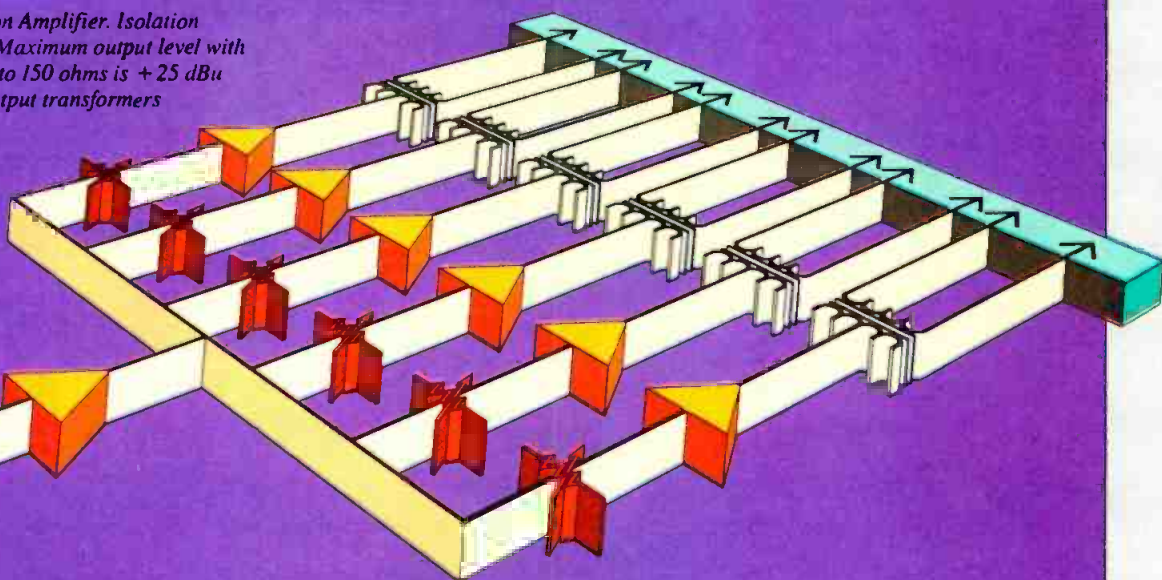
Introducing a series of super high-performance audio amplifiers designed to be part of a versatile three rack-unit card-frame system. The Series 2500 will offer a variety of 20 plug-in amplifiers. The first four are featured in this bulletin.

Thorough circuit design coupled with industrial high-grade components assure unconditional stability and long-term reliability. A full-frame steel housing surrounds each amplifier for structural support and electrical shielding.

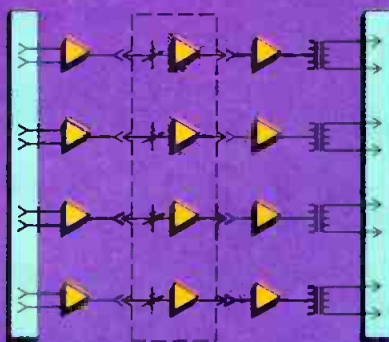
Some of the exceptional specifications common to 2500 Amplifiers are: +28 dBm into 600 ohm loads from 30 Hz to 20 kHz all outputs driven; +32 dBV max input level; SNR > 100 dB; input CMRR typ 75 dB @ 50 Hz; 4  $\mu$ s rise time; max phase shift +22.5° @ 20 Hz, -22.5° @ 20 kHz; output source impedances of 80 ohms or less.

Interconnection to external equipment is simple and reliable via .025 square post terminations. This universally accepted technology is inexpensive and easy to install or modify.

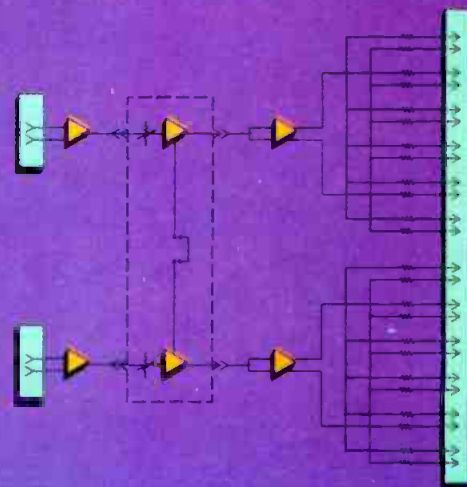
*MODEL 2510 1 X 6 Audio Distribution Amplifier. Isolation between outputs typ 70 dB @ 1 kHz. Maximum output level with <0.1% THD from 30 Hz to 20 kHz into 150 ohms is +25 dBu and +28 dBm into 600 ohms. The output transformers do not require termination and exhibit less than 1% overshoot.*



*MODEL 2516 Quad Buffer Amplifier is primarily designed to interface unbalanced -10 dBV IHF level equipment to balanced +4/+8 dBm professional equipment.*



*MODEL 2514 Quad Line Amplifier can be used as four discrete amplifiers or two stereo pairs. Optional remote-gain VCA circuitry is available.*



*MODEL 2512 Stereo 1 X 6 Audio Distribution Amplifier can be used as a single 1 X 12 or a dual 1 X 6 distribution amplifier. Optional remote-gain VCA circuitry is available.*

**RTS SYSTEMS**

INCORPORATED

A Compact Video Company

For more information on the Series 2500 call or write

RTS SYSTEMS, INC. PROFESSIONAL INTERCOMMUNICATIONS • PROFESSIONAL AUDIO PRODUCTS  
1100 West Chestnut Street, Burbank, California 91506 • Phone 818/843-7022 • Telex 194855

Circle (183) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



**Paltex/California Paltex (1005)**

**Introductions**

- **ESPRIT:** 5-VTR edit controller, 1400 line edit list memory, back-trac EDL trace, editing, animation, user defined keys, HELP.
- **GEMINI:** component digital video processor, 8-bit 4-2-2 sampling, handling stable and unstable VTR outputs, non-synchronous video.

**Product line**

Editing controller systems.

Circle (790)

**Panasonic Industrial (1019)**

(Video Systems)

**Introductions**

- **AK30:** 3-tube ENG/EFP camera; M-format outputs.
- **RS-422 interface:** allows standard bus machine control capability to video recorders, players.
- **AU-350:** M-Format recorder, player, editor, with 422-bus control.
- **TQ-2024:** optical memory disc player.
- **Editing controller:** 3-machine system.
- **Video production switcher.**

**Product line**

TV cameras, video recorders, programmable multideck VCR system, video monitors, editing controllers.

Circle (798)

See ads pages 47/49-53/167

**Panasonic/Ramsa (437)**

**Introductions**

- **WR-8660:** Production audio mixer.

**Product line**

Microphones, audio consoles, audio recorders, Technics turntables.

Circle (799)

See ad pages 47-53

**Patchbay Designations (1773)**

**Introductions**

- Patch prints.
- Film inserts for rear-illuminated button switches.

**Product line**

Patch panel labels.

Circle (791)

See ad page 278

**Peerless Sales (1618B)**

**Introductions**

- **4004-050/4004-090:** false ceiling camera arms.

**Product line**

Camera support systems.

Circle (792)

**Penny & Giles (436)**

**Introductions**

- Servo-controlled, motor-driven audio fader.

**Product line**

Audio attenuators.

Circle (793)

**Perrott Engineering (1729)**

**Product line**

- Clip-on and belt battery systems, battery chargers, lighting systems.

Circle (794)

See ad page 104

**Philips TV Systems (707, 1500A)**

**Introductions**

- **LDK-54:** new generation of portable cameras with configurations for ENG, EFP multicore, EFP triax, includes Lineplex tape format products.
- **LDH-7020:** 20-inch high resolution color monitor.
- **CVE:** component video effects system with dual channel, integral digital switcher and real-time capability.
- **LDM-3003:** digital comb filter decoder.
- **LDM-1791:** high efficiency Klystron UHF TV transmitter.

**Product line**

TV cameras, video monitors, digital effects systems, graphic arts systems, compact disc players, video recording equipment, FM, TV transmitters.

Circle (795)

See ad pages 312-313

**Philips Test & Measuring (1408A)**

**Introductions**

- **PM5633:** sync/pattern generator with component output.
- **PM5652:** NTC-7 VITS generator/ inserter, including external signal input.

**Product line**

IEEE-bus capable sync/pattern generators, TV modulators, waveform vector monitors, color analyzers, VITS generators, inserters.

Circle (796)

See ad page 127

**Phoebus (1331C)**

**Introductions**

- **Mighty Arc:** mini version of Ultra Arc followspot; rated at 70% light output of Ultra Arc short-throw unit.
- **Ultra Arc series II:** high intensity, long-life lamp, for long-throw use.

**Product line**

# Incomparable !



## 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

**Video Production:**

Character Generators  
Animation Stands  
Switchers  
Special Effect Generators

**Machine Control:**

Activating VTR's, Film Chains, etc.  
Multiple VTR Sequencing  
Time-of-Day Events  
Alarms

**Invaluable. Incomparable.  
In stock at \$2,160.**

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

See us at  
NAB Booth  
1807A



Sales/Marketing Headquarters:  
10 Kearney Rd. • Needham, MA 02194  
Tel: (617) 449-7546 • Telex: 940536  
**Superior Time-Code Products**

Circle (184) on Reply Card

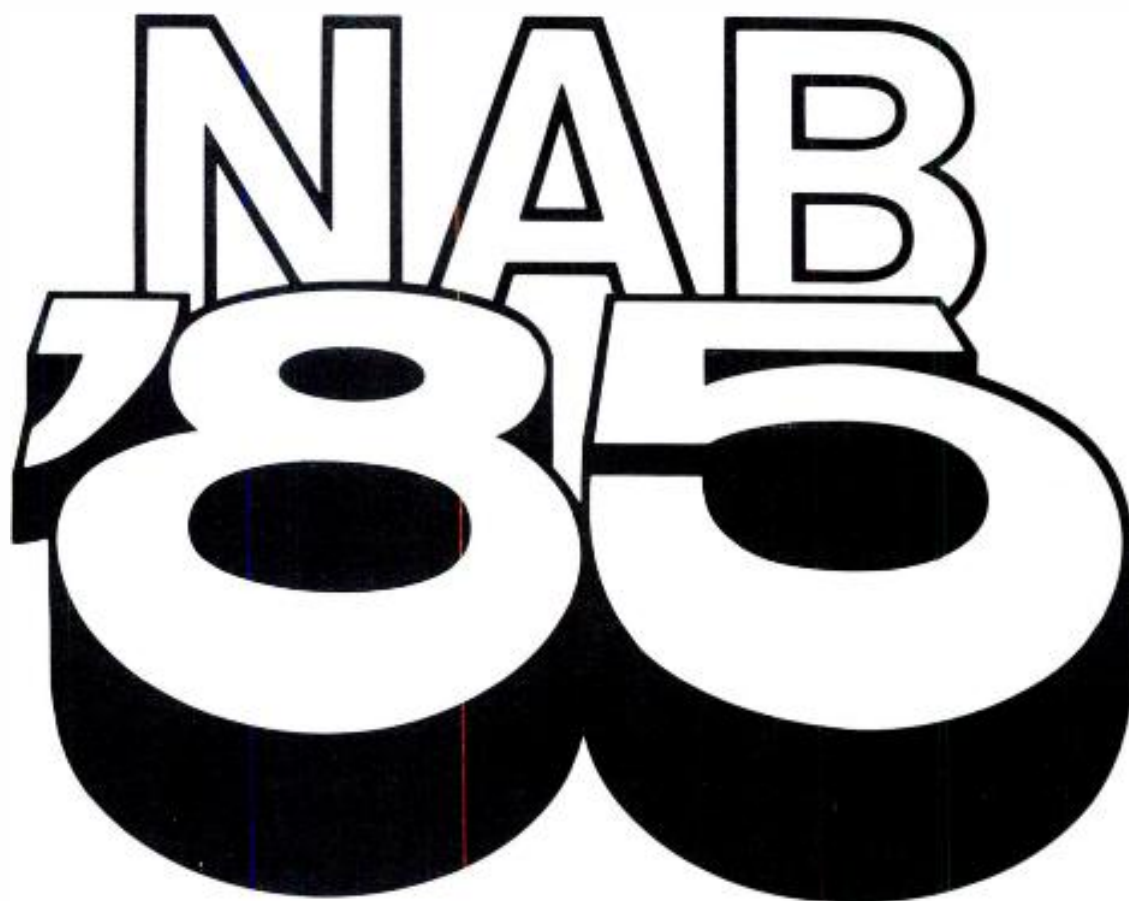


**Interactive Systems Company (ISC)**  
of Boulder, Colorado  
is happy to announce  
their merger with  
**The Grass Valley Group, Inc.** on  
**1 February 1985.**

See  **ISC** editing systems in booths 1167 and 1171 at NAB '85.

Circle (185) on Reply Card

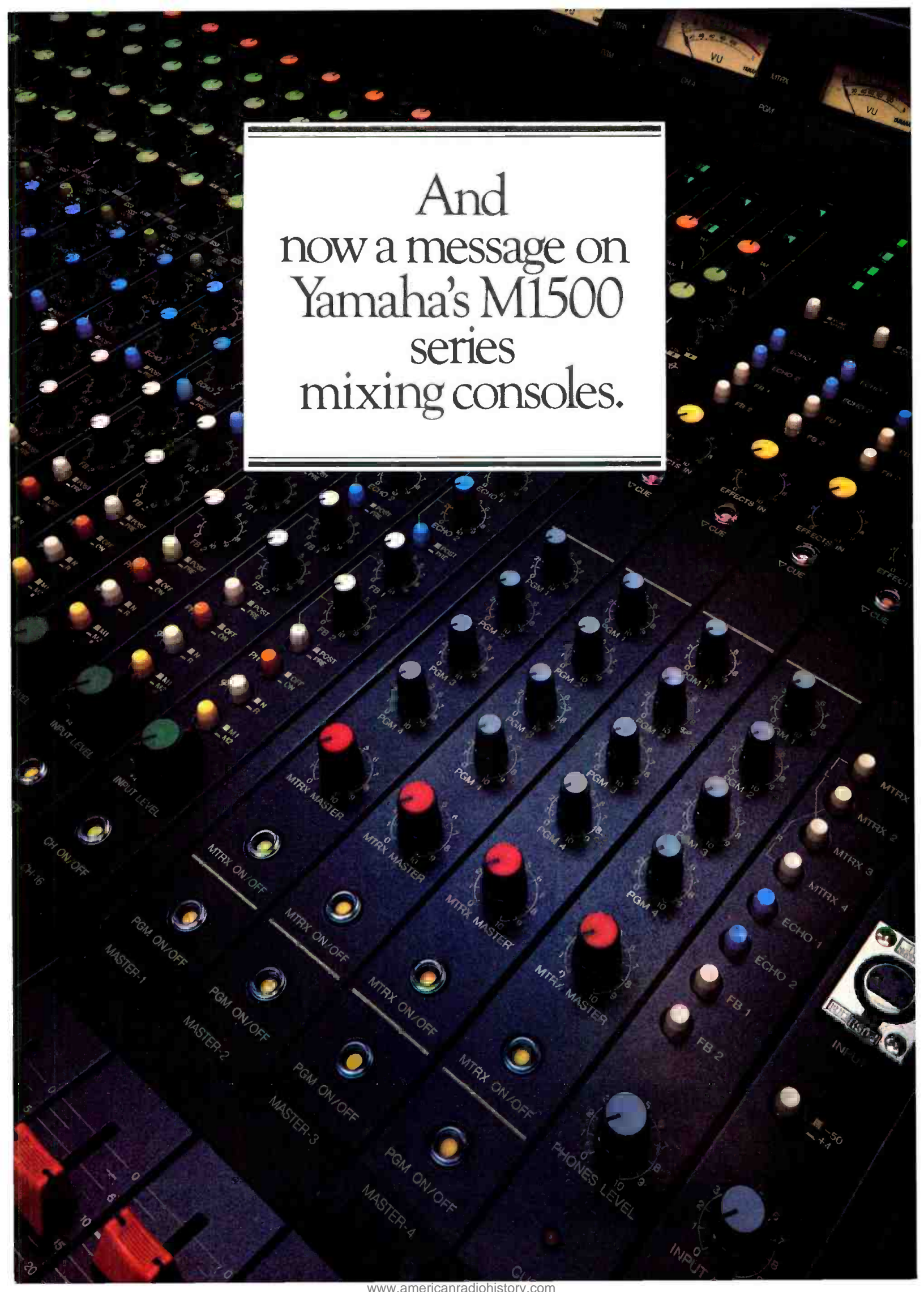




## Exhibitor Map

**Because of the early printing of this issue before NAB '85 Convention and Exhibition, the map bound in this issue may not include all of the most recent booth assignments. For the most up-to-date information, pick up a copy of our updated map at the Las Vegas Convention Center just outside the main exhibition floor. The map will be as current as the information from NAB permitted as of March 1, 1985.**





And  
now a message on  
Yamaha's M1500  
series  
mixing consoles.



# M1516A



## GENERAL SPECIFICATIONS

FREQUENCY RESPONSE +0, -3dB, 20Hz to 20kHz; +0, -0.5dB, 30Hz to 15kHz.

TOTAL HARMONIC DISTORTION (THD)\*

Less than 0.5% @ +10dB, 20Hz to 20kHz. Less than 0.1% @ +20dB, 50Hz to 20kHz.

HUM AND NOISE\* (20Hz to 20kHz, 150Ω source, Input Selector set at "-60")

- 128dBm Equivalent Input Noise (EIN);
- 95dB residual output noise with all Faders down.
- 73dB PROGRAM OUT (77dB S/N); Master Fader at nominal level & all Input Faders down.
- 64dB PROGRAM OUT (68dB S/N); Master Fader and one Input Fader at nominal level.
- 73dB MATRIX OUT; Matrix Mix and Master controls at maximum, one PGM Master Fader at nominal level, and all Input Faders down.
- 64dB MATRIX OUT (68dB S/N); Matrix Mix and Master controls at maximum, one PGM Master Fader and one Input Fader at nominal level.
- 70dB FB or ECHO OUT; Master level control at nominal level and all FB or ECHO mix controls at minimum level. (Pre/Post Sw. @ PRE.)
- 64dB FB or ECHO OUT (68dB S/N); Master level control and one FB or ECHO mix control at nominal level. (Pre/Post Sw. @ PRE.)

MAXIMUM VOLTAGE GAIN (Input Selectors set at "-60" where applicable)

PROGRAM & MATRIX 84dB; Channel In to the corresponding output. EFFECTS 20dB; Effects In to PGM Out.  
FB & ECHO 94dB; Channel In to FB/ECHO Out. SUB IN 10dB; Sub In to PGM Out.

EQUALIZATION (±15dB maximum)

LOW: 50, 100, 200, 350, 500Hz, shelving. HIGH MID: 1.2, 2, 3.5, 5.7kHz, peaking.  
LOW MID: 250, 350, 500, 700, 1000Hz, peaking. HIGH: 10kHz, shelving.

HIGH PASS FILTER 18dB/octave rolloff below 80Hz.

PHANTOM POWER For remote powering of condenser microphones, +40V DC can be switched on via a rear panel Master phantom power switch. When an individual Input Phantom switch is also On, voltage is applied to pins 2 and 3 of that input's balanced XLR connector.

DIMENSIONS/WEIGHT M1516A 34" W x 36 1/2" D x 14 1/2" H 147 lbs. M1524 55 3/4" W x 36 3/4" D x 14 1/2" H 213 lbs.  
M1532 55 3/4" W x 36 3/4" D x 14 1/2" H 231 lbs.

\*Measured with a 6dB/octave filter @12.47kHz; equivalent to a 20kHz filter with infinite dB/octave attenuation.

The specs shown are for the 16-channel M1516A console. When you need the same outstanding performance but more channels, there's the 24-channel M1524 and the 32-channel M1532. All three mixers have remote rack-mounted power supplies and are ideal for just about any fixed or portable sound reinforcement or broadcast application.

Of course, all three M1500 consoles have legendary Yamaha quality, reliability and craftsmanship. Which explains why you see Yamaha mixers wherever you look. Studios. Concert halls. Clubs. Theatres. Churches. We could go on, but you get the message.

For more information, write: Yamaha International Corporation, Combo Products Division, P.O. Box 6600, Buena Park, CA 90622. In Canada, Yamaha Canada Music Ltd., 135 Milner Ave., Scarborough, Ont. M1S 3R1.





Phoebus, continued

Lighting instruments for follow spot use.  
Circle (797)

# **Piher Electronics/PESA (1409A)**

- Video monitors; monochrome and color monitors; 14- and 20-inch models, broadcast grade.
- Sync analyzer.
- Cable tester.
- Upgrades to character-generator products.

**Product line**  
Audio, video and pulse DAs, character generators, graphics systems, video switchers, routing switchers sync generators.  
Circle (800)

# **Pinzone (1617,1617A)**

- RCD-100: computerized diagnostic system for RCA TCR-100 videotape cart machine.
  - TCR-100: total refurbishment system.
  - Microtech Time Slot personnel scheduling program.
  - Dimecas vertical interior multichannel audio encoding/decoding system for stereo conversion of any existing monoaural system.
  - 5.0 meter motordriven polar-mounted turnkey satellite system.
- Product line**  
Satellite communication equipment.  
Circle (801)

# **Plastic Reel/America**

- Introductions**
- Video Vault: shipping cases for Kodak 1/4-inch video cassettes.
- Product line**  
Video spot reels, cassette shipping containers.  
Circle (802)

# **Polaroid (173)**

**Product line**  
Photographic materials.  
Circle (803)

# **Porta-Pattern (1427)**

- Introductions**
- 001-30, 001-31: BBC zone plate chart.
  - 006-30, 006-31: BBC zone plate transparencies.
  - 001-44, 006-44: 11-step log grey scale chart, transparency.
  - 001-45, 006-45: depth of modulation chart, transparency.
  - Series 050: bantam test chart systems.
  - Series 030: 18x24-inch test charts, systems.
- Product line**  
Test charts, systems, test slides, films, transparencies, transparency illuminators, medical TV and specialized optical test media.  
Circle (804)

# **Potomac Instruments (100)**

- Introductions**
- QuantAural QA-100: real-time program audio analyzer, evalu-

- ates character and amount of audio processing in use; meter and bargraph display shows spectrum, peak to average ratio, peak density.
- AMS-11: C-QUAM stereo demodulator, used with SMR-11 receiver for off-air monitoring of AM stereo.

**Product line**  
Audio test systems, AM, FM, VHF, UHF field strength meters, directional antenna monitors, AM monitor receivers, logging systems, remote control systems, modulation controllers.  
Circle (805) See ad page 226

# **PrismaGraphics (204)**

**Product line**  
Presentation folders, media kits.  
Circle (806)

# **Procart (112)**

**Product line**  
Broadcast recording cartridges.  
Circle (807)

# **Procommotion (434)**

- Introductions**
- High Rev: a computerized traveling game show.
- Product line**  
Promotional services and material.  
Circle (808)

# **QEI (307)**

- Introductions**
- 695T2.5kW: 2.5kW FM transmitter, all solid-state.
- Product line**



# **Video Delay Lines**

ALLEN AVIONICS Video & Pulse Delay Lines replace 75 ohm coaxial cable, provide a more suitable method of achieving precise short delays. The units reduce size, weight, installation costs, save time & effort in making delay changes.

Part No.	Delay Range (Nano-Sec.)	Delay Steps (Nano-Sec.)	Method of Variation	Maximum Insertion Loss (at 100 KHz (db)	Amplitude Flatness At Any Delay Setting 100 KHz to 5.5 MHz (db)	Max. Rise Time (Nano-Sec.)	Package Size (Inches)
VAR005	3-7	Continuous	Trimmer	.20	.2 Max.	N.A.	3 3/8 x 1 1/2 x 1 1/4
VAR011	0-11	Continuous	Trimmer & Toggle	.20	.25	N.A.	4 3/8 x 2 3/8 x 1 1/16
VAR256	0-256	Continuous	Trimmer & Toggle	.15	.4	18	4 3/8 x 2 3/8 x 1 1/16
VPO010	0-10.5	.5	Toggle	.15	.2	3	4 3/8 x 2 3/8 x 1 1/16
VPO127	0-127	1.0	Toggle	.15	.3	14	4 3/8 x 2 3/8 x 1 1/16
VPO255	0-255	1.0	Toggle	.15	.3	16	4 3/8 x 2 3/8 x 1 1/16
VPO317	0-317.5	2.5	Toggle	.15	.3	20	4 3/8 x 2 3/8 x 1 1/16
VPO635	0-635	5.0	Toggle	*.50	.4	25	4 1/16 x 3 1/16 x 2 1/16
VP1100	0-1100	10.0	Rotary	1.25	.4	30	4 1/16 x 3 1/16 x 2 1/16
VP1270	0-1270	10.0	Toggle	*3.00	.4	30	4 1/16 x 3 1/16 x 2 1/16
VP2075	0-2075	25.0	Toggle	*3.00	.5	40	7 3/8 x 4 1/16 x 2 3/16
VS0315	0-315	5.0	Strap	.25	.4	28	4 x 2 x 1 1/4
VS0635	0-635	5.0	Strap	.60	.5	33	5 x 2 x 1 1/4
VS1275	0-1275	5.0	Strap	1.25	.5	33	5 x 3 x 1 1/4
VS2075	0-2075	25.0	Strap	2.50	.5	40	6 1/2 x 3 1/2 x 2

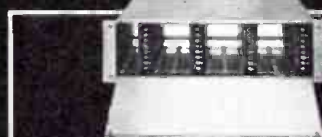
# **RACK MOUNTABLE UNITS**

VRM0255	0-255	1.0	Slide Switch	.40	.4 Max.	20	1 1/4 x 4 1/8 x 4
VRM0637	0-637.5	2.5	Slide Switch	*1.00	.4	28	1 1/4 x 4 1/8 x 6
VRM1275	0-1275	5.0	Slide Switch	*3.00	.4	33	1 1/4 x 4 1/8 x 9
VRM2270	0-2270	10.0	Slide Switch	*3.00	.5	40	1 1/4 x 4 1/8 x 9
VRS0317	0-317.5	2.5	Strap	.40	.5	26	1 1/4 x 4 1/8 x 4
VRS0635	0-635	5.0	Strap	.75	.5	35	1 1/4 x 4 1/8 x 6
VRS1270	0-1270	10.0	Strap	1.50	.5	37	1 1/4 x 4 1/8 x 9
VRS2260	0-2260	20.0	Strap	3.00	.5	40	1 1/4 x 4 1/8 x 9

See us at NAB SHOW, BOOTH 1627

\*±.2db variation at any delay setting.

Circle (187) on Reply Card



# **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: 516-248-8080



QEI, continued

LPFM emergency, high-power FM transmitters, FM modulation monitors.

Circle (810)

See ad page 315

**QSC Audio Products (626)**

Product line \_\_\_\_\_

Monitor speakers.

Circle (811)

**QSI Systems (1325)**

Introductions \_\_\_\_\_

- PSF-777: battery-powered split field color bar generator, programmable 8-character source ID, 1kHz tone.
- SW-402: mini-EFP switcher, 4-input, 2-output, vertical interval with lap dissolve, tally closures.
- DM-171: 171-channel direct access varactor tuned demod, full AFC all channels, mid- and super-channel tuning offset.
- CB-1680: source ID generator, SMPTE bars, 1kHz tone, 16-character ID, storing 80 messages.

Product line \_\_\_\_\_

Source ID generator, video DAs, color bar, blackburst generators.

Circle (812)

**Q-TV (1401D)**

Introductions \_\_\_\_\_

- VPS-500: Computer Prompter system
- VPS-1000: Super Computer Prompter system.
- Mini Video Prompter.

Product line \_\_\_\_\_

Console transport, conveyor transport and on-location prompter systems.

Circle (809)

**Quanta (1432)**

Introductions \_\_\_\_\_

- Microgen MG200: Titling character generator with multiple fonts, colorization, automation, disc memory.

Product line \_\_\_\_\_

High-resolution face-loading graphics/titling systems, titling generators, newsroom computer system.

Circle (813) See ad page 231

**Quickscan Systems (1405B)**

Introductions \_\_\_\_\_

- Interface: For computer access of machine readable VITC publications, similar to recordable, erasable videodisc.

Product line \_\_\_\_\_

Electronic publishing via video still frames with consumer VCRs.

Circle (814)

**Quickset (1105)**

Product line \_\_\_\_\_

Tripods, pedestals, cam, fluid heads, CCTV camera mounting systems.

Circle (815)

**R-Columbia (1111)**

Introductions \_\_\_\_\_

- 6058: ENG/IFB hands-free telephone with tone or pulse dialing, mic mute, volume control, three mic in, three

headphone out, clips to belt.

Product line \_\_\_\_\_

Wired, wireless intercoms, headphones, headphones with mic.

Circle (816) See ad page 278

**RCA (1000)**

Introductions \_\_\_\_\_

- TTG-60U: 60kW solid-state UHF transmitter.
- CCD-1S: sports model camera with CCD image sensing and slow motion capability.
- TH-700: Type C video recorder.

Product line \_\_\_\_\_

TV cameras, video recorders, telecine systems, VHF, UHF TV transmitters, antennas, transmission line.

Circle (817) See ad page 165

**RF Technology/CML (171)**

Introductions \_\_\_\_\_

- TX-100: 950MHz wireless microphone transmitter with any of three diversity receivers.
- RF-710/715: high gain, weatherproofed RF power amplifiers at 7GHz, 50dB gain, 10W.
- RF-704/705A: rack-mount, fixed-link systems, programmable frequencies, built-in diagnostics.
- RF-1304/1305: rack-mount, fixed-link systems, programmable frequencies, built-in diagnostics.
- RF-272: 2.7GHz 2W to 10W switchable transmitter for international market, remote-control; frequency agile;



**CART 'EM UP ON AA-4!**

From AOR to CHR, Country to Jazz—Whatever the format, this cart's for you. For outstanding high frequency sensitivity and headroom, compatibility with all cart machines, the multi-format AA-4 delivers the sound that audiences turn on.

**AUDIO PAK AA-4.  
FOR STATIONS WHO CARE  
HOW THEY SOUND.**

Circle (188) on Reply Card





## When the FCC changed the rules, EIMAC was prepared for continuing HAM operations.

The FCC changed the allowable output power for linear amplifiers in amateur radio service. Hams can now run at 1500 watts PEP into an antenna. EIMAC was right there to meet requirements with its 3CX1200A7 tube.

### Low-cost replacement for small spaces.

RF cabinets of many linear amplifiers currently use the EIMAC 3-500-Z tubes. The new 3CX1200A7 for design takes size into consideration and, by design, is recommended as a single, low-cost replacement for a pair of EIMAC 3-500-Z tubes for new amplifier designs.

### General Specifications

The EIMAC 3CX1200A7 is a high-mu, compact, forced air cooled triode for zero-bias class AB2 amplifiers.

- 2.9" dia. x 6.0" long
- Plate dissipation: 1200 watts
- Glass chimney SK-436 available
- Standard EIMAC SK-410 socket available

More information is available on the new EIMAC 3CX1200A7 tube from Varian EIMAC, or any Electron Device Group worldwide sales organization.

Varian EIMAC  
1678 S. Pioneer Road  
Salt Lake City, Utah 84104  
Telephone: 801 • 972-5000

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



Circle (189) on Reply Card



# STEREOSCOPE™ LETS YOU MOVE TO STEREO TV WITH CONFIDENCE



Television broadcasters moving to stereo audio can monitor every critical parameter at a glance with B&B's unique new AM-3 StereoScope Verification System.

#### ■ CRT DISPLAY

ch-1/left, ch-2/right, ch-3/SAP, and X/Y for phase and separation

#### ■ THREE PRECISION VU METERS

meet ANSI 16.5-1954 specifications

#### ■ THREE PEAK RESPONDING LED DISPLAYS

showing headroom availability

**B & B SYSTEMS, INC.**

28111 N. Ave. Stanford

Valencia, CA 91355

(805) 257-4853

See us at NAB Booth # 1336 or call or write us.

Circle (190) on Reply Card

## Time and Money!

**Omnimount Products Save You Both!**

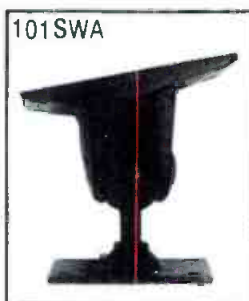
Eliminate tedious, time consuming eye bolt and chain installations.

No need to fabricate expensive custom brackets.

OMNIMOUNT'S Universal Mounting Assemblies are slick, clean, unusually flexible and very strong.

They'll meet or exceed your most demanding mechanical specifications and aesthetic requirements.

If you have problems in mounting, securing, hanging, supporting ... we've got answers for you.



Our new brochure is yours for the asking. Please ask.

100WA

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10850 Vanowen Street  
North Hollywood, CA 91605-6470  
(818) 766-9000  
Telex: 181149 West LSA

Circle (191) on Reply Card

RF/Continental, continued  
weatherproof.

- RF-700/701: 7GHz portable microwave system for ENG.

#### Product line

Wireless camera links, LPTV transmitters, ENG antennas, PowerPac transmitters for ENG, central microwave receivers, emergency restoration microwave systems.

Circle (818)

#### ROH

(1634)

#### Introductions

- 190 series: extended range of line monitors in rack-mounted and portable packages.
- 2010: mainframe audio systems.
- 211/212: audio DAs with 150Ω and 600Ω impedance capability.

#### Product line

Audio monitor equipment, audio DAs, intercom, party line, IFB systems.

Circle (819)

#### ROHN

(103)

#### Introductions

Equipment shelters: prefabricated fiberglass buildings.

#### Product line

Towers, tower accessories, antenna supports, equipment shelters, obstruction lighting systems.

Circle (820)

#### R/Scan

(1470)

#### Product line

Lightning detection equipment.

Circle (821)

#### RTS Systems

(1142)

#### Introductions

- Series 17: low-cost intercom system.
- Series 250: card-cage amplifier system.
- Model 848: dedicated line, intercom system.
- Plantronics: lightweight headsets.

#### Product line

Intercom, IFB systems, professional audio products.

Circle (822)

See ad page 243

#### Radio Arts

(418)

#### Introductions

- TV tribute programs.

#### Product line

Program services.

Circle (823)

#### Radio Systems

(213)

#### Introductions

- DM-1: LED-type stereo VU meter.
- MA-5: 5-channel mic pre-amp.

#### Product line

Audio consoles, phono pre-amps, audio DAs, studio timer.

Circle (824)

#### Ramko Research

(415)

#### Introductions

- RS1660: switching and routing products.

#### Product line

Audio cart machines, audio consoles, phone equipment, audio amps, DAs, routing switching systems.

Circle (825)

#### Rank Cintel

(1219)

#### Introductions

- Shot change detector: facilitates





# Which twin has Upgrade #2?

When Optimod-FM (Model 8100A) was designed, we kept the future of your investment in mind. As formats and competition change, the processing needs of radio programmers change.

Last year we introduced the "XT" Six-band Limiter Accessory Chassis to create high energy processing for high-energy, mass-appeal formats. Followed by Upgrade #1. As a result of our continuing research into processing technology for such formats, we now introduce Upgrade #2. (Both Upgrades affect only the "XT". The industry-standard basic processor remains unchanged.)\*

You can't tell which Optimod-FM system above has Upgrade #2 just by looking—but you certainly can tell by listening. Upgrade #2 makes the system louder, and gives it a new sense of "air", brilliance and clarity. The bass is tighter and has more "punch". And all the XT's positive qualities are preserved: excellent consistency in texture and tonal balance from source-to-source, a remarkable freedom from pumping and other processing side-effects, superbly clean voice quality, and tight modulation control for maximum loudness.

If you're buying a new "XT" Accessory Chassis, you get the Upgrade *for free*—there's no price increase. You can tell if the upgrade is there by the code M03 on the Serial Label and "Upgrade #2" marked on the carton.

If you already own an "XT", you can get this Upgrade *for free* just by filling out the coupon. (We can serve you better if you write, not call.) However, if the M03 code is on your Serial Label, you already have it. The Upgrade consists of several resistors which can be installed by the station engineer.

Why is this FREE?

Because we don't feel that you should have to replace an expensive processor every few years as competitive pressures develop or when some other manufacturer wants to get you for \$6000 to achieve only a marginal improvement. With the "XT", you get much more than 'marginal' for only \$2295.†

If we can upgrade Optimod-FM economically, we'll continue to do so to protect your investment. The Optimod-FM system is designed to be the superior choice now and for years to come.

## A NOTE

The basic Optimod-FM is a *very* loud and *very* clean processor. It should be used alone where your audience prefers a less-processed sound, truer to the original texture and tonal balance of the record. When more density or consistency is needed, the "XT" chassis supplies it—and it can be added at any time simply by plugging it in to the connector provided in the back of the basic processor.

\*Upgrade #1 has already been provided to all early owners and has been incorporated in all units. For reference, it is outlined with the instructions for Upgrade #2.

†(Suggested List.)

## Orban Associates Inc.

645 Bryant Street, San Francisco, CA 94107  
(415) 957-1067, Telex: 17-1480

**orban**

ORBAN PROCESSING KEEPS YOU COMPETITIVE

Circle (192) on Reply Card

Call Letters \_\_\_\_\_  
Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_  
Zip \_\_\_\_\_  
Serial # \_\_\_\_\_  
State \_\_\_\_\_





## HERE'S $\pi$ IN YOUR EYE

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.

The better the performance, the more noticeable the phenomenon. In our case, with more than 20 international patents so far, this field select switch was absolutely necessary.

So that you could have the same flat response in either field or both fields.

These are Point Source reference monitors. Coaxial, and time compensation adjusted in a true concentric design. Stereo imaging the way it happens in nature.

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.



FOSTEX RP TECHNOLOGY



RM765



RM780

# Fostex®

Pro Sound Division

FOSTEX CORPORATION OF AMERICA  
15431 Blackburn Avenue, Norwalk, CA 90650 (213) 921-1112

Circle (193) on Reply Card

### Rank Cintel, continued

film color grading on Mk III/Amigo, identifies scene changes, referring corrections entered into Amigo memory during a scene back to the beginning of that scene.

- Steadyguide: picture anti-weave feature, guides film at point of scan to reduce picture weave.

Product line \_\_\_\_\_

Telecine systems, magnetic sound followers.

Circle (826)

### Real World Technologies (1520)

Introductions \_\_\_\_\_

- Additions to Uni-Vuer products and phase coherency systems.

Product line \_\_\_\_\_

CRT video display of keyed audio signal levels, audio phase measurement and correction products.

Circle (827)

### Recortec (1416)

Introductions \_\_\_\_\_

- VTE-102: 90-minute 1-inch reel tape evaluator.
- VTE-103: 3-hour 1-inch reel tape evaluator.

Product line \_\_\_\_\_

Tape cleaners, evaluators.

Circle (828)

### Rees Associates (1727)

Product line \_\_\_\_\_

Facilities design, architectural planning, engineering services, project management.

Circle (829)

### Regis-BLT (152)

Product line \_\_\_\_\_

Video switchers, video monitors, digital effects systems.

Circle (830)

### Register Data (128)

Product line \_\_\_\_\_

Computer software for radio business systems.

Circle (831)

### Research Technology (1626)

Introductions \_\_\_\_\_

- Evaluator: 1-inch videotape product, inspects tape for physical damage and dropout, high speed, color CRT defect display.

Product line \_\_\_\_\_

Videotape cleaners, evaluators, film editor systems, film cleaning systems.

Circle (832)

See ad page 268

### Richardson Electronics (125)

See Calvert Electronics

### Riviera Broadcast (1784)

Product line \_\_\_\_\_

Equipment leasing services.

Circle (833)

### Rockwell Int'l. (1767)

Product line \_\_\_\_\_

Microwave video relay equipment.

Circle (834)

### Rohde & Schwarz (1203)

Introductions \_\_\_\_\_



the Ross Multi-Level Effects system with an affordable price.

# Introducing the RVS-210

- ten inputs
- twelve patterns
- non-sync enable
- three color generators
- three auto transition units
- complete twelve event memory
- full transition preview capability
- extensive effects keying facilities
- analog border generator with drop shadow borders on self key
- serial interface to computerized editors

Now that there's a competitor,  
there's no  
competition.



See the RVS-210  
at NAB booth 1110



Canada: Ross Video Limited, 500 John St., P.O. Box 220, Iroquois, Ont., K0E 1K0, 613-652-4886, Telex 05-311579

U.S.A.: Ross Video Inc., P.O. Box 880, Ogdensburg, N.Y., 13669-0880

Circle (194) on Reply Card



- UVF: portable video analyzer.
- RS002: satellite receiving system.
- SBKF: CATV modulator.
- FM & TV transmitters.

**Product line**

Video noise meters, demodulators, TV signal generators, oscilloscopes, spectrum analyzers, video distortion analyzers, FM, TV transmitters.

Circle (835)

See ad page 84

**Rosco Laboratories (1235)**

**Introductions**

- Cinegel: expanded, improved color-collection and light control system.
- Roscolux: heat-resistant color effects filters, diffusion materials.
- Designer patterns: projector effects used in spotlights.

**Product line**

Lightning gobos, color filters, camera platforms.

Circle (836)

**Roscor (1181)**

**Introductions**

- TV-45: remote truck.
- Mini-Ram: ENG van.

**Product line**

Remote production vehicles.

Circle (837)

**Ross American Logic (1332)**

**Product line**

Electronic lighting displays and control systems for television and

theater, scoring, clocking, projection systems for TV game shows.

Circle (838)

**Ross Video (1110)**

**Introductions**

- RVS 210: 10-input video production switcher, includes multilevel effects system, 12 patterns, three auto transition units, color generators, extensive keying, optional RGB keyer and serial interface to editing controller.

**Product line**

Video protection switchers, video keying equipment, downstream keyers, switcher automation system.

Circle (839)

See ad page 255

**Russco Electronics (413)**

**Introductions**

- Dial-up remote unit: speech compressor handles inputs from two microphones and one line level source, powered from Telco line to avoid batteries or power supply weight.

**Product line**

Audio mixer, turntables, phono pre-amp; tone arms, audio amps, DAs.

Circle (840)

**SESCOM (1616)**

**Introductions**

- Series PO: miniature modular system, with power supply, mini-amplifiers, DAs, 3-channel mini-mixers, phono pre-amp, source and output selector.

**Product line**

Modular products, audio DAs, trans-

formers, audio processors.

Circle (842)

**SMPTE (1632A)**

**Introductions**

- "Components of the Future": papers from SMPTE conferences.

**Product line**

Test charts, slides for film and video, standards information.

Circle (843)

**SWR (1644)**

**Introductions**

- Coaxial switch: adaptation converts existing RF patch panel to coaxial switch without modifications to current equipment.
- K-line flange: enhancement to 4 1/8-inch coaxial feed line.

**Product line**

Coaxial feed line, RF switching systems, RF signal plumbing.

Circle (841)

**Sachtler (1648)**

**Introductions**

- Video 20: studio and OB pedestal, lightweight, but stable tripod with pneumatic center column, can be used with Semi Dolly.
- Hot Pod: tripod for ENG.
- Semi Dolly: lightweight rolling triangular dolly, independent brakes, cable guards, folds to minimum volume with hand grip for easy carrying.

**Product line**

Camera support products.

Circle (844)

## Video Distribution Amplifier in a Chip



A low cost solution to video distribution. VBB-1 is a high performance hybrid video amplifier/line driver with two outputs. Its specifications are outstanding and it is easy to use. Two of these and you have a 1 in, 4 out D.A. \$39.00 each singles - \$28.00 each hundreds.

Call or write:

(408) 225-1425

APERT-HERZOG CORPORATION  
7007 Realm Dr. B3, San Jose, CA 95119

*Apert-Herzog*

Circle (195) on Reply Card

## One Second Video Store



**STEPFAST** is a digital video storage and display system. It stores 32 reduced size images and displays 16 of them in a 4 x 4 format for time relational viewing. **STEPFAST** can be readily interfaced to your telecine or edit system. **STEPFAST** speeds the transfer process and edit decision times dramatically.

Pat. Pend.

Call or write:

(408) 225-1425

APERT-HERZOG CORPORATION  
7007 Realm Dr. B3, San Jose, CA 95119

*Apert-Herzog*

Circle (295) on Reply Card



# NUMBER ONE PICKS NUMBER ONE



KDKA Eyewitness News

When the number one stage and studio lighting manufacturer in America, STRAND CENTURY, chose the first team of lighting specialists to represent them nationally...It came as no surprise to the industry. They chose Cercone-Vincent. Cercone-Vincent Assoc., Inc. has earned a reputation as the Leader in turnkey lighting system installations.

Cercone-Vincent offers you lighting system design and engineering, equipment, installation, and production services. Why not do it right the first time? With Cercone-Vincent you know what you get from the start...That's why hundreds of companies have chosen the Leaders.

#### Representative Client List:

Cosmos Broadcasting Corporation  
Gateway Communications, Inc.  
Gaylord Broadcasting of Ohio  
Hearst Television Stations

Lesea Broadcasting  
NBC Stations Division  
Scripps Howard Broadcasting  
Storer Communications  
Westinghouse Broadcasting and Cable

CERCONE VINCENT  
ASSOCIATES, INC.

2741 Noblestown Road  
Pittsburgh, PA 15205  
412-922-0900

KDKA-TV Pittsburgh, PA

Circle (196) on Reply Card

Pittsburgh • Cleveland Cincinnati

Don't miss our booth at the NAB show booth #2241.

[www.americanradiohistory.com](http://www.americanradiohistory.com)



### Saki Magnetics

#### Introductions

- Base plate: for ATR100 2-track and ¼-inch and ½-inch machines, duplicates all functions of original.

#### Product line

Ferrite heads for Ampex, MCI, Mincom, Otari, Scully, Studer and Technics, multitrack heads.

Circle (845)

### Samson Music Products

(324)

#### Introductions

- TH-1: body pack transmitter for wireless instrument or lavalier mic use.

#### Product line

Wireless mic/instrument pickup systems, diversity receivers.

Circle (846)

### Schneider

(1403)

#### Introductions

- TV64/65/66: 14.5x wide-angle lens in ½-inch, 1-inch and 1¼-inch formats, optional integral diascope.

#### Product line

Camera lens systems for ENG, studio and field use.

Circle (847)

### Scientific-Atlanta

(1017)

#### Introductions

- Portable earth terminal, for Ku-band.
- Integrated RF terminal, for Ku-band.
- B-MAC transmission system products.

#### Product line

Satellite communications equipment, antennas, receivers, TBC/synchronizers, digital video processors.

Circle (848)

### Selco/Sifam

(438)

#### Introductions

- AL19, AL29: audio level indicators.
- R22F, R32F: full spec VU meters.
- 22A, 32A, 34A: peak program meters.

#### Product line

Instrument knobs, VU, PPM meters, level indicators.

Circle (849)

### Sennheiser Electronic

(1137)

#### Introductions

- SK2012 system: wireless microphone, body-pac transmitter and receiver.
- EM 1036: modular, wireless body-pac receiver.
- SKM 4031: hand-held, wireless transmitter.

#### Product line

Microphones, dynamic, electret, condenser, headphones, test equipment.

Circle (850)

See ad page 222

### Sharp Electronics

(1102)

#### Introductions

- TV camera.
- High resolution video monitors.

#### Product line

TV camera, triaxial camera control systems, video monitors.

Circle (851)

### Shintron

(1417)

#### Product line

Character generators, composite, component video switching equipment, routing switchers, time code equipment, audio, video, pulse and sub-

carrier DAs.

Circle (852)

### Shively

(623)

#### Introductions

- 2530: balanced bandpass filter combiner, for 10 40kW inputs; bandwidths to  $\pm 150\text{kHz}$ ,  $\pm 25\text{ns}$  group delay, channel-to-channel isolation 50dB or greater at carrier frequency.

#### Product line

FM antennas, TV antennas, rigid coaxial transmission line, RF patch panels, VSWR protection systems, RF filters, antenna pattern studies.

Circle (853)

See ad page 170

### Shook Electronics

(1310)

#### Introductions

- 1020: Omega Van—new design on chassis where box can be removed; 45-foot network trailer.

#### Product line

Mobile production vehicles.

Circle (854)

See ad page 158

### Shure Brothers

(1401A)

#### Introductions

- FP11: mic-to-line amplifier.
- FP12: headphone bridging amplifier.
- FP31: ENG, EFP portable mic mixer.
- SM83-CN: omnidirectional, lavalier condenser mic.
- SM90, SM91: surface-mount microphones with omni- and uni-directional characteristics.

#### Product line

Microphones, mic mixers, modular amp, interface products, mic accessories, phono cartridges.

Circle (855)

See ads pages 151/270

### Sigma Electronics

(1333)

#### Introductions

- SCH-385: subcarrier, horizontal phase meter.
- VSS-120: video switcher with stereo audio control, 12x1 configuration.
- VSD-200: video and stereo audio DA system, 1x6 configuration.

#### Product line

Audio, video DAs, routing switching modular signal processing equipment.

Circle (856)

### Skotel

(1126)

#### Introductions

- TCG-80N/006: LTC/VITC jam sync time code generator.

#### Product line

Time code products.

Circle (857)

### Warren R. Smith

(1106)

#### Introductions

- Updated animatic graphic system.

#### Product line

Film, video animation products.

Circle (858)

### Solid State Logic

(1723)

#### Introductions

- Series SL 5000 M: computer-controlled audio consoles, designed for mono, stereo production and multichannel modular to accommodate from 12 to 42 mono/stereo inputs; signal processing for each input.
- SSL Synchronizer, 5-machine control system, distributed microprocessor de-

# NAB

**SNG UNIT TO BE  
DEMONSTRATED LIVE  
AT NAB LAS VEGAS  
SHOW.**

**DATE:** Sunday, April 14th  
– Thursday April 17th

**EVENT:** Live demonstration  
of SNG Portable Uplink

**LOCATION:** Outdoor Satel-  
lite exhibit area.

**TIME:** Daily 11 A.M. and  
4 P.M.

For more information,  
visit the GEC McMichael's  
indoor booth, No. 1514.



**GEC McMICHAEL**



# GEC McMICHAEL

# BROADCAST NEWS

## ADVANCED ANTENNA DESIGN/VIDEO COMPRESSION CREATES BREAKTHROUGH

### **New Portable Uplink Small Enough To Go Anywhere For Live Reports.**

Covering news events from "any" location in the world used to be an impossibility. Now it's a reality.

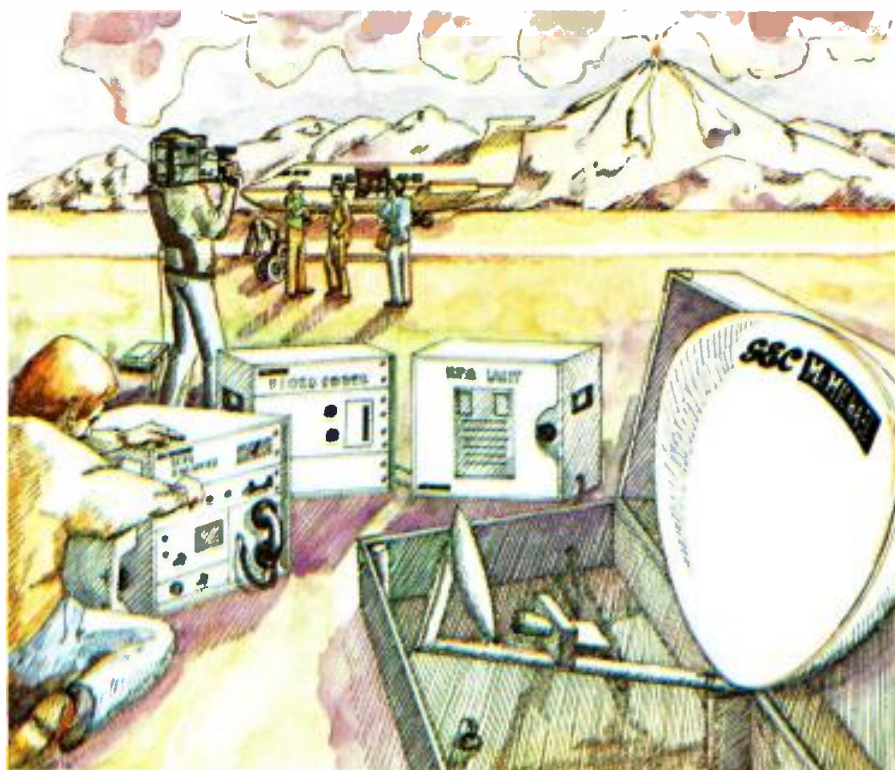
With GEC McMichael's unique Satellite News Gathering (SNG) FLY-AWAY, news events that previously could not be captured by existing television transmission systems can easily be covered "live," regardless of their location.

The entire FLY-AWAY system is compact and lightweight enough to be flown to remote locations in a private plane as well as by regularly scheduled airlines. Once on location, the SNG terminal can be quickly set up by as few as two men in ½ hour and powered by a hand-carried portable generator.

**The entire FLY-AWAY system is compact and lightweight enough to be flown to remote locations in a private plane as well as by regularly scheduled airlines.**

The SNG terminal equipment is packaged in three shock-mounted aircraft enclosures. The majority of which weigh no more than 80 pounds. Since the weight and size of the system are so attractive, it can easily fit into an econoline-type van, allowing rapid deployment for live satellite coverage of local events.

Designed for portability and quick, efficient set-up, the FLY-AWAY is composed of GEC-McMichael's unique elliptical Ku band antenna, uplink Ku band electronics and McMichael's own video compression bandwidth electronics.



Each of the three shock-mounted containers which make up the SNG system measures 27" x 24" x 21". The total system including uplink/receive electronics, antenna and portable generator weigh no more than 500 pounds total. The one-piece offset gregorian-fed antenna measures 2 x 1 x .5 meters and weighs 90 lbs packaged. In order to ensure quick set-up time and retain critical surface tolerance enroute and during operation, the antenna reflector will remain in one piece.

The McMichael Ku band antenna is the heart of the FLY-AWAY system since it allows real-time transmission from anywhere in the world.

In the event of signal loss due to severe weather conditions or poor footprint locations, the GEC McMichael CODEC makes it possible for the operator to reduce the bandwidth. As a result, the system permits live video transmissions from any global location under practically any weather conditions.

GEC McMichael, a leader in Ku band satellite transportable technology in the United Kingdom and Europe for over 6 years, just recently introduced its line of broadcast products to the United States. The development of the portable SNG system resulted from the company's

expertise in Ku band transportable terminals, ACE standards conversion equipment and video bandwidth compression teleconferencing equipment.

**To date, there is absolutely no better way to beat the competition to the scene than with the new FLY-AWAY Satellite News/Data Gathering System. For more information about this exciting live/remote transmission breakthrough, please contact GEC McMichael 8260 East Raintree Drive, Scottsdale, Arizona 85260. Phone: 602/948-7255 TLX: 6502246202**

**S&C McMICHAEL**

## **NOBODY DOES MORE WITH LESS SPACE**

Circle (198) on Reply Card to have a salesman to call.  
Circle (315) on Reply Card to receive literature.

March 1985 Broadcast Engineering 259



## TELEVISION TRANSMITTERS SERVICEABILITY!



**Custom Engineering**—for field modernizing and up-powering all makes of VHF and UHF transmitters. **Spares** for most makes of VHF and UHF transmitters.

Solid state technology works wonders. We're into it 100%. But we also believe compactness can be overdone. At Townsend, we design cabinets roomy enough to be quickly and safely serviced by human hands!

- High power **UHF** to 240 Kw
- High power **VHF** to 50 Kw
- **VHF** and **UHF LPTV** transmitters
- All solid state **MDS** and **ITFS** transmitters

See us at Booth 1420 at NAB

# TOWNSEND

**The Television Transmission Specialists**

Townsend Associates, Inc.  
79 Mainline Drive, Westfield, MA 01085 • 413-568-9581

Circle (199) on Reply Card

## "UNEQUIVOCALLY THE BEST TCR-100 CARTRIDGE AVAILABLE"

— Expressed by engineers at over 100 TV stations across the U.S.



National Video Service is confident you too will be sold on our TCR-100 cartridge. That's why we're offering you a **free sample**. One test and you'll be hooked. To receive your free TCR-100 cartridge call (415) 846-1500.

### THE BEST PRODUCT

Reliability is one of the most important features to look for in a TCR-100 cartridge. You can always trust National Video Service's TCR-100 cartridges. It is manufactured to RCA's TCR-100 specifications, and has Lexan® door latches to provide a **lifetime guarantee** against the number one breakage problem of the competition! To provide the best quality NVS uses only 3M Scotch 400 video tape.

### THE BEST PRICE

National Video Service will not knowingly be undersold on any of our services. New one-minute message cartridges are as low as \$24.95.

**Emergency?** National Video Service offers same day shipping via pre-paid Federal Express.



**National Video Service**  
2150 Rheem Drive  
Building G  
Pleasanton, CA 94566  
(415) 846-1500

TCR-100 New Cartridge Sales • Reloading • Trade-In-Exchange

Circle (200) on Reply Card

### Solid State Logic, continued

- sign; for ATR, VTR or film.
- SSL programmable equalizer: console-mounted control panel, remote electronics, two channels of 3-band parametric EQ and stereo pan.

Product line \_\_\_\_\_

Audio consoles for production, multitrack recording, computer console automation interfaces, machine synchronizers.

Circle (859) See ads pages 184-185

### H.A. Solutec

(1517)

Introductions \_\_\_\_\_

- SOL-6800 AD/AD/O: generator of code IDs on commercial spots for recognition by SOL-6800.
- SOL-6800: automated broadcasting system for commercial insertion, controls one VTR, integrated 4-input stereo audio, video switcher, satellite cue-tone triggered.
- SOL: component switcher for SOL-6800 system for two or three levels of component video.

Product line \_\_\_\_\_

Automation, commercial insertion systems for television, CATV.

Circle (860)

### Sono-Mag

(139)

Introductions \_\_\_\_\_

- ESP-2: automation programmer system.

Product line \_\_\_\_\_

Program automation equipment.

Circle (861)

### Sony

(605, 1200)

(Broadcast Products)

Introductions \_\_\_\_\_

- BVP-3A: Betacam camera.
- BVP-360: camera, now in production.
- BVW-15: free standing dynamic tracking player, complements BVW-10.
- HDTV: improvements, including TV projection screen.
- BVH-2700/BVP-3000: super motion recorder/camera system.
- APR-5000 series: audio recorder.
- Additions to intelligent video systems.
- HG tape: 5-minute play length cassettes for Betacam.

Product line \_\_\_\_\_

Cameras, videorecorders, HDTV equipment, automation systems, editing controllers, video processors, video monitors, computers, audio recorders, audio consoles, Beta, VHS, U-matic and 1-inch reel videotape, microphones, wireless microphones, compact disk players.

Circle (862) See ads pages 34-35/140-141/293

### Soper Sound Music Library

(1620B)

Introductions \_\_\_\_\_

- Series XI: 3-album/tape collection.

Product line \_\_\_\_\_

Production music services.

Circle (863)

### Soundcraft Electronics

(219)

Introductions \_\_\_\_\_

- SAC2000: stereo on-air console for radio.
- Series 20: microprocessor-controlled 2-track audio recorder.
- Series 600: 8-bus recording console.

Product line \_\_\_\_\_

Audio mixing consoles, multitrack



# WE'VE GOT YOUR NUMBER!

**Wilkinson**

**8090**

Not just a tired design with a new exciter or a revised paint scheme, the 8090 Series is a new approach to meeting the challenge of competitive FM broadcasting today and tomorrow.

Superb craftsmanship, unsurpassed performance, and tough reliability on the job make the Wilkinson 8090 Series your only real choice.

## STANDARD FEATURES:

- Full FIVE year warranty the industry's best\*.
- Five subcarrier inputs.
- Single tube design up to 30 kilowatts.
- Internal RF routing for flexibility and redundancy.
- Designed from the ground up for impressive main channel audio performance with multiple SCA operation.
- Exclusive POWER-GARD™ control and protection package.
- Spare parts kit with each transmitter.
- Extra metering for ease of adjustment.
- Backed by 24-hour service.

\*Limited warranty, some exclusions apply.

## SEE US AT THE NAB BOOTH NO. 305.

Call our Marketing Department for more information on your winning number — 8090.



Wilkinson Radio Division

Circle (201) on Reply Card

2360 Industrial Lane  
Broomfield, Colorado 80020  
(303) 465-4141  
TWX: 910-938-0396



audio deck.  
Circle (865)

See ad page 99

# **Sound Technology (500)**

## **Introductions**

- Series 2100/2200: programmable, bus-controllable signal generators and distortion analyzers, single, dual channel, integral computer, controller, applicable to radio, TV proofs.

## **Product line**

Tape recorder test systems, audio distortion analyzers, filter sets.

Circle (864)

See ad page 39

# **Spantel**

## **Introductions**

- FMSCA: subcarrier paging signal generator.

## **Product line**

FM subcarrier paging equipment.

Circle (866)

# **Spectra Image (1400)**

## **Introductions**

- Laser edit system: optical video disc applications, demonstrated with Ampex editing control systems.

Circle (867)

# **Spectrum Planning (510)**

## **Product line**

Engineering, consulting services.

Circle (868)

# **Spencer Broadcast (408)**

## **Introductions**

- ATK-1: Audio-path stereo phone pre-amp with axial tilt correction.
- SO-2: Audio-path stereo separation optimizer.
- SLP-15: Technics CD player, magazine loading.
- EPA 250: Technics tone arm for SP-015, SP-10 turntables.
- QSC audio amplifiers.

## **Product line**

Distributor of electrical power line filters, cart alignment tools, audio equipment.

Circle (951)

# **Sprague Magnetics (705)**

## **Introductions**

- Film heads for Magnasync, MTM, Quad-Eight/Westrex, Steenbeck.
- Replacement heads for Sony BVH-1000, BVH-2000.
- Duplicator heads for Cetec Gauss, Electro Sound.
- Replacement cartridge heads.

## **Product line**

Replacement heads, recorder parts for most popular recording equipment.

Circle (869)

# **Stage Lighting (1128)**

## **Introductions**

- 1280: Opti-Mist fog, smoke machine.
- 1580: Mini-Mist fog, smoke machine.
- 8080: Maxi-Mist fog, smoke machine.

## **Product line**

Dimming systems, auto color changers and iris changers for lighting equipment.

Circle (870)

# **Stainless (1315)**

## **Product line**

Guyed, self-supporting towers for television FM, AM, microwave, multi-use to 2000 feet.

Circle (871)

See ad page 297

# **Stanton Magnetics (102)**

## **Introductions**

- Dynaphase 30M: single-sided headphone; 100Ω or 600Ω.
- UD-100G, UD-100B: pro disco uni-directional dynamic mic, 500Ω, 60Hz-15kHz.
- Narrator: headphone/mic combination, with 20Hz-20kHz response, gooseneck boom, 32Ω headphones.

## **Product line**

Headphones, phono cartridges and styluses, phono pre-amps, record care products.

Circle (872)

# **Stantron/Unit of Zero (1123)**

## **Product line**

Equipment racks, enclosures.

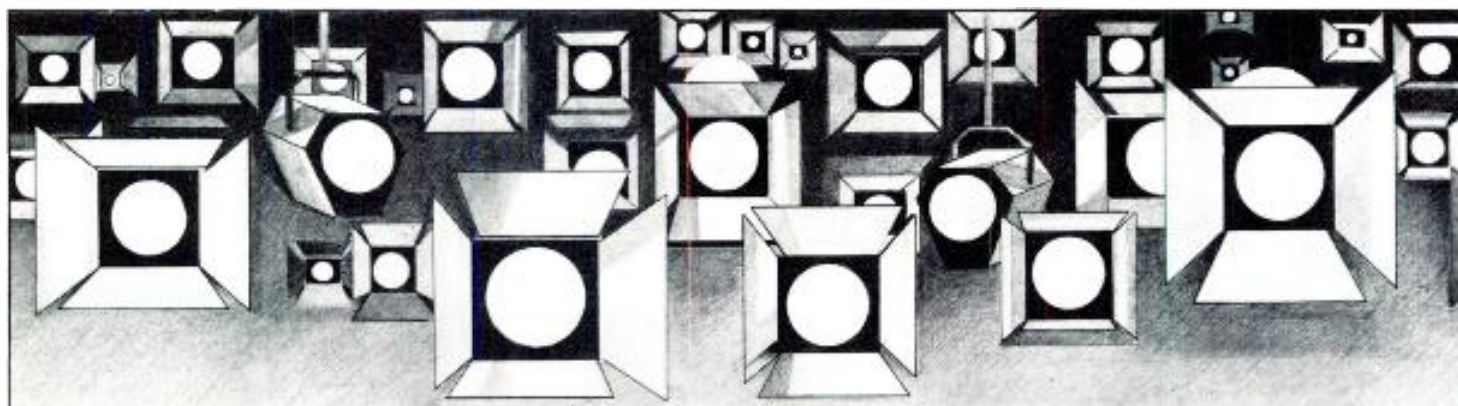
Circle (873)

See ad page 235

# **Steenbeck (1424)**

## **Introductions**

- ST201V: videorecorder; videocassette machine with electronic control and synchronizing system, tabletop controls; shelf.
- ST1B: 35mm film to tape transfer unit with electronic counter, loop programming and interlock capabilities.



## **Two concerns about studio lighting.**

The first is that you can spend liberally on lighting equipment and still not get what you want. The second is that you can waste more in down-time than in the price of extra equipment if you don't have what you need.

We've already helped with more than 1,000 studio facilities all over the American continent, including all major networks. So if you're ready...

## **A remedy for these concerns.**

We have people who will work with you customizing your studio lighting to your particular wants by installing a designed package lighting system that meets the wide spectrum of your needs.

For further information, contact your Kliegl representative or call or write our office.

**kliegl**

Kliegl Bros.  
32-32 48th Avenue  
Long Island City, NY 11101  
(718) 786-7474 Telex: 960158

Circle (202) on Reply Card



# Make The Stereo Transition With Benchmark!

We at Benchmark Media Systems would like to introduce to you some new ideas:

The high density System 1000 frame and DA-101 card. This card redefines "distribution amplifier". It has two instrumentation inputs, two gain stages, two wideband power amplifiers and accessory daughter boards. The versatility of this card is almost unlimited. Without daughter boards the DA-101 may be used as; A Mono 10 out D.A. where L+R or L-R can be generated at the card. A 10 watt stereo or 40 watt mono monitor amp. A Timecode D.A. with no cross-talk. A Stereo, 10 output single ended D.A. Current daughter boards include: The EQ-01, a dual, three band, semi-parametric E.Q.; the RGC-01, a dual remote gain control, with Dynafex<sup>®</sup> noise reduction, the OSC-01, an ultra low distortion oscillator. Many more daughter

boards to come.

Other products we manufacture are: The TPC-7000 audio console, specifically designed for the TV production vehicle with features, such as reverse IFB, NET join, computer editor interface, matrix and discrete stereo, extensive metering, 24 mono, 4 stereo inputs, master modules, and only 40"w x 28"d x 16"h.

The RPM-1, a remote program meter card, with Peak, VU and peak hold functions, a peak overload indicator, local and gang switch capability.

The DIA and DOA series, differential input and differential output devices.

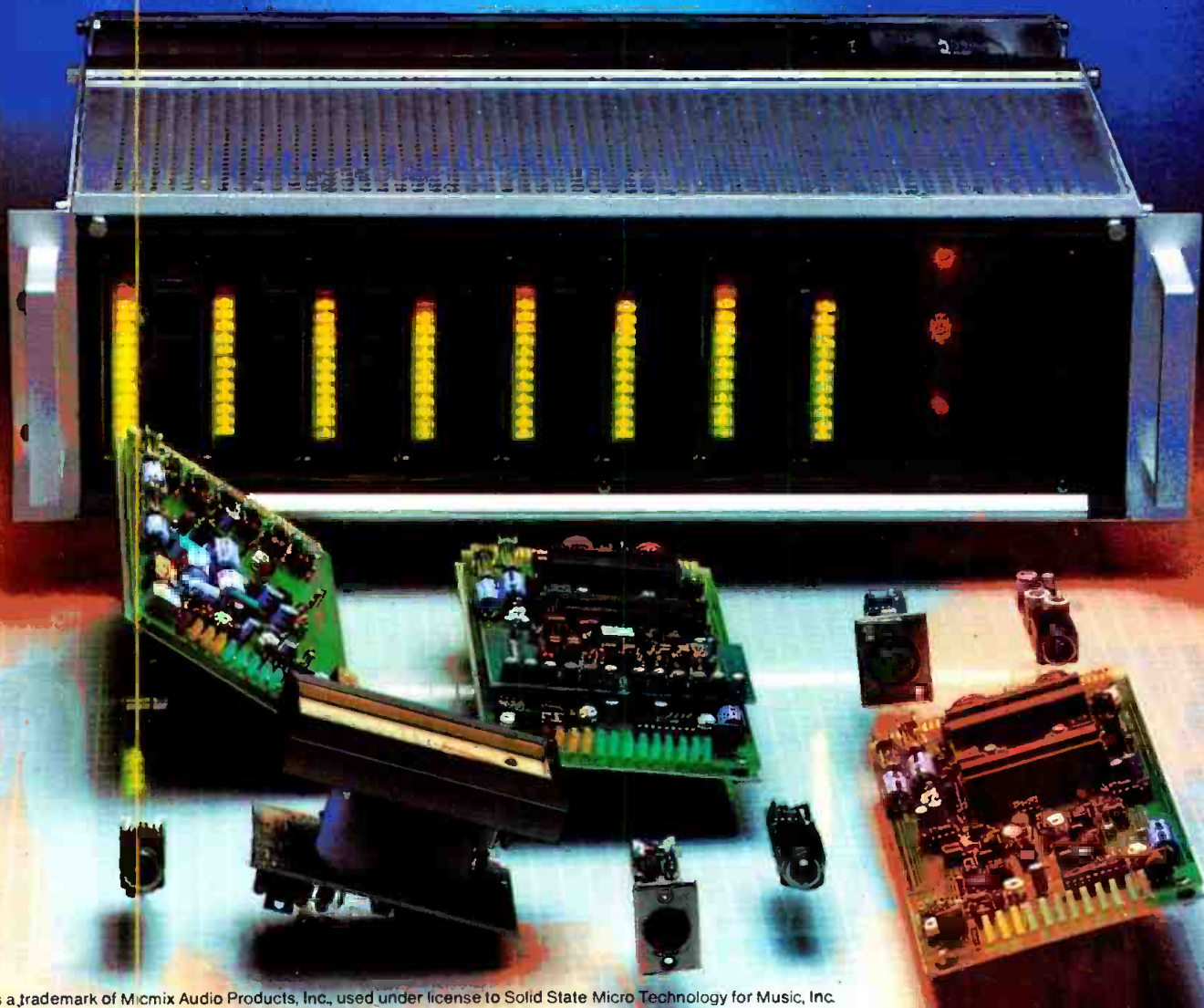
To see how we can help with your stereo changeover, call today and ask to speak to Allen Burdick.

See us at NAB Booth #2264

*Benchmark*  
MEDIA SYSTEMS, INC.

3819 Brewerton Rd. • North Syracuse, N.Y. 13212 • (315) 452-0400

Circle (203) on Reply Card





Steenbeck, continued

Product line \_\_\_\_\_  
Film editing equipment, telecine systems, film-to-tape transfer equipment.  
Circle (874)

**Storeel** (1008)  
Introductions \_\_\_\_\_  
• Room Stretchers: high-density storage system for Beta and VHS cartridges.  
Product line \_\_\_\_\_  
Audio, videotape storage systems.  
Circle (875)

**Straight Wire Audio** (408)  
Introductions \_\_\_\_\_  
• Stereo Sentinel: automatic stereo

synthesizer.

• 3D/RP: playback amp for ITC machines.  
Product line \_\_\_\_\_  
Distribution amps; encode/decode processing amps; low-noise pre-amps.  
Circle (876)

**Strand Century** (1418)  
Product line \_\_\_\_\_  
Lighting instruments, dimmers, dimmer controllers.  
Circle (877)

**Studer Revox** (201)  
Introductions \_\_\_\_\_  
• A820: audio recorder, micropro-

cessor controlled functions and internal settings.

• D820: DASH format 2-channel audio recorder.  
• A725: broadcast CD player.  
• A80 MKIV: multitrack audio recorder.  
• A80VU-3LB: 1-inch B- and C-video layback recorder.  
• B215: cassette deck with automatic alignment, level setting.  
• Studio 3: close reference monitor amps.  
• A810-PT: audio recorder for film audio, with mono and stereo pilot-tone.  
Product line \_\_\_\_\_  
Analog, digital audio recorders, CD players, audio cassette decks, portable, studio audio mixers, telephone interfaces, SMPTE/EBU synchronizing systems, audio power amps, automation reproducers.  
Circle (878) See ad pages 162-163

**Swintek Enterprises** (1503)  
Introductions \_\_\_\_\_  
• MARK 200D/AC: mini full-duplex radio intercom system, for use with hard-wired intercom links from RTS, Clear-com, powered from the hard-wire, accepts external tone-encoded feeds.  
• MARK QDC: wireless mic system, designed for use with TV cameras.  
Circle (879)

**Switchcraft** (427)  
Introductions \_\_\_\_\_  
• Series TTPC: PC board jackfields.  
• Series RAPC: right-angle PC mount audio connectors, receptacles.  
• Series E: audio connectors, receptacles.  
Product line \_\_\_\_\_  
Jacks, jackfields, jackpanels, plugs, connectors, receptacles, patchcords, molded cable assemblies, switches.  
Circle (880) See ad page 233

**Symetrix** (616)  
Introductions \_\_\_\_\_  
• 105: multiline broadcast telephone interface system.  
Product line \_\_\_\_\_  
Audio processor systems, equalizers, audio noise reduction equipment, audio monitor amps.  
Circle (881) See ad page 70

**Symtec** (1522)  
Introductions \_\_\_\_\_  
• Supercolor 1024: graphics system and character generator, operates around the 68000 microprocessor and IBM PC-XT, with 1024 displayable colors available in NTSC or RGB.  
Product line \_\_\_\_\_  
Graphics systems, character generator/titlers.  
Circle (882)

**System Associates** (1331E)  
Product line \_\_\_\_\_  
Broker of used broadcast equipment.  
Circle (883)

**3M Broadcasting/Related Products** (1002)  
Introductions \_\_\_\_\_  
• 6600: control system, five multifaceted control panels.  
• MFA Paint system: high resolution

# #1 in the Broadcast Industry

## PESCHEL AUTOMATIC VOLTAGE REGULATOR

### HERE'S WHY:

- Highest Efficiency
- Reliability & Serviceability
- Compact, lightweight design
- Dry type, convection cooled
- Individual phase control
- Transient Suppression
- Regulator bypass switch
- Loss of phase, overvoltage protection
- Reduced voltage turn on



### Open Letter to the Broadcast Industry

After five years of manufacturing regulators, Hipotronics has captured nearly 100% of the broadcast market in applications above 50 kVA. We have concentrated on this industry and it shows. Almost all transmitter manufacturers (especially in UHF) now resell our regulators with their transmitters, and many stations have chosen our regulators as well. We are always the sole regulator exhibitor at the NAB convention.

We are committed to the broadcast industry and to providing the best possible voltage regulator with the features you have asked for. If you are already a customer, thank you. If not, let us help you with your power requirements. I look forward to talking with you soon.

Sincerely,

*Michael T. Peschel*  
Michael T. Peschel  
Product Mgr. & Engineer  
PAVR

"See us at the NAB Show Booth #1779."

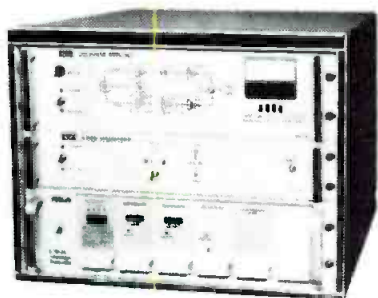


FOR LITERATURE WRITE  
ON COMPANY LETTERHEAD  
TO: HIPOTRONICS, INC., RT 22  
BREWSTER, NEW YORK 10509  
OR CALL: 914-279-8091

Circle (204) on Reply Card



# WE'VE BEEN BEATING THE ENEMIES OF GOOD TELEVISION TRANSMISSION FOR 25 YEARS!



## TTS-10GA 10 WATT GaAs FET ITFS/MDS TRANSMITTER

- \* 100% SOLID STATE
- \* SEPARATE VISUAL/AURAL AMPLIFICATION
- \* BUILT-IN VISUAL/AURAL COMBINER
- \* SWITCHING REGULATED POWER SUPPLIES
- \* BROADBAND REPLACEMENT MODULES
- \* AIR COOLED
- \* 100 WATT AMPLIFIER AVAILABLE

## TYPE TTU500ODP 5000 Watt UHF Transmitter

- \* FOR NTSC, PAL OR SECAM
- \* I.F. MODULATION
- \* SOLID STATE EXCITER/DRIVER
- \* FCC TYPE ACCEPTED
- \* BUILT IN PROTECTIVE CIRCUITRY
- \* REMOTE CONTROL ADAPTABLE
- \* COMPLETELY SELF CONTAINED

## TYPE TTU100SR 100 Watt UHF LPTV Transmitter

- \* PRECORRECTION ENHANCED LINEARITY
- \* 50 dB DYNAMIC RANGE ADAPTIVE AGC
- \* 100% SOLID STATE
- \* EXCITER PORTION AVAILABLE AS A SOLID STATE 1 WATT TRANSLATOR (MODELS TU1A/U OR TU1A/V)
- \* AMPLIFIER PORTION ALSO AVAILABLE AS 100 WATT LINEAR AMPLIFIER (TU100S)
- \* INTERCHANGABILITY OF PLUG-INS WITH MINIMUM RETUNING

Call Toll Free 1-800-233-6193

**EMCEE BROADCAST PRODUCTS**, Div. of Electronics, Missiles & Communications, Inc. White Haven, Pa. 18661 (717) 443-9575

And nobody — absolutely nobody — has done it more convincingly than **EMCEE**.

In a broad array of finely engineered transmitters, translators and systems for VHF, UHF, ITFS, and MDS requirements.

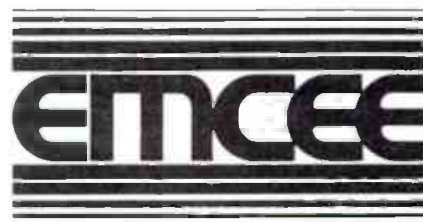
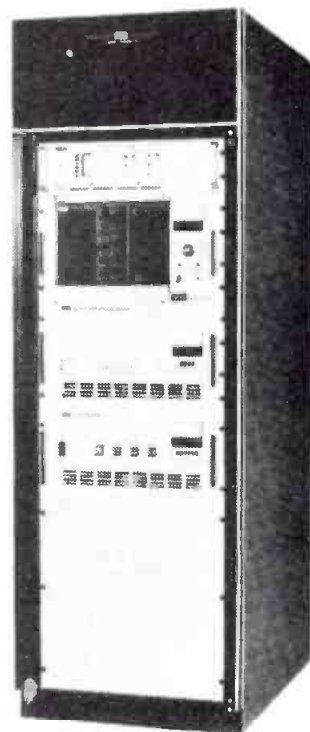
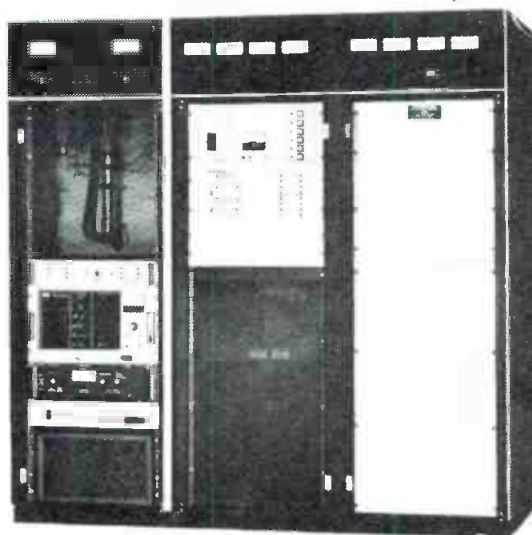
As you'll discover when you visit **Booth #1621** at the forthcoming **NAB SHOW**, where **EMCEE** will be displaying not only our standard products, but the newest ones, too.

Such as our recently perfected 5 Kw UHF color transmitter, whose performance characteristics are so outstanding we're sure you'll be astonished by them.

But superb as it is, it's merely one of a number of fine new products **EMCEE** will be introducing at the show.

And remember...**EMCEE** is a full-service company that can direct a project through every stage — from planning to construction through installation and finally to maintenance.

**See you at Booth #1621!**



Circle (205) on Reply Card



3M, continued

graphic arts design station.

Product line \_\_\_\_\_

Routing switchers, character generators and titlers, electronic graphics system.

Circle (723)

See ad page 283

### 3M Magnetic Audio/Video

Products

(1002)

Introductions \_\_\_\_\_

- Betacart cassette.
- Premium grade U-matic cassette.
- Super High Grade Beta and VHS cassettes for 1/2-inch camera systems.

Product line \_\_\_\_\_

Reel audio, videotape, computer floppy disks.

Circle (721)

### 3M Optical Recording Project

(1002)

Introductions \_\_\_\_\_

- OROM: optical data disc, prerecorded media, 5 1/4-inch, 2500Mbytes concentrically recorded.
- CD ROM: optical data disc, prerecorded media 4.72-inch, 350-600Mbytes, standard CD format, spiral configuration.
- Erasable disc: user recordable, updatable, erasable, 5 1/4-inch 250-500Mbytes, based on magneto-optics principle.
- Write-once disc: recordable media, 5 1/4-inch (250-400Mbytes), 12-inch, (1-1.3Gbytes), non-erasable.

Product line \_\_\_\_\_

Laser videodisc, user applications.

Circle (722)

### 3M Stormscope

(200)

Introductions \_\_\_\_\_

- Stormscope: thunderstorm mapping device.

Circle (724)

### TFT

(109)

Introductions \_\_\_\_\_

- 831: TV/SAP generator.
- 832: TV/professional channel generator.
- 850: TV stereo modulation monitor.
- 8500: TV/microwave composite sub-carrier generator.
- 8501: TV/microwave composite sub-carrier demodulator.
- 840: AM stereo exciter.
- 841: AM stereo monitor.

Product line \_\_\_\_\_

STL systems, FM/FM stereo monitors, remote control systems.

Circle (885)

See ad page 189

### TSM

Introductions \_\_\_\_\_

- HS-100P: servo-controlled pan/tilt system.
- Micro-controller: for HS-100P, provides 100 presets for zoom, focus, pan, tilt for single camera.
- Micro-controller IV: controls HS-100P systems for four cameras, includes 20 motion memories.

Product line \_\_\_\_\_

Camera support and support control systems, optics services, ENG accessories.

Circle (886)

### Taber

(711)

Product line \_\_\_\_\_

Bulk tape degaussers, audio heads, audio recorder servicing.

Circle (887)

### Taft TV and Radio

(136)

Introductions \_\_\_\_\_

- Up/downlink service now includes Kansas City, MO, to all domestic satellites.

Product line \_\_\_\_\_

Occasional use satellite time services.

Circle (888)

### Tamron

(1316)

Product line \_\_\_\_\_

Camera lens systems for ENG and other 2 1/2-inch format cameras.

Circle (889)

### Tascam

(1304)

(Professional Division)

Introductions \_\_\_\_\_

- MS-16: 1-inch 16-track audio recorder deck, full servo control and compatible with SMPTE interlock systems, +4dBm XLR connections, optional console, 10-point auto-locator, dbx processing.
- Half-track audio deck with centerline time code capability.
- Tape duplicators.
- Monitor speakers.
- Audio consoles.
- Ministudio: field recorder, cassette format.

## HOW DO YOU IMPROVE ON A GOOD THING?



### Peter Lisand follows a tough act...

Peter Lisand has learned from its successes. Proof of this can be seen in our two new camera support systems. Our heavy-duty camera head has a 30-50 pound capacity, while the light-duty style holds 15-30 pounds. Here are a few reasons both heads deserve your attention:

- True fluid action maintains a smooth regulated motion by a sensitive system without brake shoes, bands, or other mechanical parts to interfere with its operation. Separate positive locks and drag are featured on the pan and tilt. Tilt achieves a full 90° vertical position.
- Sealed leak-proof chamber assures long-lasting, problem-free operation.
- Adjustable quick-release will counterbalance camera and lens requirements. (optional)
- Versatile control—use right, left or dual handles.
- New reversible foot, rubber-tipped for interiors and standard metal points for outside use, can be ordered with either of the JRA tripods. (optional)
- Tripods come with various top castings to accommodate existing systems.
- Complete the light-duty system with the JRA-83M, a new light weight tripod that weighs in at 7 lbs., with a total combined weight of 16 lbs.

These Peter Lisand products reflect our highest standards and are backed with our one-year no-hassle guarantee.

**Peter Lisand** <sup>TM</sup> <sup>®</sup>  
MACHINE  
CORP.

352 RIVER ROAD, EDGEWATER, N.J. 07020  
Phone: 943-5600 (Code 201)

Circle (206) on Reply Card



# IN THE WORLD OF DA's... ONE NAME STANDS OUT-



# DATATEK

**HIGH QUALITY...**products that equal or surpass the most demanding specifications.

**FAMILY OF COMPATIBLE MODULES...**fill your exact needs. Choose from a wide variety of video, pulse, time code, audio and switching modules.

**ONE UNIVERSAL RACK FRAME...**allows intermixing A/V distribution, switching or IDS modules in the same frame to accommodate your exact system needs.

**STANDARD FEATURES — NOT OPTIONS...**include power supplies, cable equalizing, precise path delay matching and more.



See Us At NAB Booth #142

1121 Bristol Road, Mountainside, NJ 07092 • (201) 654-8100



Tascam, continued

- Cassette deck: 4-track with 1 $\frac{1}{2}$ ips.
- Logging decks.

Product line

Audio recorders, audio consoles, microphones, tape and audio accessories.

Circle (884)

See ad page 131

Teatronics

(1786)

Introductions

- Producer: memory control console with 2-scene 24-channel patch and 10 preset submasters. ability to use all 24 channels as additional submasters, patching for 252 dimmers.

Product line

Lighting dimmers, controllers.

Circle (890)

Tec-Pro

(2218)

Introductions

- MJS 401D: audio measurement test set.
- ART 421: auto reverberation timer.
- Talkback systems.
- CX: C-Tape Developments contact, flexible microphones.
- RCM2: PMG Diversified record cleaning machine.

Circle (891)

See ad page 304

Tektronix

(1601)

Introductions

- 1710B, 1711B: waveform monitor with burst phase indicator, in NTSC and PAL.
- TSG-17A: digital sync, test signal

generator, RS-170A, SMPTE color bars, 10-bit signal generation.

- 1450-1: TV demodulator.
- 1450F20: wideband audio upgrade retrofit kit, for BTSC multichannel sound compatibility. Japanese dual sound with Fax channel compatibility.
- 118-F02: interface 118AS audio synchronizer to NTSC or PAL video devices.
- Prototype TSG-300: analog component test signal generator in Beta, RGB, YUV formats.

Product line

Waveform, vector monitors, automatic video measurement system, audio and video synchronizers.

Circle (892)

See ad page 11

Telemet

(1202)

(Division of Geotel)

Introductions

- Stereo/audio demodulator.
- Routing switcher.
- Card File: fiber-optics system.

Product line

Demodulators, spectrum, sideband analyzers, video, pulse DAs, modulators, thermal equalizer, routing switchers, fiber-optic systems, test signal generators, chroma keying systems.

Circle (893)

Telepak San Diego

(192)

Introductions

- T-scope: TEK 1740/50 waveform/vector pak.
- T-GRA: Nagra recorder pak.
- T-Gaf, T-MiniGaf: grip, gaffer paks.
- T-20, T-68, T-50TCG: paks for Sony BVW-20, VO-6800 and BVW-50 with TC generator pocket.

Product line

Equipment transport, carrying bags.

Circle (894)

Telescript

(1407)

Introductions

- C-64 prompter: prompting program for Commodore C-64 personal computer.

Product line

Monitor prompting systems, prompter transports, fluid heads, camera support products, PA/podium systems.

Circle (895)

Television Engineering

(1700)

Introductions

- Latest design in mobile vehicles.

Product line

Engineering design; consultant services, audio and video equipment distributors.

Circle (896)

Television Equipment

(1216)

Introductions

- Freedom-1: Racial ultra-light headsets, with cushioned, flat surface receiver; fully adjustable headband; miniature microphone; 2 ounce approximate weight.
- MCL 420B: satellite receiver sub-carrier filter, reduces herringbone pattern interference.
- MDP525B: filter maintains 75 $\Omega$  impedance across video band, per NTSC

# Stop using bad tape. Reduce tape dropouts. Improve video quality.

The RTI Videotape Evaluator/Cleaner finds control track and other physical damage that make a tape useless. It can even print out exact damage locations. You'll know instantly which tapes shouldn't be used.

It eliminates up to 70% of temporary tape dropouts. Good tapes will look even better.

It also eliminates frequent head clogging by reducing tape-borne dirt and loose oxide.

Protect your tapes, your recorders and your reputation.

This machine will pay for itself in tape costs alone. For detailed information, write or call us toll free at 800/323-7520.\*

Models available for U-Matic, VHS or Beta.



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PRODUCTS  
COMPANY

A Subsidiary of Research Technology International

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\*Illinois, Alaska, Hawaii or outside the U.S.A.,  
call 312/677-3000

See Us at NAB Booth #1626

Circle (208) on Reply Card



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FROM UNION CONNECTOR**

**AN INEXPENSIVE  
COMPUTERIZED  
CONTROLLER**  
For The UNITROL System

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**UNITROL**  
LIGHTING CONTROL SYSTEM

**NO DIMMER RACKS  
NO PATCH PANEL  
NO MAINTENANCE  
NO CONTROL WIRING**

**NO ADJUSTMENTS OR TUNING  
NO CONTRACTOR INSTALLATION COSTS  
NO OPERATIONAL TRAINING  
INSTALLS IN MINUTES BY STAGE CREW**



Plug light source into SU-1 . . . Then plug SU-1 into any outlet . . . Now plug DIGI-1 into any outlet anywhere on the same wiring system . . . **AND YOU ARE READY TO GO.**

- AC LINE CARRIER CONTROL
- COMPLETELY SILENT
- 2400 WATTS (2.4KW)
- CONTROLS UP TO 256 CIRCUITS

- SOLID STATE DIMMERS
- PORTABLE OR HARDWIRED
- MODULAR AND EXPANDABLE
- MORE ECONOMICAL THAN A PACK SYSTEM

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**UNION CONNECTOR CO., INC.**

149 BABYLON TURNPIKE  
ROOSEVELT, NEW YORK 11575  
Tel: (516)623-7461

U/L Listed  
OSHA Acceptable

Circle (209) on Reply Card



## Television Equipment, continued

report No. 7 for non-linearity signal tests.

- Demonstration: computer-assisted optimum filter designs calculated from required parameters.

### Product line

Videotape cleaners, evaluators, 2-inch, 1-inch, 3/4-inch formats, video, pulse delays, video filters, audio, video and pulse DAs, telephone, field phone systems, production crew headsets.

Circle (897)

## Television Technology (305)

(TTC/Wilkinson)

(TTC/Ampro-Scully)

### Introductions

- 8090 series: FM transmitters, single tube design with advanced control circuitry.
- 8090 FM exciter.
- XLFM: FM broadcast translator.
- XL1000: UHF TV transmitter.
- XL20: 20W UHF TV translator.
- MATV-F-10: 10W VHF transmitter.

### Product line

LPTV, TV transmitters, translators, AM, FM transmitters, power condition equipment, audio consoles, audio cart systems, reel-to-reel audio decks, satellite communications equipment.

Circle (898)

## Telex Communications (600/1605A)

### Introductions

- FMR-50: wireless microphone, available as condenser or dynamic handheld or belt-pack with electret lavaliere or head-worn mic.

### Product line

Mics, wireless mics, intercom systems, headsets, reel, cartridge audio tape recorders and loggers, tape duplicating systems, film and slide projectors, A-V products.

Circle (899)

## Tennaplex (1127)

### Product line

Broadband antennas for FM & television.

Circle (900)

## Tentel (1613)

### Introductions

- HPG-C: Video head tip protrusion, drum eccentricity gauge for Type C equipment.
- TG-H18-CBD: Tension gauge for Type C recorders; ball bearing construction.

### Product line

Tension gauges; head protrusion, drum eccentricity gauges; VCR measurement equipment.

Circle (901)

## Theatre Service/Supply (1513)

### Product line

Grip equipment; curtains, track systems; overhead rolling lighting support systems; scenic supplies; lighting connectors, distribution boxes; specialty lighting grid

hardware.

Circle (902)

## Thermodyne (1637)

### Product line

Equipment cases.

Circle (903)

## Thomson-CSF Broadcast (1001)

### Introductions

- TTV-1525C: studio camera.
- TTV-1623: Betacam system, using Saticons.
- TTV-1624: Betacam system, using plumbicons.
- 5700 NTSC: color processing system.
- TTV-840: THOM-C.A.T. computer-aided test system.
- TV-5305: special effects image processor.
- TTV-4400: automatic contract corrector.
- TTV-7650/7660: DA/AD converters.
- Transmitters: 1kW, 2.5kW for FM.
- Vidifont: character graphics system with paint box and GraphicStore.

### Product line

Audio processors, audio DAs, video processors, enhancers, slide scanners, FM, UHF, VHF transmitters, TVRO system; video signal multiplexers.

Circle (904)

See ad page 159

## Thomson-CSF/Tube Div. (1003)

### Introductions

- TH-3639A: 160W Ku-band TWT for portable uplinks.
- TH-3689: 85W Ku-band TWT for portable uplinks.

# Perfect reception in long yardage situations.

Shure's new FP11 and FP12 field production units help the signal come through loud and clear. The compact size and ultra-rugged design of these units make them perfect for ENG, EFP, film and even sound reinforcement situations. Lightweight, with belt clips, they'll go

anywhere to cover all the action.

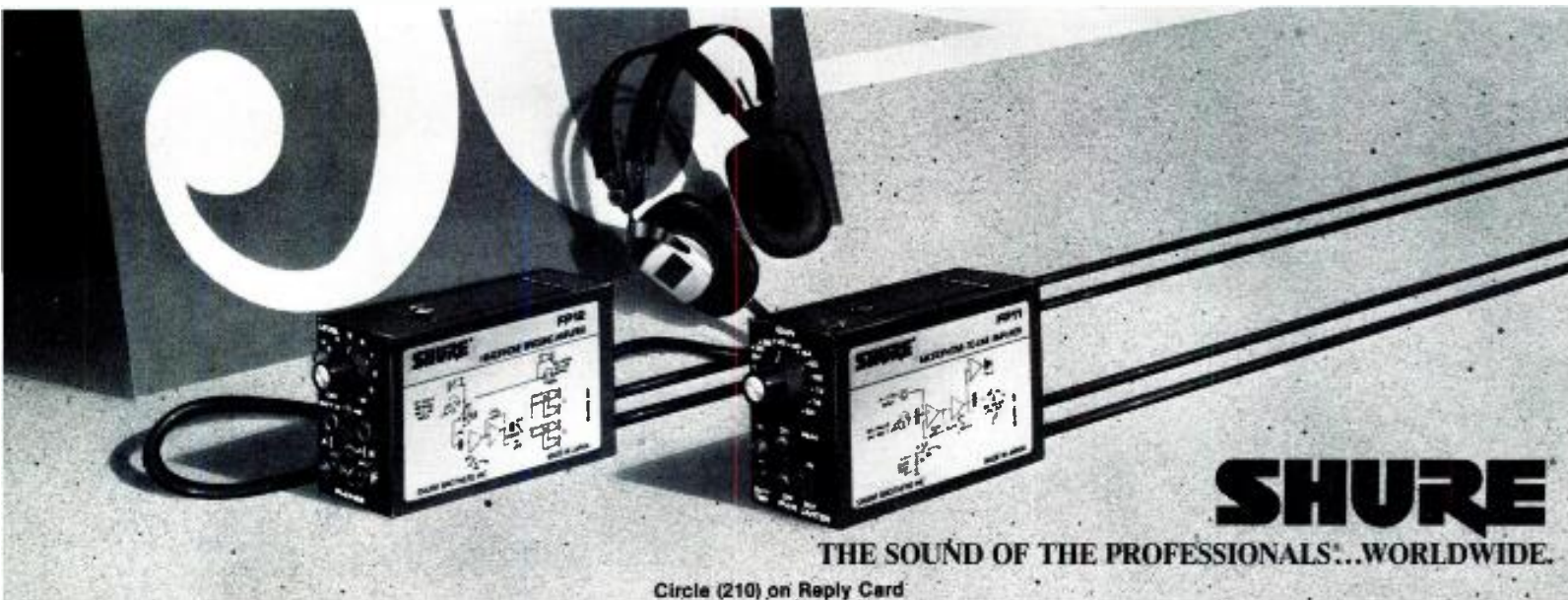
## FP12 Headphone Bridging Amp

The FP12 lets you check any audio line through headphones, without terminating the signal. The unit accepts standard 1/4" or 3.5 mm mini-plugs. Its 96 dB of gain drives headphones even with a weak signal.

## FP11 Mic-to-Line Amplifier

The FP11 boosts mic signals to line level by up to 84 dB, giving a clear, static-free signal over long distances. It features a precision stepped gain control, a switchable limiter, and easy access to batteries for checking or replacement.

For more information on Shure's complete field production family, call or write Shure Brothers, Inc., 222 Hartrey Ave., Evanston, IL 60204, (312) 866-2553.



# SHURE

THE SOUND OF THE PROFESSIONALS...WORLDWIDE.

Circle (210) on Reply Card

www.americanradiohistory.com



# HIGH KLYSTRON EFFICIENCY SIMPLE AS ABC\*

(\*Annular Beam Control)

- LOW INITIAL COST
- LOW REPLACEMENT COST

With more than three decades of manufacturing experience we have kept the broadcaster in mind by offering low initial cost, reliable, efficient performance and low replacement cost. You also have a choice of output power up to 64kW..

## ABC Electrode\*

Power operating costs can be reduced significantly with Amperex broadband UHF klystrons having Annular Beam Control (ABC). The ABC Electrode is a rugged, "low voltage" beam control that can achieve efficiencies in excess of 65%. (See graph.)

## Wideband Capability

Amperex UHF klystrons cover the entire UHF band from 470 MHz to 860 MHz with a single tube.

## Efficient Cooling Design

For over a decade we have supplied the optimum cooling modes. You have a choice of proven cooling structures for vapor cooling, vapor condensation or water cooling with the same tube.

## Rugged Mechanical Design

Our experience in manufacturing power tubes with glass-to-metal and ceramic-to-metal seals led us to the development of alumina ceramic-to-metal seals completely eliminating the use of highly toxic beryllium oxide in all of our power klystrons.

Actual performance data shows that our designs using alumina ceramic-to-metal construction contributes significantly to the life and reliability of our UHF klystrons.

## Long Life Expectancy

User records show that the average lifetime of Amperex UHF klystrons exceed 32,000 hours. Peak lifetimes have been recorded in excess of 80,000 hours.

## Low Replacement Cost

Since Amperex UHF klystrons use external cavities, tube replacement cost is reduced by at least 40% when compared to internal cavity klystrons.

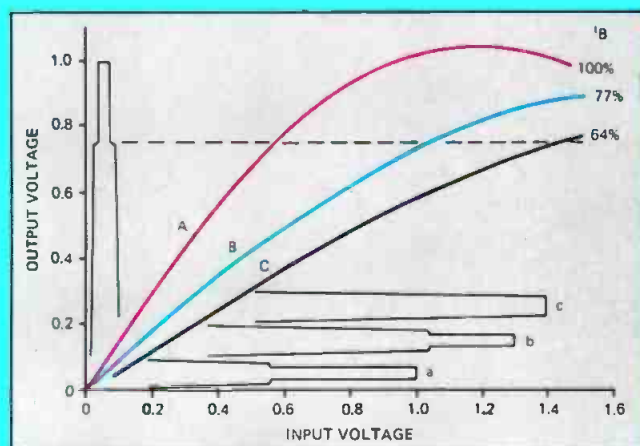
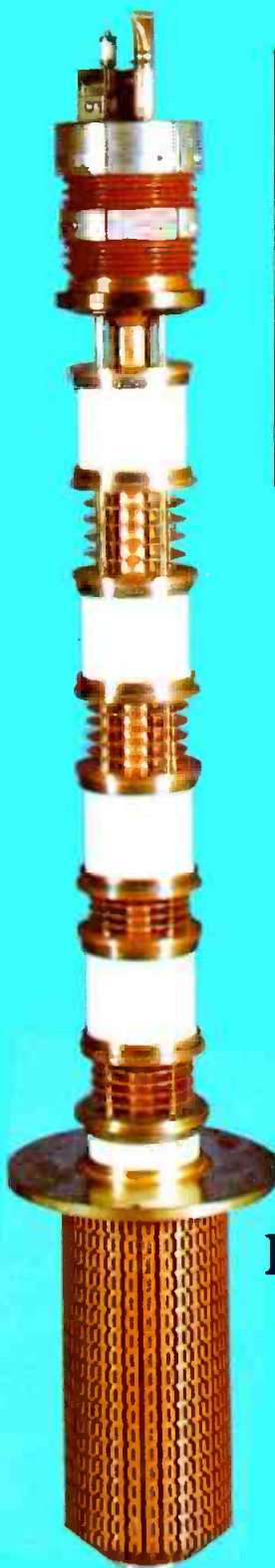
When you're looking for the best UHF power package, you can't find a better performer than the Amperex UHF power klystrons. We have designed our UHF power klystrons to give you optimum performance in video and aural transmitters backed up with a proven record of "on-the-air" performance.

**SEE US AT THE NAB SHOW  
BOOTH #1412**

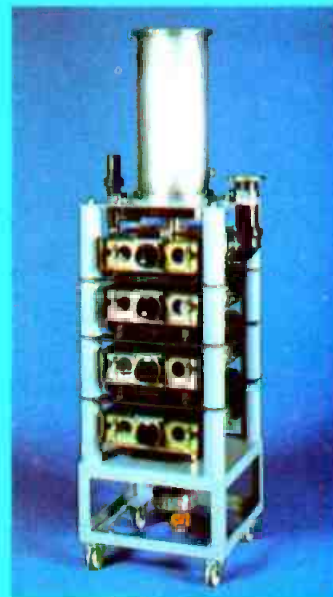
**Amperex® Electronic Corporation**

A NORTH AMERICAN PHILIPS COMPANY  
230 Duffy Avenue, Hicksville, NY 11802

Phone: 516/931-6200 TWX: 510/221-1839 WATTS: 1-800-227-1613



Klystron output voltage versus input voltage (relative values)



**KLYSTRON HOTLINE**

**800-227-1613**



Whether you're thinking of a new installation or retrofitting, call Peter Fochi, Power Tube and Rectifier Product Manager, at the above toll free number for information on improving your on-the-air performance and reducing your operating costs.



Thomson-CSF, continued

- TH-563: 50kW tetrode for TV transmission.
- TH-558: 500kW shortwave tetrode.

Product line

Tetrode power tubes for FM, UHF and VHF transmitters.

Circle (905)

See ad page 159

**Tiffin**

(1422)

Introductions

- MCS: magnetic filter system, mounts to lens of camera to hold optical filters.

Product line

Optical filters, lens adaptors, accessories, shades.

Circle (906)

**TimeLine**

Introductions

- LYNX: Time code module containing independent time code generator, wideband reader and transport synchronizer. for SMPTE code, with RS-422 serial port communications.

Circle (907)

**Torpey Controls**

(465)

Product line

Digital clocks, timers, video message generator.

Circle (908)

**Townsend**

(1420)

Introductions

- TV transmitter: 1kW VHF, solid-state.

- TV transmitter: 1kW, UHF.
- TV transmitter: 25kW, VHF.
- TV transmitter: 60kW, UHF.
- Demo: Live stereo television.

Product line

UHF, VHF TV Transmitters/systems; transmitter power supplies.

Circle (909)

See ad page 260

**Trident**

(633)

Introductions

- Series 75: mixing console; standard 28-input, 24-monitor, 24-bus board.
- Series 65: cosmetic update, mixing console, fully modular, from 16-input to 40-input board with 8, 16 or 24 monitors.

Product line

Audio mixing consoles.

Circle (910)

**Trompeter**

(1211)

Product line

RF connectors, RF, audio patch panels, jacks, plugs, cables.

Circle (911)

**U.S. Tape & Label**

(602)

Product line

Pressure-sensitive promotional products.

Circle (912)

**Ultimate Support**

(641)

Introductions

- UB-12PB: 12-foot boom package for sound, lighting, black anodized aluminum tripod with wheels, boom in sections, swivel-joint T-fitting, ditty bag, custom tote bag.

Product line

Tripods, lighting, utility stands, equipment tables, mic, sound, lighting booms.

Circle (913)

**Ultimate**

(1642)

Introductions

- Ultimate-5: enhanced video compositing system.

Product line

Video keying, compositing systems.

Circle (914)

See ad page 130

**Union Connector**

(1783)

Introductions

- SU-1: 2.4kW dimmer, remote computer-controlled.

Product line

Light dimmers, controllers, electrical wiring devices, electric distribution equipment.

Circle (915)

See ad page 269

**Uni-Set**

(1236)

Introductions

- New set table systems, featuring new heights.

Product line

Scenery, studio set products.

Circle (916)

**United Media**

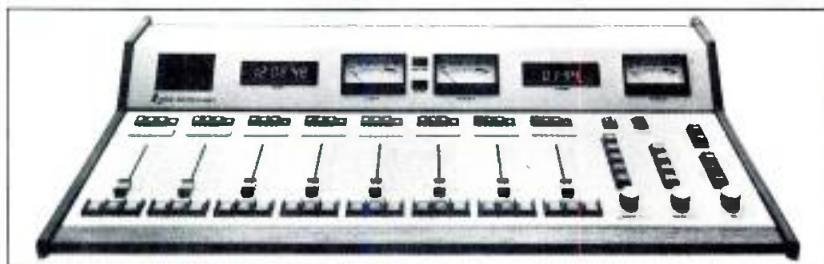
(1300)

Introductions

- Image Artist: digital image processing system, combines effects with electronic stylus, digitizing pad.
- Mini-Comm: upgradable A/B roll editing controller, for three VTRs with switcher control; EDL.
- 500 Sequencer: real-time or time code

**NEW**

## Better than BMX! Ahead of Auditronics! Astounding Price!



### The **Logitek** **PERFECTIONIST** 8 and 12-Channel Broadcast Consoles

	<b>PERFECTIONIST</b>	<b>Audi. 200</b>	<b>BMX</b>
<b>Max THD</b>	<.1%	<.15%	<.3%
<b>Inputs/ mix channel</b>	<b>4</b>	2	2
<b>Fader Type</b>	<b>rotary or slide</b>	slide only	slide only
<b>Connectors</b>	<b>remote punch blocks</b>	internal plugs	rear panel Molex
<b>Switches</b>	<b>hall-effect</b>	<b>hall-effect</b>	mechanical
<b>Warranty</b>	<b>5 years</b>	1 year	not listed
<b>Price (8 ch./12 ch)</b>	<b>\$8,500/10,500</b>	much more	even higher

Hear it at NAB Booth 613 or

**CALL 800-231-5870**

(Texas, Alaska, Hawaii call 713-782-4592 collect)

for full information and the name of your  
Logitek *Instant Action Dealer*.

**Logitek** Electronic Systems, Inc.

Circle (212) on Reply Card



# With SAM you don't have to play it again

SAM (Station Automation Manager) plays for keeps. And SAM plays the finest in television "look" the first time, everytime.

SAM performs an air-day schedule in concert with your own station's traffic system, orchestrating all of your switchers, cart machines, telecines, VTR's, character generators. SAM even rehearses your programming plan before air time and talks to your operator about any missing items or timing errors. No more make-goods with SAM.

Vital Industries is booking SAM into stations now, to rave reviews.

Come to Vital's booth, #263, at SMPTE and watch SAM in action. With SAM and SANDI (Vital's Serial Data Network), your station may never have to "play it again."

Visit us at NAB  
Booth 1212



**VITAL INDUSTRIES, INC.**

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(904) 378-1581 • TWX 810-825-2370  
TLX 80-8572 VITAL-A-GAIN

## Vital is the leader in television automation

Circle (213) on Reply Card



CINE 60 SUN-GUN

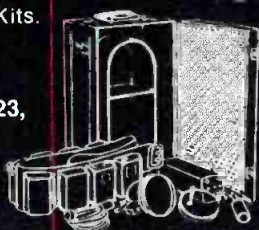
# Beautifully Simple

Beautiful . . . because it's fresnel-soft and uniform — ideal for video. And simple because . . . if 250 Watts is too much, change to 150 Watts. Need more? Go to 350 Watts. Want to go really light? Use 100W (12V) or 70W (14.4V). Outdoors, swing-in the built-on Daylight Filter. You color correct instantly! Indoors, swing away Filter and you have tungsten light! Never a need to readjust camera color controls here! For focus, vary the beam from 8 to 14 ft. For power, choose from 84 Battery Belts and Battery Packs. And, to make it beautifully simple . . . we put it all together for you in any one of 48 Portable Sun-Gun Kits, including Switchable 30V/14.4V combination Kits. See your dealer or send for data, today.

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Circle (214) on Reply Card

## REALTIME VIDEO PROCESSING BY DIGIVISION



DRGB-343  
High Resolution  
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**Products to solve your  
realtime video processing  
problems:**

- DRGB-343 High Resolution Video Converter
- FluoroVision Video Processor
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**Specialized contract  
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- Realtime Non-Linear Exposure Compensation
- Locally Adaptive Contrast Manipulation
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- Standard Video Input/Output

**Visit  
us at  
NAB Booth  
1620A**



4980 Carroll Canyon Road, San Diego, CA 92121, (619) 458-1111

Circle (215) on Reply Card

United Media, continued  
comparator, for control of 16 devices.  
• New list management software.

Product line \_\_\_\_\_  
Editing controllers, dialog replacement systems, time code products, audio router/dissolver.

Circle (917)

See ad page 229

**United Press International (430)**  
Introductions \_\_\_\_\_

• UPI-1: updated version of broadcast computer.

Product line \_\_\_\_\_

Radio programming series.

Circle (918)

**United Research (313)**  
Introductions \_\_\_\_\_

• AS6002SM: 3-speed reel-to-reel recorder.

Product line \_\_\_\_\_

Reel, cassette recorders, recording tape, test, alignment tapes, recorder accessories and replacement parts, audio processing amps.

Circle (919)

**United Ropeworks (126)**  
(Phillystran Division)

Product line \_\_\_\_\_

Electrically transparent tower-guy materials.

Circle (920)

**URSA Major (512)**  
Introductions \_\_\_\_\_

• MSP-126: multitape stereo processor, 20kHz bandwidth; eight processing modes; switchable input for mono operation.

• 8x32-Mk II: digital reverb system—to 20s decay time, 64 memories, eight reverb programs; optional remote control.

Product line \_\_\_\_\_

Digital reverb, effects systems.

Circle (921)

**Utah Scientific (1114)**  
Introductions \_\_\_\_\_

• AVS-1B: routing switcher with eight levels of switching, standard matrix 260x320, expandable, reprogrammable control panels, redundant control, memory systems.

• Control systems; dumb terminal series controller for AVS-1B, six different 4-level reprogrammable panels.

• Machine control system: for proposed SMPTE standards.

• Station automation hardware, features speed, flexibility, failure protection.

• Party line machine control system.

Product line \_\_\_\_\_

Routing, master control switchers, station automation products, audio, video DAs, machine control systems.

Circle (922)

See ad page 156-157

**Valentino (1231)**  
Product line \_\_\_\_\_

Production music, sound effects.

Circle (923)

**Valley People (318)**  
Introductions \_\_\_\_\_

• 440: Limiter, compressor, de-esser, single channel multifunction audio processor.

Product line \_\_\_\_\_



# TWO GREAT SPANISH PICTURES



The Spanish artist Velázquez painted classic pictures in 1660. And today, PESA high-resolution color monitors create the crisp pictures that meet the exacting specifications of the broadcast industry. Again, from Spain comes the precision and quality that make a classic.

PESA color monitors have been selected for their quality for many years. The finest broadcast facilities and production houses use PESA monitors exclusively.

PESA monitors are designed by the Spanish masters to be a formidable contender among the American monitor suppliers.

PESA America Inc.  
6043 N.W. 167th Street  
Miami, Florida 33015  
305-556-9638

PESA

CHARACTER GENERATORS • MONITORS • TERMINAL EQUIPMENT • MOBILE VANS • TRANSMISSION EQUIPMENT

Circle (216) on Reply Card

March 1985 *Broadcast Engineering* 275



Valley People, continued

Audio compressor/limiter processors, noise reduction systems, audio expanders, parametric EQ, mic pre-amps, matching interfaces.

Circle (924) See ad page 284

**Varian Associates (1605)**

(Microwave Equipment Division)  
(Microwave Tube Division)

**Introductions**

- VPW-6890: 800W TWT power supply, integral with Ku-band TWT amplifier.

**Product line**

Klystron test systems; visual couplers.

Circle (925)

**Varian EIMAC/California (1605)**

**Introductions**

- 4CM400,000A: multiphase cooled tetrode, 500kW for MW, shortwave broadcast service.
- CV2225: 5kW FM cavity.
- CV2228: 10kW FM cavity.
- CV2202: 30kW FM cavity.
- CV2230: 60kW FM cavity.
- CV2242: 14kW lowband VHF TV cavity.
- CV2252: 15kW highband VHF TV cavity.
- Klystron: UHF TV high efficiency tube.
- 3CX500A7: focus triode.
- 4CX20,000D: tetrode power tube.
- BCX5000U7: tetrode power tube, UHF.
- 4CX25,000A: triode power tube, HF.

- 3CX10,000B7: triode power tube, HF.
- AM-2215: solid-state amplifier, 86MHz to 108MHz.
- 3CX800A7: triode power tube, VHF.
- 3CX500A7: triode power tube, HF.
- 4CV100,000E: tetrode power tube, HF.
- 8974: tetrode super-power tube, HF.

**Product line**

Transmitter tubes.

Circle (926)

See ads pages 29/251

**Varian EIMAC/Utah (1605)**

**Introductions**

- 3CX1200A7: linear triode tube.
- 4CX1500BC: linear tetrode tube.
- Special cavity.

**Product line**

Power amplifier tubes.

Circle (927)

See ad page 149

**Vector Technology/CSP (440)**

**Introductions**

- ISO-coupler products.

**Product line**

AM antenna phasing equipment, antenna tuning systems.

Circle (928)

**Video Associates Labs**

**Introductions**

- Micro-Key System: based on IBM computers.
- Video overlay: videodisc control system.

**Product line**

TV titling systems with small computers.

Circle (929)

**Video International (1524)**

**Introductions**

- STC 2003/4: digital standards converter system handles all standards; incorporates time base corrector, frame synchronizer, effects generator and 12dB of noise reduction (EBU standard).

Circle (930)

See ad page 222

**Videomagnetics (1109)**

**Product line**

VTR head refurbishing services.

Circle (931)

**Videomedia (1308)**

**Introductions**

- EAGLE XR: 150-event A/B roll upgradable editing controller.
- MAGNUM: 250-event, disc-operating system with list management.
- VMC-202: station management, traffic control system.
- EAGLE I, II, III: 250-event, upgradable editing controllers.

**Product line**

Video/audio editing controllers, machine control systems, station automation equipment.

Circle (932)

**Videotek (1633)**

**Introductions**

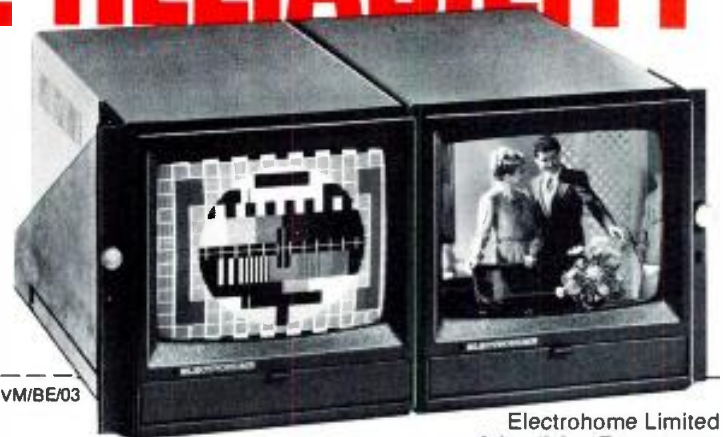
- HR-130: 13-inch high resolution color monitor.
- RS-183A: 18x1 computer controlled routing switcher, with three audio

# AFFORDABLE RELIABILITY

## ELECTROHOME EVM SERIES MONITORS HAVE BEEN PROVEN RELIABLE WITH 60,000 HOUR MTBF TESTING.

Other Electrohome strengths for the broadcast industry include—

- High resolution, precise linearity and geometry
- Switchable dual differential inputs
- D.C. restoration
- Convenient front controls
- Switchable underscan
- Wall, ceiling and rack mount accessories
- 9", 12", 15", 17" and 23" screen sizes
- Switchable power supply 110/220/240 volt 50/60 Hz operation
- Custom design service available to meet your specifications or requirements



EVM/BE/03

Please send me more information on the Electrohome Video Monitor.

Electrohome Limited  
Advertising Department  
P.O. Box 1663  
Buffalo, New York 14203

Name \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_ City \_\_\_\_\_

State \_\_\_\_\_ Zip Code \_\_\_\_\_ Phone \_\_\_\_\_

## ELECTROHOME ELECTRONICS

Electrohome Limited, 809 Wellington Street North, Kitchener, Ontario, Canada N2G 4J6. Telephone (519) 744-7111. Telex 069-55449

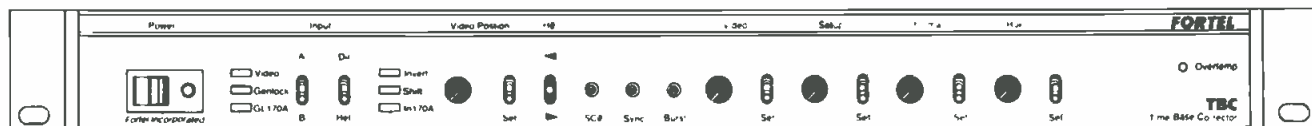
Circle (217) on Reply Card

See us at NAB booth #1744

\*Support documentation available upon request.



# THE TBC THAT SKIPPED A GENERATION



FORTEL introduces the most significant advancement in the history of time base correction. The TBC<sup>32</sup> Time Base Corrector™ — a powerful innovation in performance, cost, size, and weight. The TBC so advanced it has been described as having... skipped a generation in the development cycle."

The compact power of the TBC<sup>32</sup> delivers performance that meets or exceeds that of all other 1" Type "C", 3/4" and 1/2" composite heterodyne TBCs.

The industry's most advanced TBC features:

- Optional 8 or 9 bit digitizing at 14.3 MHz sampling rate for unsurpassed SNR, K Factor, and differential phase and gain.

- A superwide 30 line correction window easily corrects even the most severe time base errors, and provides dynamic tracking without expensive memory options.

- Exclusive DYNA-TRAC™ dynamic tracking capability for up to 2X reverse through 4X forward play speed,

including slow motion and stop action, and shuttle mode viewing of  $\pm 50$  play speed.

- Phase Comp II™ velocity compensation and superior DOC based on line averaging.

- Super compact size (single rack height), lightweight (15 pounds), and low power consumption.

- Industry's best one-year warranty on parts and labor.

For under \$13,000.00, the TBC<sup>32</sup> is thousands of dollars less than the latest models from Ampex and Sony. Models that offer less performance and fewer features.

FORTEL's POWER OF INNOVATION sets new performance standards for 1" Type "C", 3/4" and 1/2" heterodyne TBCs, while reducing size, weight, power consumption, and best of all, price. Call or write FORTEL today for more information or a demonstration of the TBC<sup>32</sup> — the TBC that skipped a generation.

™TBC<sup>32</sup> Time Base Corrector, DYNA-TRAC and Phase Comp II are trademarks of FORTEL Incorporated

**FORTEL Incorporated**  
2985 Gateway Drive  
Norcross, Georgia 30071  
404-447-4422



Circle (218) on Reply Card



# HANDS-FREE ENG/IFB/TELEPHONE

- Operates From Any Modular Telephone Jack.
- Single or 2-Line Models.
- Tone or Pulse Dialing.
- 1 Ounce Headphone/Mic.

Exclusive features for ENG/IFB use include a mic mute switch, control for adjusting incoming volume, 3 mic inputs, 3 headphone outputs, ringer circuit for alerting user to incoming calls.

A 1 ounce headphone/mic (with or without headband) is available for "hands-free" telephone operation. Full size circumaural headphones with noise cancelling mics are also available for use in high ambients. Telephone is small, approx. 2" x 4" x 1" and has a clip for attaching to user's belt. Tone or pulse dialing. Single or switchable 2-line models available. Request bulletin 2Y.



Try It At NAB Booth 1111

## R-COLUMBIA PRODUCTS

2008 St.. Johns Ave., Highland Park, IL. 60035-2499 • (312) 432-7915 TWX: 910-692-2160

Circle (246) on Reply Card

## PATCHPRINTS



Custom Patch Bay Designation Strips and Film Inserts For Rear-Illuminated Button Switches.

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Booth No. 1773

Call or write for  
FREE sample and information

THE PATCH BAY DESIGNATION COMPANY

Div. of Glendale Rubber Stamp & Printing Co., Inc.

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Circle (247) on Reply Card

## RELIABLE ROTARY ATTENUATORS



- PREMIUM MATERIALS
- QUALITY WORKMANSHIP
- PROVEN PERFORMANCE
- MANY STYLES
- ALL IMPEDANCES

SHALLCO, INC.  
P. O. BOX 1089  
SMITHFIELD, N. C. 27577  
919/934-3135

Circle (248) on Reply Card

Videotek, continued channels.

- VIS-1200: 12x1 routing switcher.
- System 8: 8-inch professional color monitor, waveform monitor and 6x1 switcher package.
- Modular precision video DAs.

Product line

Color video monitors, receiver/monitors, waveform monitors; vectorscopes, distribution amps, audio monitors, routing switchers, TV demodulators.

Circle (933)

See ad page 153

**VideoStar Connections**

(1122)

Introductions

- Satellite transmission services.
- Demonstration: satellite uplink.

Circle (934)

**Viking Cases**

(1731)

Introductions

- Super Vikilite: equipment containers.

Product line

Equipment transport and carrying cases.

Circle (935)

**Vital Industries**

(1212)

Introductions

- SAM: station automation manager.

Product line

Video switchers, effects systems, TV automation.

Circle (936)

See ad page 273

**WSI**

(1104)

Introductions

- WSISAT: 31-level high resolution clouds-only satellite imagery.
- FAXbrief: National Weather Service difax maps on standard, portable dot-matrix computer terminal/printer.

Product line

Satellite-source weather data displays, information services.

Circle (937)

**Ward-Beck Systems**

(1224)

Introductions

- ST-Series: TV production console with stereo submaster, master and auxiliary mix buses, standard 24-input and 36-input frame sizes.

Product line

Audio consoles, intercom systems, VU-PPM meters.

Circle (938)

See back cover

**Weather Bank**

(223)

Introductions

- WeatherCheck: satellite-delivered weather information system.
- WeatherBrief: Telco-delivered weather information system.

Circle (939)

**Wheatstone Broadcast Group**

(121)

Introductions

- TV-80: production console for eight to 48 inputs, discrete and VCA subgroups, remote editor control, four sends, routing and control for SAP formats.
- DA-80/160: audio DAs in 1x8, 1x16 or two 1x8 formats, front panel controls and test facilities.

Product line

Audio consoles, audio compressor/limiter processors, graphic equalizers.

Circle (940)





Complete News Van Systems



Portable ENG Microwave Gear



Proven Autotrackers, Steerables,  
& fixed Video Links



The Industry's Best Helicopter  
Systems



**NEWS  
BREAKING  
AHEAD**

**BMS specializes in microwave products made specifically for the television industry.**

**The innovative technology behind this product line offers a fresh approach to giving your station the competitive edge.**

**Unlike other microwave companies, our complete line is designed, built, and integrated all under one roof.**

**BMS manufactures complete microwave systems for news trucks and cars, as well as the widest variety of fixed links and ultra portable video transmitters, receivers, and antennas for all applications.**

**Our helicopter transmit and relay systems set industry standards. BMS field proven autotracking and steerable antennas provide reliable ENG remotes.**

**BMS is all you need to know for your microwave needs.**

7322 Convoy Ct.  
San Diego, CA 92111  
ph. (619) 560-8601  
TWX 9103351662

**BMS**  
www.bms.com

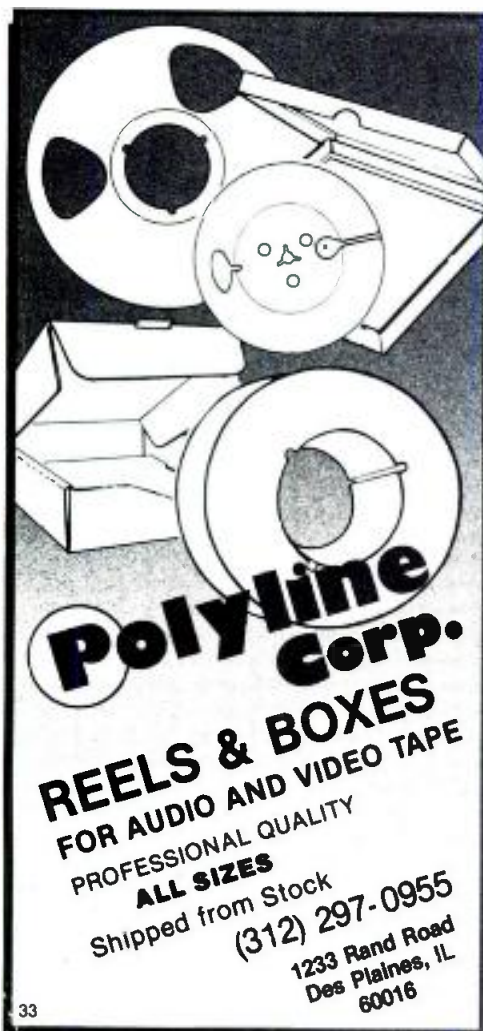
**Broadcast  
Microwave  
Services, Inc.**

**NAB Booth #1749**

Circle (220) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)





**Polyline Corp.**  
**REELS & BOXES**  
 FOR AUDIO AND VIDEO TAPE  
 PROFESSIONAL QUALITY  
**ALL SIZES**  
 Shipped from Stock  
 (312) 297-0955  
 1233 Rand Road  
 Des Plaines, IL  
 60016

33

Circle (221) on Reply Card

**White Instruments (1318C)**  
 Introductions \_\_\_\_\_  
 • 4500: active  $\frac{1}{3}$ -octave graphic equalizer.  
 Product line \_\_\_\_\_  
 Active, passive graphic EQ, audio  
 analyzers, cross-over networks, audio  
 filters.  
 Circle (941) **See ad page 309**

**Winsted (1238)**  
 Introductions \_\_\_\_\_  
 • Mobile rollup cart: A/V equipment  
 cart for small audio mixers, turn-  
 tables, tape decks, extra VTRs.  
 • Betacam/Betacart: tape truck for pro-  
 gramming setup, tape transport,  
 portable storage.  
 • Sloping consoles: 19 $\frac{1}{4}$ -inch rack based,  
 for  $\frac{1}{2}$ -inch editing setup.  
 • Consoles: paint box, electronic news-  
 room and editing styles.  
 Product line \_\_\_\_\_  
 Racks, consoles for editing systems,  
 tape, film storage systems, tape trucks,  
 equipment cabinets.  
 Circle (942) **See ad page 220**

**Wireworks**  
 Introductions \_\_\_\_\_  
 • MMB Series: microphone multicable  
 miniboxes; smaller-than-usual safe  
 boxes for on-camera use.  
 • TE-3: microphone cable tester.  
 • MYJ/MYC: prism component; units that  
 allow different channel sizes to be  
 integrated into one system.  
 • MSJ/MSC: Multipin input microphone

splitter.  
 Product line \_\_\_\_\_  
 Audio cables, connectors, interface  
 devices.  
 Circle (943)

**Wold Communications (1515)**  
 (Satellite Division)  
 Product line \_\_\_\_\_  
 Satellite communications up-/down-  
 linking services.  
 Circle (944) **See ad page 292**

**Wolf Coach (1317)**  
 Introductions \_\_\_\_\_  
 • Satellite news gathering services.  
 Product line \_\_\_\_\_  
 Mobile production vehicles.  
 Circle (945)

**Frank Woolley & Company (1405C)**  
 Product line \_\_\_\_\_  
 Video animation using polarized light.  
 Circle (946)

**World Tower (519)**  
 Product line \_\_\_\_\_  
 Tower and tower services.  
 Circle (947)

**Yamaha (1340)**  
 Product line \_\_\_\_\_  
 Audio consoles, amplifiers, audio  
 delay and reverb systems, speakers,  
 enclosures.  
 Circle (948) **See ad pages 247-248**

# SCULLY - The Originator of the DELTA Revolution.



See Us at NAB Booth 305

ITC would like you to believe they first conceived the modular tri-deck cart machine, but really it was part of the Scully 8300 way back in 1981.

Now that AMPRO/Scully is a Television Technology Company you can have the ORIGINAL revolutionary design. What else would you expect of Scully.

## The Scully 8300 offers:

- Three independently removable decks
- Crystal referenced DC Servo Motor
- Non-magnetic stainless steel capstan shaft
- Even MORE affordable



AMPRO/Scully Division

Circle (222) on Reply Card

2360 Industrial Lane  
 Broomfield, Colorado 80020  
 (303) 465-4141  
 TWX: 910-938-0396



# An editing control system that's as creative as you are. At Camera Mart.



**Convergence ECS-200 Series Video Editing Control System**

From the Convergence Corporation comes the ECS-200 Series Video Editing Control System, which facilitates visual editing to a degree that we at Camera Mart have wanted to offer you for a long time.

The heart of the "user-friendly" ECS-200 is the joystick which enables the editor to move a "piece" of reality slower or faster in time.

To make things even easier, one or two keystrokes control most functions.

The ECS-200 Series accurately stores away your every creative decision and lists in frame accurate time code all your visual ins and outs, duration of transitions, and identities of all your source material.

The three ECS-200 Series models will store from 50 to 850 lines of edit material in their internal memory. An expanded "409" feature will clean overlaps only, inserts only, or both. It will join match frame edits, and group video edits recording to audio channel for quicker, one-pass auto-assembly.

It's new, and, as you'd expect, it's available right now from Camera Mart.

**The more you know about video, the more you can  
rely on Camera Mart.**

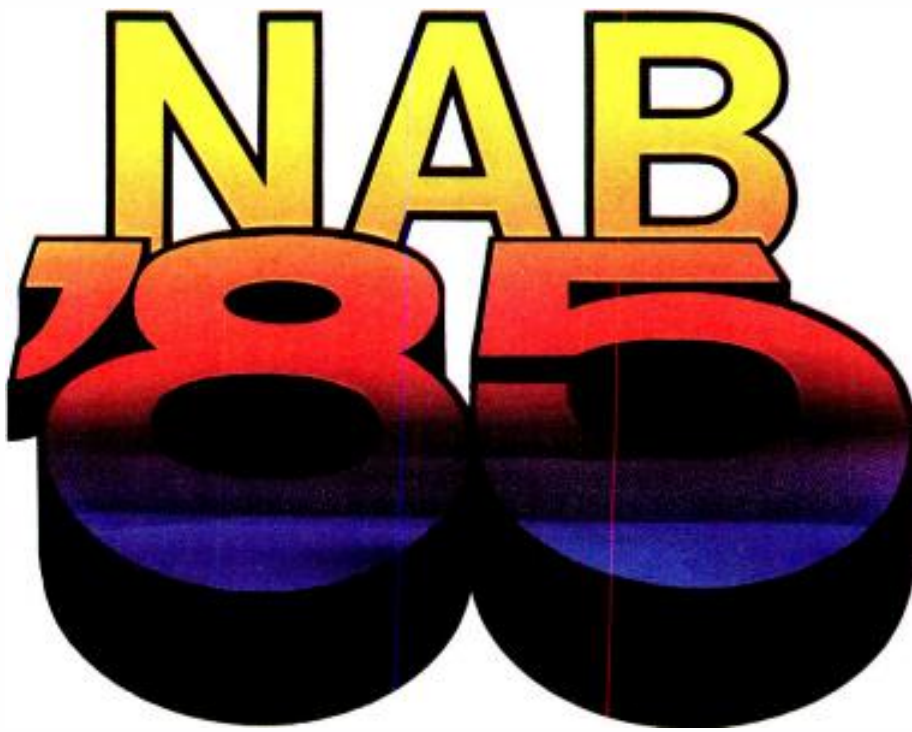
**The Camera Mart, Inc.**

456 West 55th Street, New York 10019 • (212) 757-6977/Telex: 1-2078  
304 First St., Liverpool, NY 13088 • (315) 457-3703

**Sales • Service • Rental**  
Circle (223) on Reply Card

**See Us at NAB Booth No. 1018**





This directory for exhibitor products at NAB '85/Las Vegas groups the companies producing equipment in 110 categories. This should help if you are looking for a specific piece of equipment. Each exhibitor's booth number is also listed to help you in locating it on the convention floor.

Because of the last-minute changes, there may be some discrepancies in the booth numbers. Be sure to check your NAB program for an update.

# Product directory

## ACOUSTIC MATERIAL

Alpha Audio (210)  
Broadcast Supply West (112A)  
Centro (1101)  
Industrial Acoustics (322)

## AMPLIFIER

### (Audio)

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AF Associates (1611)  
AMEK Systems (1620)  
Amtel (1745)  
Aphex Audio (513)  
Arrakis Systems (1421)  
Audio Broadcast Group (637A)  
Audio Engineering Associates (174)  
Audio + Design/Calrec (2115)  
ATI/Audio Technologies (420)  
Auditronics (505)  
BGW (421)  
Broadcast Audio (319)  
Broadcast Supply West (112A)  
BSM (637)  
Bryston Ltd. (517)  
Central Dynamics (1409)  
Channelmatic (328)  
Connectronics (608)  
Crown International (428)  
dbx (107A)  
Datatek (1428)  
Datatronix (1504)  
Di-Tech (1221)  
Dolby Labs (1311)  
Dynair Electronics (1404)  
Electro-Voice (1159)  
Evertz Microsystems (1745)  
Hallikainen (208)  
Howe Audio (321)  
ICM Video (1766)  
JBL/UREI (615)  
LPB (405)  
Leitch (1021)  
Lenco (1419)  
Logitek (613)  
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McMartin (701)  
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Ramko (415)  
Russco (413)  
Sescom (1616)  
Shure Brothers (1401A)  
Sigma Electronics (1333)  
Solway/ANT Telecommunications (2351)  
Straight Wire (408)  
Studer Revox (201)  
Symetrix (616)  
Tascam (1304)  
Telemet (1202)  
Thomson-CSF Broadcast (1001)  
URSA Major (512)  
United Research (604)  
Valley People (318)  
Ward-Beck (1224)  
Wheatstone (121)  
Yamaha (1340)

## AMPLIFIER

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Belar (203)  
Comark (1217)  
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Marti (501)  
Nurad (1426)  
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## AMPLIFIER,

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Central Dynamics (1409)  
Channelmatic (328)  
Colorado Video (1222)  
Corporate Comm. Consultants (1161)  
Datatek (1428)  
Di-Tech (1221)  
Digivision (1620A)

Dynair (1404)  
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Graham-Patten (1227A)  
Grass Valley Group (1207)  
Grumman Corp. (1631B)  
HEDCO (1225)  
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ICM Video (1766)  
Intergroup Video/ISI (1232)  
Knox Video (1511)  
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Sigma Electronics (1333)  
Sony (1200)  
Telemet (1202)  
Thomson-CSF Broadcast (1001)  
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Colorgraphics Weather (1114)  
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Interand (1016)  
Kavouras (1635)  
Lyon Lamb (1632A)  
MCI/Quantel (1631)  
Norpak (2236)  
Philips TV (1500A, 707)





## HOW WE BECAME THE FRONTRUNNER IN THE ROUTING SWITCHER BUSINESS.

While everyone else was making minor refinements, we went back to the drawing boards. We took the best that modern hybrid technology had to offer and designed it into our Series H Switching Systems.

The result is a new state-of-the-art in every respect. We offer the best performance specs available. Reliability is unquestioned. Maintenance is reduced.

And expansion is easier than ever.

There's a 300% increase in crosspoints-per-rack-unit. So what used to fill an entire room can now fit inside a closet.

And The Series H is available in the configuration you need to make the system practical.

Best of all, we can offer these advantages at a price that's actually

less than the price of conventional switching systems.

If you'd like us to prove how far out in front we are, call us toll-free at 1-800-328-1684. In Minnesota, call toll-free 1-800-792-1072. Outside the continental U.S., call International Operations collect at 1-612-736-2549.

We'll give you the best run for your money.

Professional Audio/Video Equipment

3M hears you...

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**3M**



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## Mica Capacitors

**LARGE STOCK**



## VACUUM CAPACITORS

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**SURCOM ASSOCIATES, INC.**

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Oceanside, California 92054  
(619) 722-6162

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Animation, continued  
Quanta (1432, 1216A)  
Warren R. Smith (1106)  
Symtec (1522)  
3M/Company/Broadcast (1002)  
Thomson-CSF Broadcast (1001)  
WSI (1104)  
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### ANTENNA SYSTEMS

Andrew (1201A)  
Bogner (1319)  
Bradley Broadcasting (186)  
Celwave RF (202)  
Cetec Antenna (509)  
Comark (1217)  
Dielectric (455)  
Elcom-Bauer (412)  
Electronic Research (105A)  
GEC McMichael (1514)  
Global Systems (1123A)  
Gorman-Redlich (506)  
Harris Broadcast (401)  
Info Transmission Systems (1734A)  
Larcen (1625A)  
LeBlanc & Dick (1149)  
M/A-COM Video (1004)  
Marti (501)  
Micro Comm (1014A)  
Microdyne (1612)  
Moseley Associates (301)  
Nurad (1426)  
RCA (1000)  
ROHN (103)  
Rockwell Int'l (1767)  
Scientific Atlanta (1017A)

Shively Labs (623)  
Tennaplex (1127)  
Vectortech (440)

### ATTENUATORS

ADM Technologies (1223)  
Bird Electronic (1625)  
Electro Impulse (117)  
Electro-Voice (1159)  
HEDCO (1225)  
Omicron (1748)  
Penny & Giles (436)  
Sescom (1616)  
Shure Brothers (1401A)  
United Research (604)  
Valley People (318)

### AUDIO BANDWIDTH EXTENDERS

Comrex (400)  
Kahn Communications (625)  
Marcom (306)  
McCurdy Radio (207)  
Valley People (318)

### AUDIO PROCESSORS (Compressor, Limiter, Equalizer, Effects)

AMEK Consoles (1620)  
ANT Telecommunications/Solway (2351)  
ATI/Audio Technologies (420)  
Advanced Music Systems (1330)  
Aphex Audio (513)  
Audio + Design/Calrec (2115)  
CRL Audio (300)  
Connectronics (608)  
Continental Electronics (101)



# Timing is Everything in Life...

And, it's no different with technology. The Model 610 Dual Compressor/Expander is engineered to fulfill today's production demands by delivering the desired end result time after time.

Consider the 610's interactive Expanded Compression mode. With this method of operation, the audio signal may be compressed to reduce dynamic range, and the expander may be used to reduce the residual noise which would otherwise be "pumped up" or accentuated by the compression process in the presence of low-level passages or pauses.

Only the symmetrical release coupling circuitry employed in the Model 610 can deliver a truly imperceptible transi-

tion between compression and expansion. Devices using less sophisticated circuitry introduce "turn-on" noise at the end of the compression process or allow noise level to recover before downward expansion takes place to cancel it. Unfortunately, instead of solving a problem these devices introduce a new one.

You'll find that all operational modes of the Model 610 deliver unsurpassed, problem-solving performance. And, operation of the unit is simple and intuitive, so that you get immediate results!

Isn't it time that you own a 610?



## VALLEY PEOPLE, INC.

P.O. Box 40306/2817 Erica Place  
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Circle (225) on Reply Card



*IRIS II media compatibility*

*Two simultaneous users  
with dual channel capability*

*Search-by-description and  
electronic list building  
with one button recall*



*Interface with  
Control Data Corporation's  
disk drives*

*Broadcast quality  
signal processing*

*Wipes and dissolves via  
keyboard or Mini-Controller*

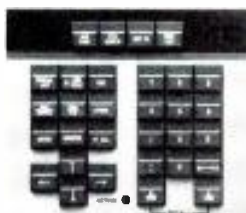
## Who just introduced a new, compact, high quality Still Store for under \$50K?

If you can't quite justify (or haven't the space for) Harris' industry-standard IRIS II, but you need multiple user capability, optional graphics, media storage expandability, and broadcast quality stills, the new IRIS C is for you.

The IRIS C will also process non-synchronous video inputs, give you RGB inputs/outputs, and time base correct, all in a package smaller than a 1 inch VTR.

So for more information, contact:

**Harris Studio Division,  
Harris Video Systems Operation,  
1255 East Arques Avenue, Sunnyvale, CA 94086  
(408) 737-2100 TELEX 4992172**



*"Soft Keys" on the Mini-Controller  
allow full IRIS operation from  
a 5"x6" keypad.*



*For great effects add the IRIS Composition System.*

## For your information, our name is Harris.

© Harris Corporation, 1984



# HARRIS

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[www.americanradiohistory.com](http://www.americanradiohistory.com)



# CAMERA & PAN-TILT CONTROL SYSTEM

Control Systems available for different ENG, EFP and RECAM cameras.



**CAMERA ADAPTER**

Triax or Component (YIQ) wireless transmission systems available.

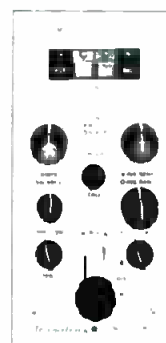


**PAN & TILT**

- Powered and controlled through same camera control Triax Cable
- 360 degree continuous rotation
- Variable speed control of Pan-Tilt & lens zoom and focus
- Human engineered joystick or computer control pre-set panel



**BASESTATION**



**RCP**

- One piece camera adapter no Hip-pack required
- 5 1/4" high, 1/2 rack Basestation
- Remote Camera Control Panel
- Remote Pan-Tilt Panel
- NTSC Video • VF Video • Chroma Key
- Genlock • Audio • Interphone • Cue
- Operating & registration controls
- Camera 12 volt power
- Convenience power for 7" viewfinder

We specialize in the design and production of camera control systems for broadcast television cameras. We design and manufacture to OEM specifications and other specific customer requirements.

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For full details write or call:

**Telemetrics Inc.**

See Us at NAB Booth 2227

• 300 ROUTE 17 NORTH • UPPER SADDLE RIVER, N.J. 07458 • TEL. (201) 825-3386

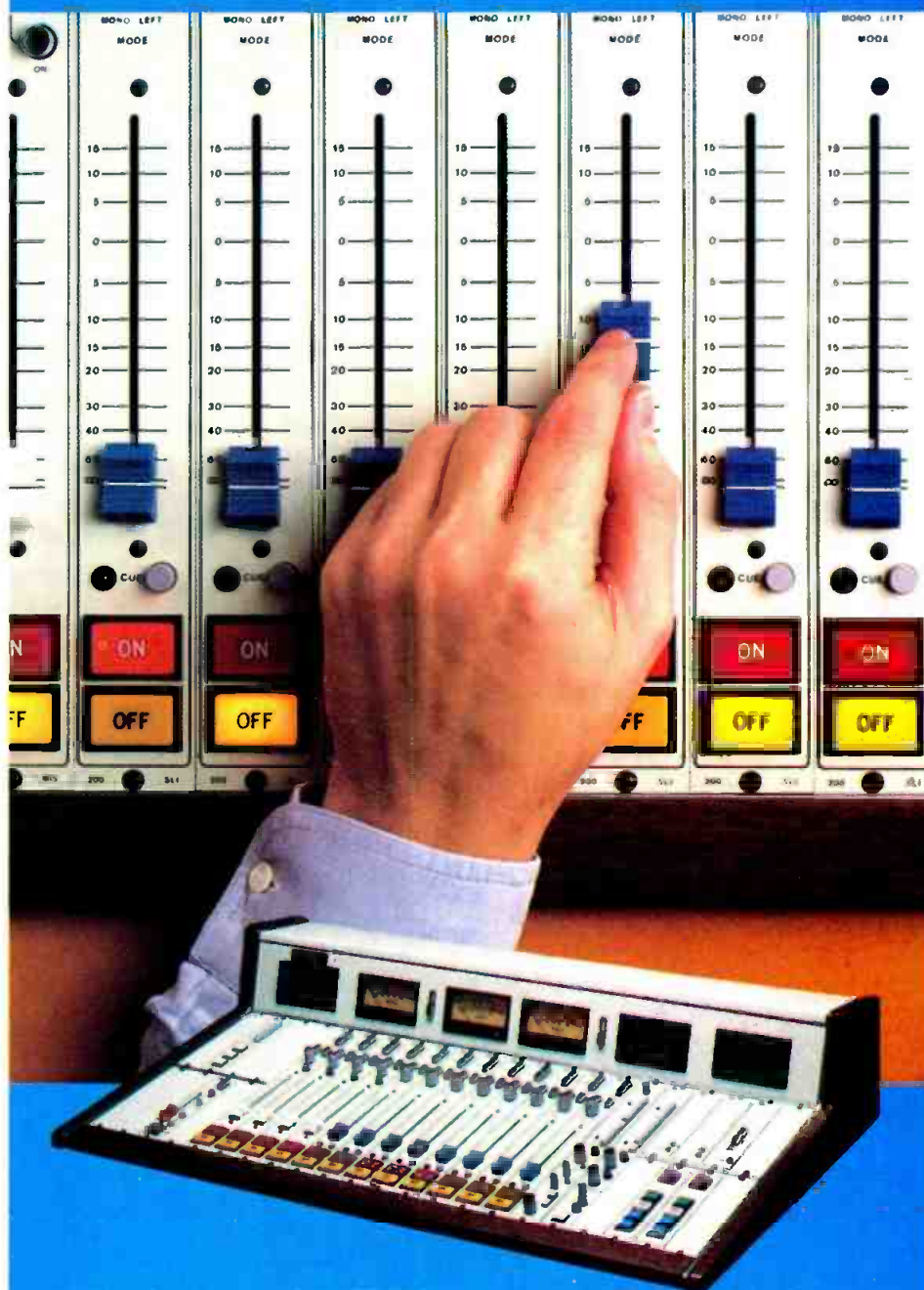


dbx (107A)  
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 Solid State Logic (1723)  
 Symetrix (616)  
 Tascam (1304)  
 URSA Major (512)  
 Valley People (318)  
 Wheatstone (121)  
 White Instruments (1318C)  
 Yamaha (1340)

#### AUDIO MIXING CONSOLES

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 AF Associates (1611)  
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 Audio+ Design/Calrec (2115)  
 Auditronics (505)  
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 Broadcast Electronics (303)  
 Comprehensive Video (1145)  
 Comrex (400)  
 Connectronics (608)  
 Continental Electronics (101)  
 Datatronix (1504)  
 Digital Entertainment (1600)  
 Electro-Voice (1159)  
 Fostex (1765)  
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 Shure Brothers (1401A)  
 Solid State Logic (1723)  
 Sony Pro Audio (605, 1200)  
 Soundcraft (219)  
 Studer Revox (201)  
 Tascam (1304)  
 TTC/Wilkinson (305)  
 Trident USA (633)

# Moment of truth



## You're on-air. Will your console, the heart of your control system, perform flawlessly?

Your air time is too valuable not to be sure. If it's an Auditronics, you can rest easy.

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### Audio mixing, continued

Valley People (318)

Ward-Beck (1224)

Wheatstone (121)

Yamaha (1340)

### AUTOMATION

(Newsroom systems)

Basys (1129)

Compu-prompt (1728)

Data Communications (609, 1014)

Jefferson Data (1629)

Listec TV Eqpt (1406)

Quanta (1432)

### AUTOMATION

(Radio station)

Autogram (120)

Barrett Associates (107)

Broadcast Electronics (303)

Computer Concepts (404)

Custom Business Systems (317)

Data Communications (609, 1014)

Ficon Cromwell (202A)

Generic Computer (308)

Harris Broadcast (401)

IGM Communications (403)

Jefferson Data (1629)

Management, The (627)

Otari (601)

H. A. Solutek (1517)

Sono-Mag (139)

### AUTOMATION

(Station business)

Alamar (1507B)

Channelmatic (328)

Computer Concepts (404)

Custom Business Systems (317)

Data Communications (609, 1014)

Ficon/Broadcast (202A)

Generic Computer Systems (308)

Hungerford & Company (310)

Jefferson Data (1629)

Kaman Sciences/KBS (1607)

Management, The (627)

Microprobe (331)

Nordic Software (622)

Register Data (128)

H A Solutek (1517A)

Videomedia (1308)

### AUTOMATION

(TV station)

Alamar Electronics (1507B)

ASACA (1017)

Broadcast Systems (1500)

Central Dynamics (1409)

Data Communications (609, 1014)

Digital Services (1302)

Lake Systems (1165)

Microprobe (331)

Panasonic (1019, 1020)

Ross Video Ltd. (1110)

Solid State Logic (1723)

H A Solutek (1517A)

Sony Broadcast (1200)

Videomedia (1308)

### BATTERIES, CHARGERS, ACCESSORIES

Alexander (1714)

Anton/Bauer (1337)

Christie Electric (1607B)

Cine 60 (640)

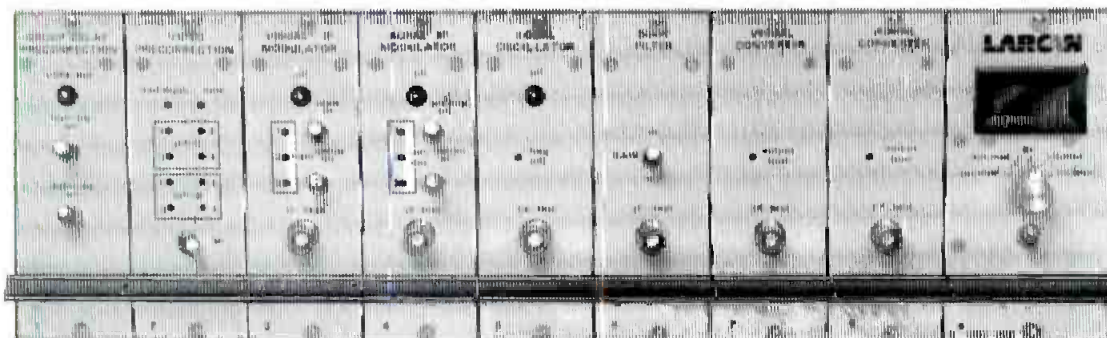
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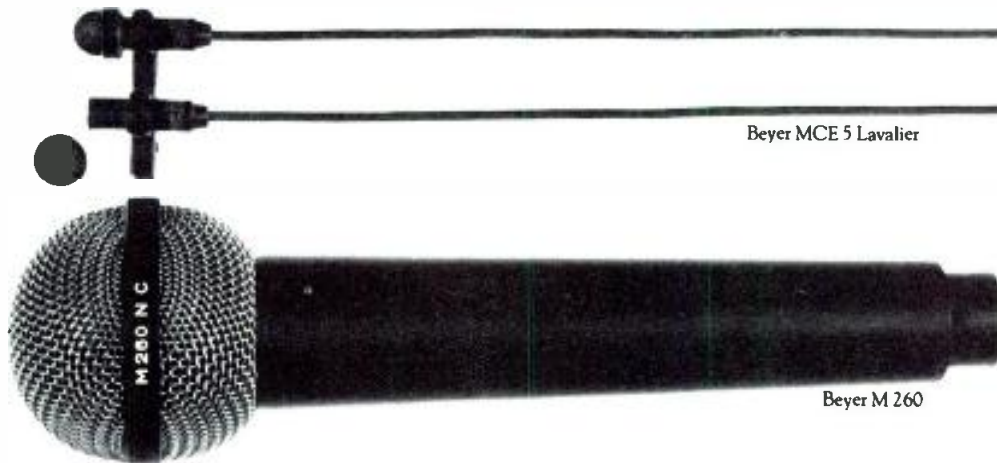
# Why Beyer mics represent a viable alternative to the usual choices in Broadcast.



Beyer MCM Condenser System



Beyer MCE 5 Lavalier



Beyer M 260

## Now there's another high-tech German condenser system.



Until recently, film and broadcast engineers thought only Sennheiser and Neumann made high-quality condenser microphone systems. Now the Beyer MCM Series offers the same German excellence in design and construction, the same kinds of accessories (windscreens, pistol grips, shock mounts) and facilities for 12V and 48V "phantom" powering.

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To optimize its compatibility with a variety of broadcast and film applications, the tiny black MCE5 is available in different configurations for powering interface and includes a system with accessories like windscreens, expansion mounts etc.

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## There's more than one way to bring out the warmth in an announcer's voice.



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The Beyer M 260 has its own custom-designed ribbon element to optimize the mic's performance based on its Broadcast applications.

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\*Extracted from competitive promotional literature or advertising.

\*Documentation supporting specific comparative claims available upon request.

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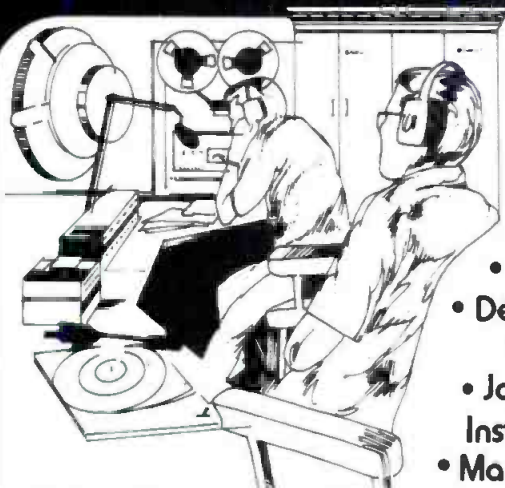
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March 1985 **Broadcast Engineering** 289



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### Batteries, continued

- Cinema Products (1301)
- Cinemills (1140)
- Coolight (1329)
- Film/Video Equipment (1153)
- Frezzolini (1107)
- G&M Power (339)
- Mitomo (1509)
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- Perrott (1729)
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### BUILDINGS, PREFABRICATED EQUIPMENT

- Allied Tower (409)
- Andrew (1201A)
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- AMCO Engineering (1218)
- Anvil Cases (1112)
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- Calzone Case (1179)
- Chemigraphic Products
- Continental Electronics (101)
- Emcor Products (429)
- Excalibur (1108)
- Fiberbilt (232)
- IGM Communications (403)
- Kangaroo Products (1151)
- Laumic (1771)
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- Nalpak (1124)
- Pacific Recorders & Engineering (113)
- Stantron (1123)
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- Listec TV Equipment (1406)
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- Quickset (1105)
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Canon USA (1012)  
Century Precision Optics (1781)  
Cinema Products (1301)  
Film/Video Equipment (1153)  
Fujinon Optical (1411)  
Karl Heitz (1737)  
Schneider (1403)  
TSM (142)  
Tamron (1316)  
Tiffen (1422)

#### **CAMERAS (TV)**

AF Associates (1611)  
Ampex (1400)  
Robert Bosch (1603)  
Cinema Products (1301)  
GEC McMichael (1514)  
Harris Broadcast (401)  
Hitachi Denshi (1402)  
Ikegami Electronics (1011, 1013)  
JVC (1234)  
NEC America/Broadcast (1415)  
Nisus Video  
Panasonic (1019)  
Philips TV (1500A, 707)  
RCA (1000)  
Sharp (1102)  
Sony (1200)  
Thomson-CSF Broadcast (1001)

#### **CAMERAS (Film, Cine)**

Arriflex (1421)  
Cinema Products (1301)

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Aurora Systems (1312)  
Chyron (1610)  
Computer Graphics (1143)  
Dubner Computer (1630)  
For-A (1306)  
Interand (1016)  
Knox Video (1151)  
Laird (1721)  
MCI/Quantel (1631)  
Mycrotek (1752)  
Piher (1409A)  
Quanta (1432)  
Shintron (1417)  
Sigma (1333)  
Symtec (1522)  
3M (1002)  
Thomson-CSF Broadcast (1001)  
Video Associates Labs (1122A)

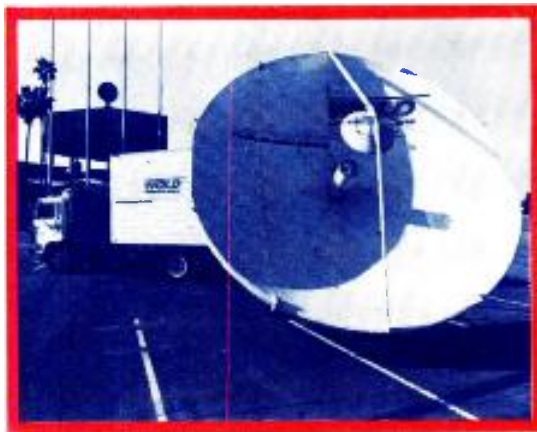
#### **COMPACT DISC PLAYERS**

Audio Broadcast Group (637A)  
ATI/Audio Technologies (420)  
Digital Entertainment (1600)  
IGM Communications (403)  
Panasonic Industrial (437)  
Philips TV (1500A, 707)  
Sony Pro Audio (605, 1200)  
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Computer Graphics Labs (1143)  
Cubicomp (235)  
Data Communications (609, 1014)  
Dubner (1628, 1630)  
Environmental Satellite Data/ESD (1509A)  
Fuji Photo Film (1413)  
Generic Computer (308)  
IBM (1607)  
Kaman Sciences (1607)  
Lyon Lamb (1632A)  
Nordic Software (622)  
Quanta (1432)  
Solid State Logic (1723)  
Sony (1200)  
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United Press (430)

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Advanced Music (1330)  
Beyer Dynamic (426)  
Eventide (323)  
Gotham Audio (509A)  
Lexicon (1139)  
Orban (607)  
Pacific Recorders &  
Engineering (113)  
Tascam (1304)

URSA Major (512)  
Yamaha (1340)

### DELAY SYSTEMS (Video)

Allen Avionics (1627)  
Broadcast Systems (1500)  
Broadcast Video Systems (1326)  
HEDCO (1225)  
Leitch (1021)  
TV Equipment Associates (1216)

### EDITING EQUIPMENT, FILM

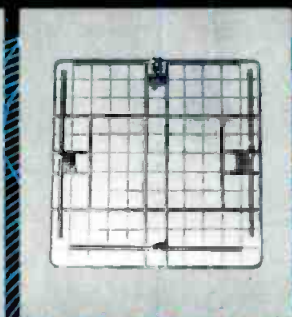
Cinema Products (1301)  
Magnasync/Moviola (1331A)  
Montage Computer (2330)  
Research Technology (1626)

### EDITING CONTROLLERS (Video)

ADDA (1100)  
Adams-Smith (1508)  
Ampex (1400)  
ASACA (1017)  
Audio Kinetics (1173)  
Robert Bosch (1603)  
CMX Systems (1639)  
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*On October 15, 1984 at KTLA's Mt. Wilson transmitter site, Ira Goldstone performed the final acceptance checks on the Modulation Sciences TV. Stereo Generator.*

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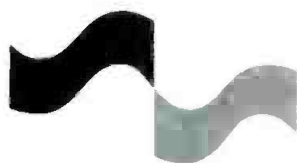


Top Left-ISLATRON protects video switchers. Center-ISLATRON protects graphic generators. Right-ISLATRON protects electronic editors. Bottom Left-ISLATRON protects videotape decks. Right-ISLATRON protects lighting control units.

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Paltex (1005)  
Panasonic (1019, 1020)  
Rank Cintel (1219)  
Sony (1200)  
TimeLine (2183)  
United Media (1300)  
Videomedia (1308)

**ENG MICROWAVE EQUIPMENT**

Broadcast Microwave Services (1749)  
Continental Microwave (171)  
GEC McMichael (1514)  
Harris Broadcast (401)  
Itelco (1338)  
M/A-COM Video (1004)  
Marti (501)  
Micro Communications (1014A)  
NEC America (1415)  
RF Technology (171)  
System Associates (1331E)

**ENCODERS/DECODERS  
(Video)**

Broadcast Video Systems (1326)  
Channematic (328)  
Colorado Video (1222)  
EEG Enterprises (1155)  
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Knox Video (1511)  
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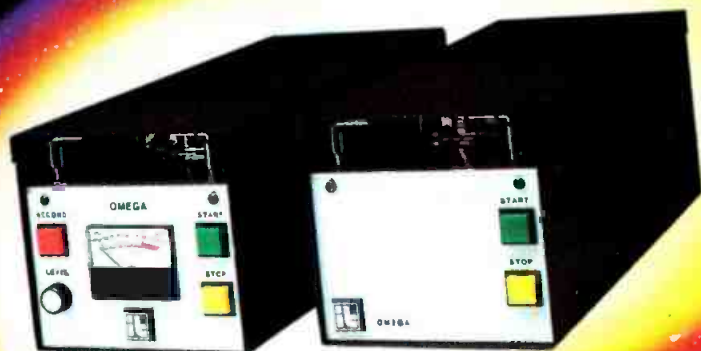
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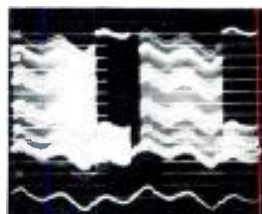
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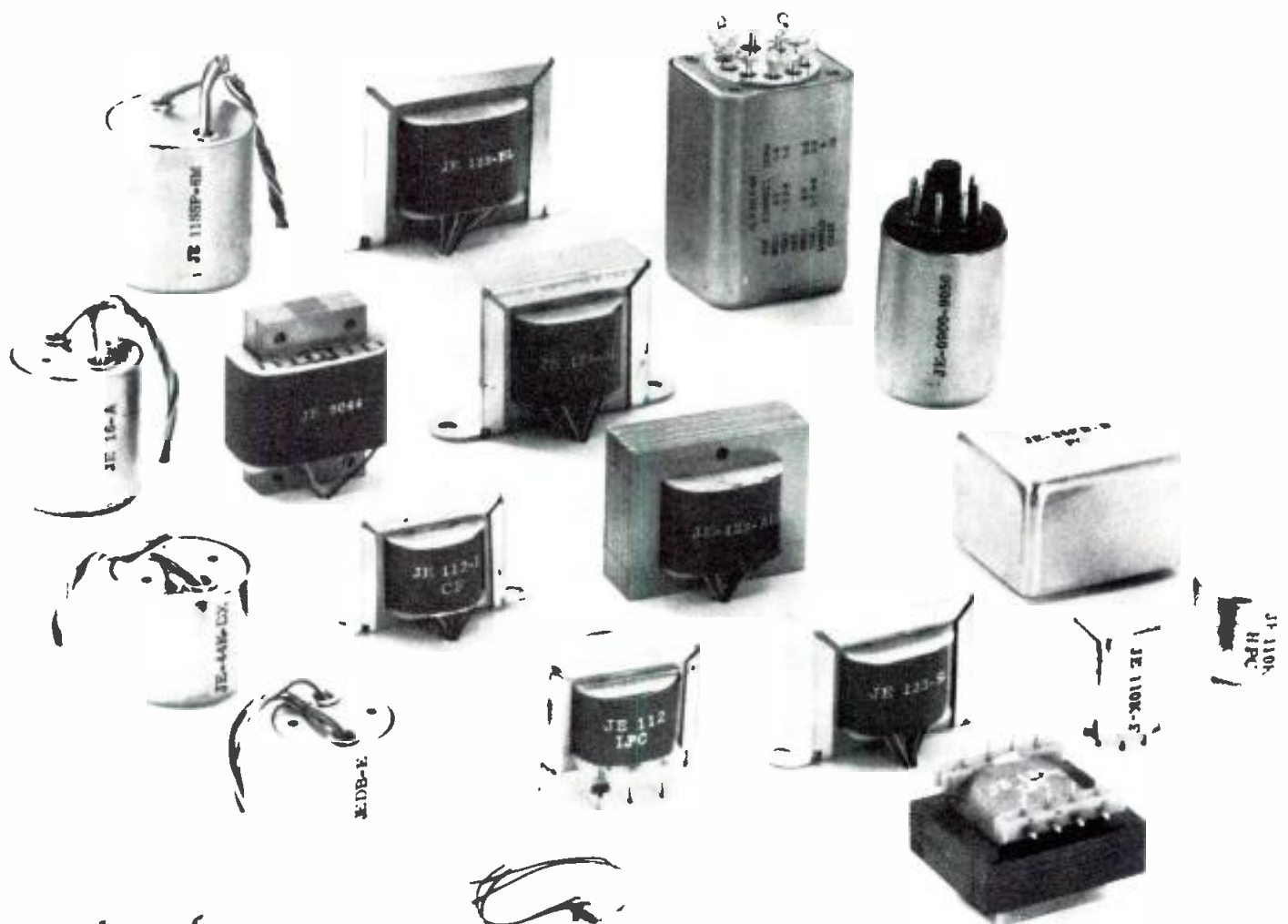
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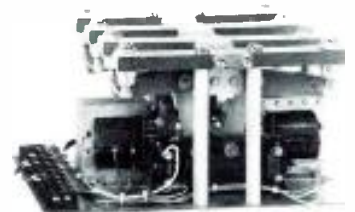
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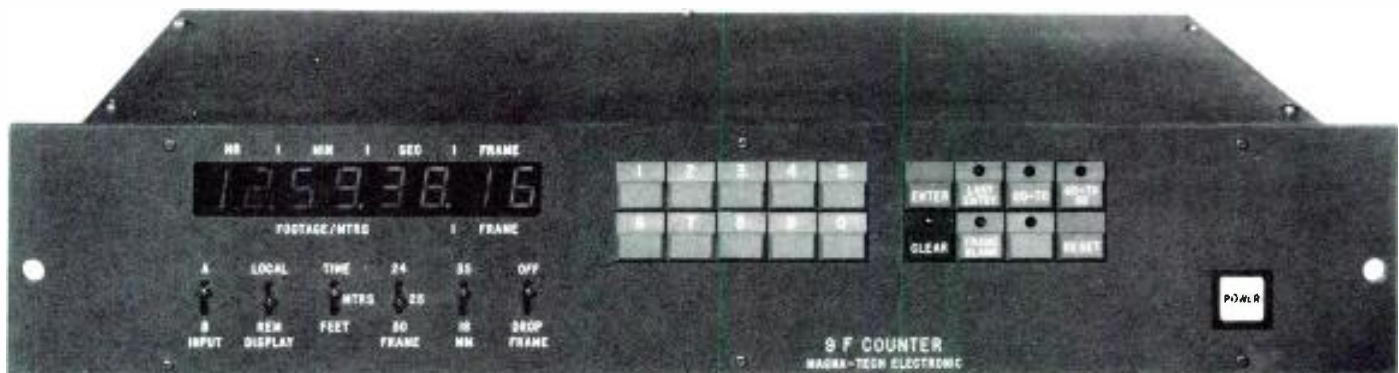
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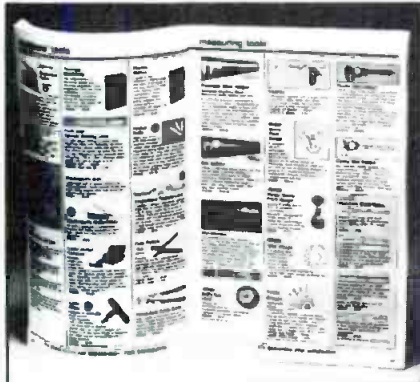
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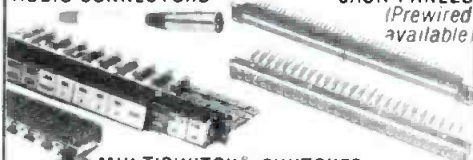
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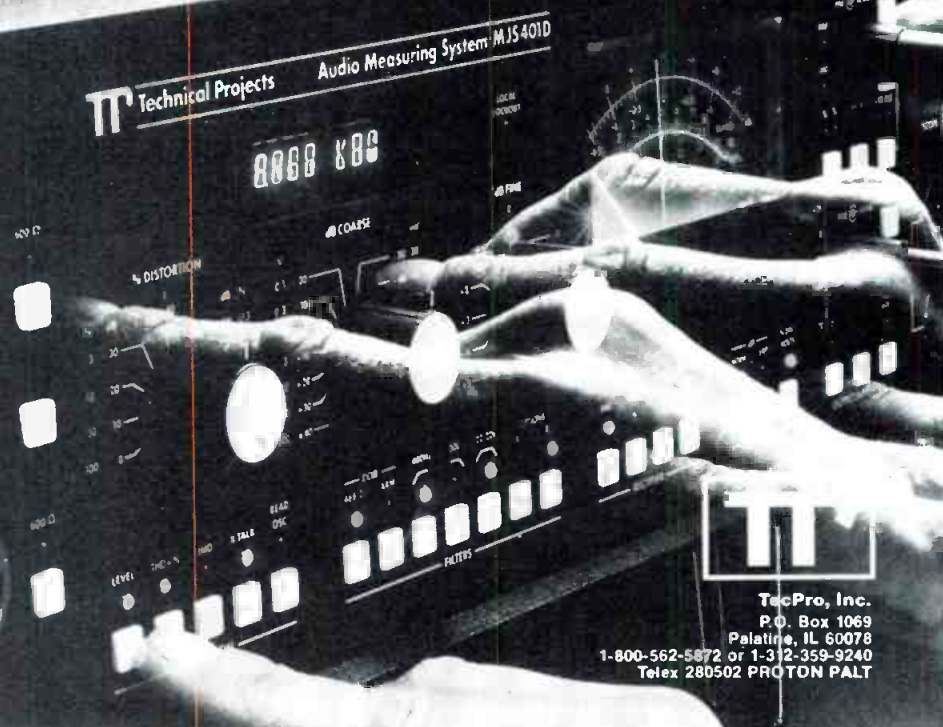
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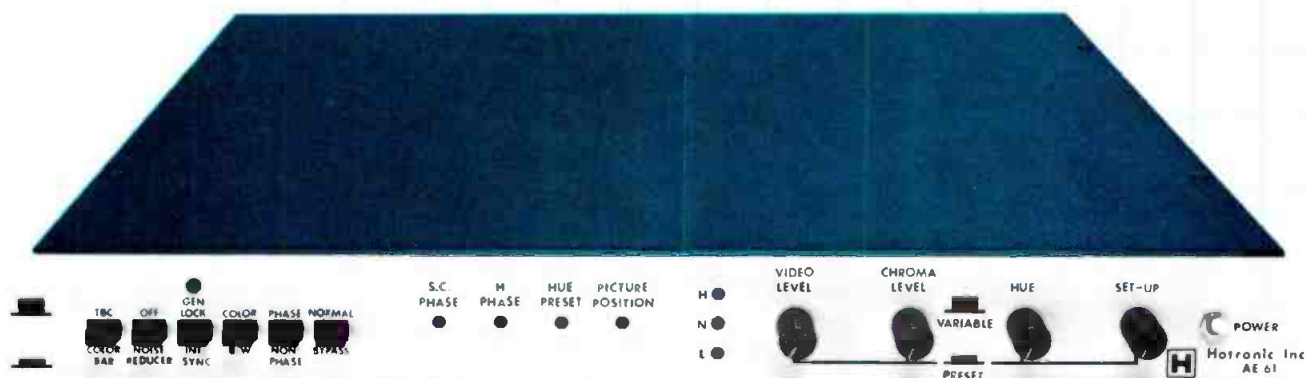
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Philips T&MI (1408A)  
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From: Dan Allen

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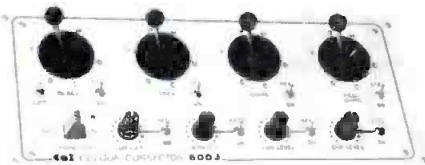
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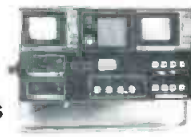


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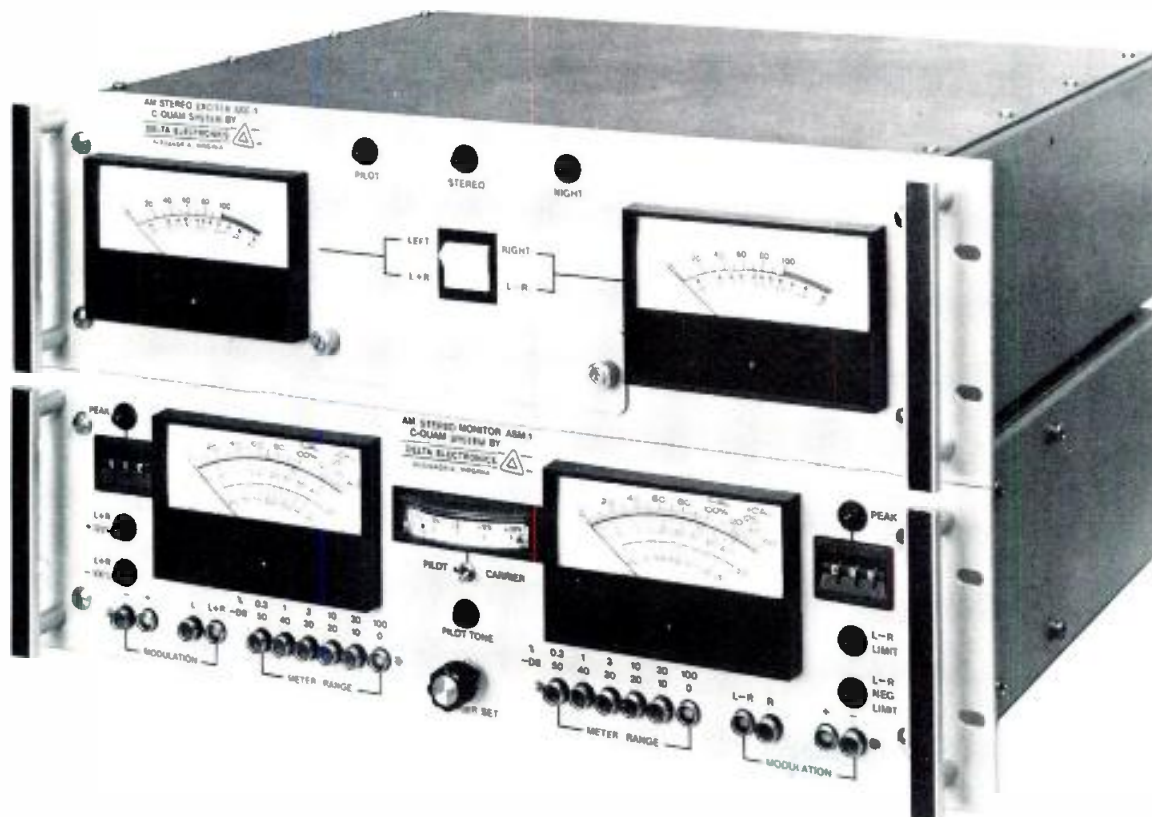


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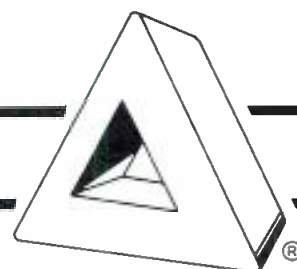
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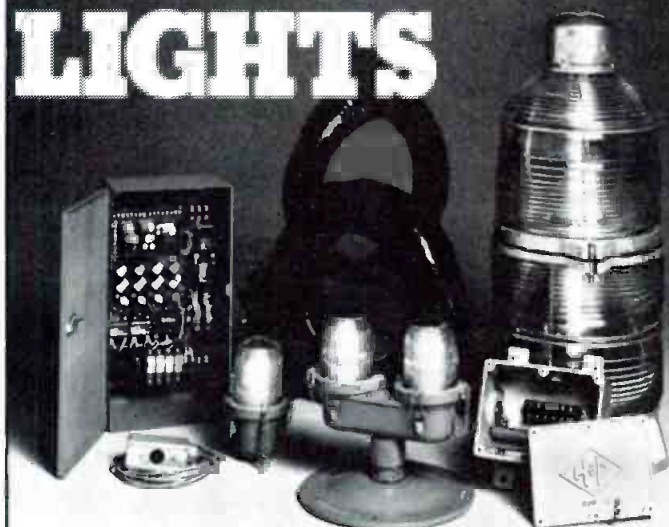
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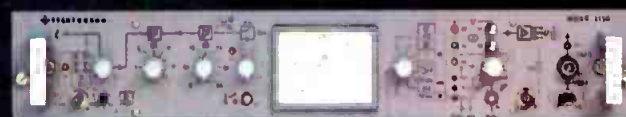
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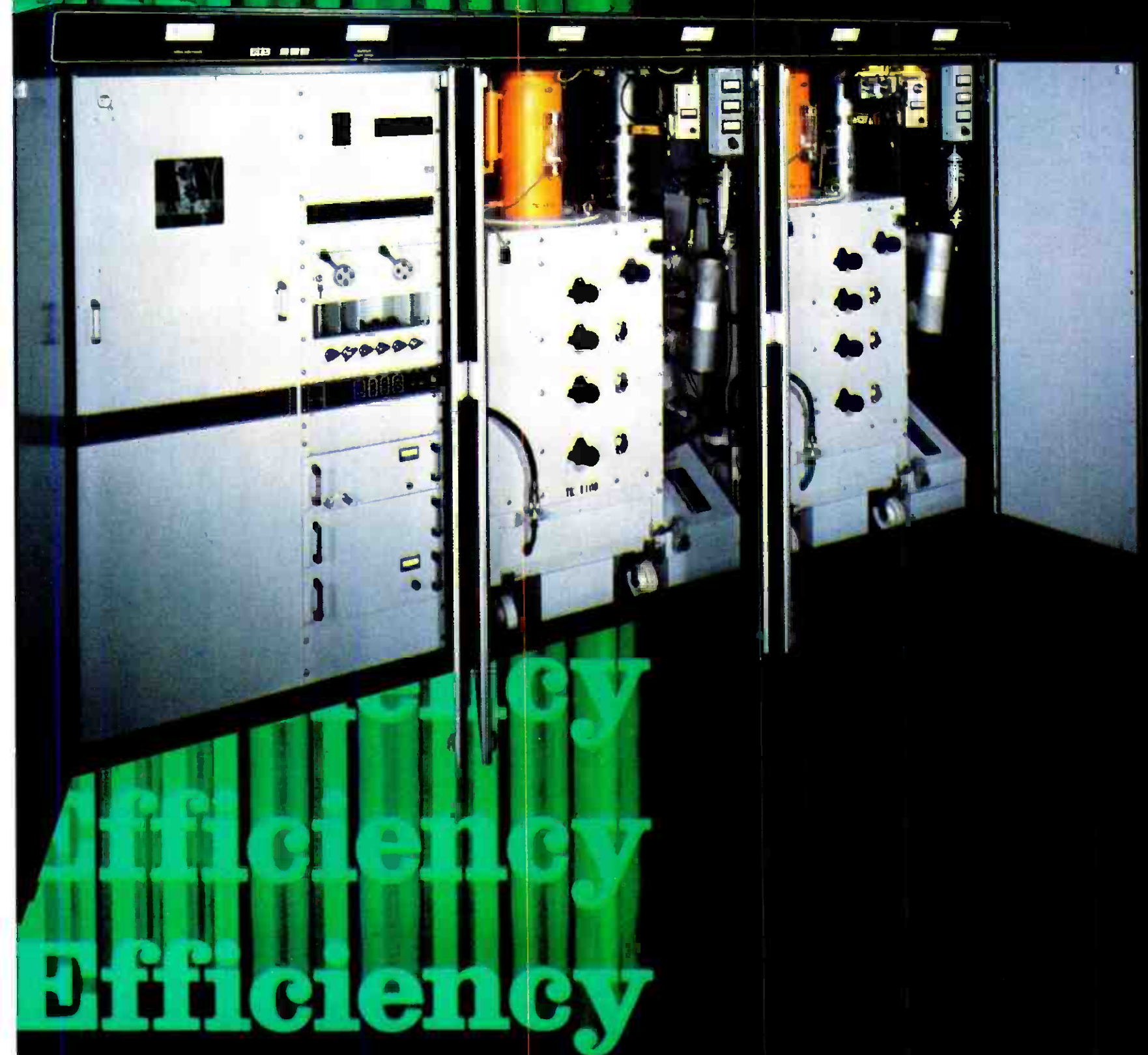
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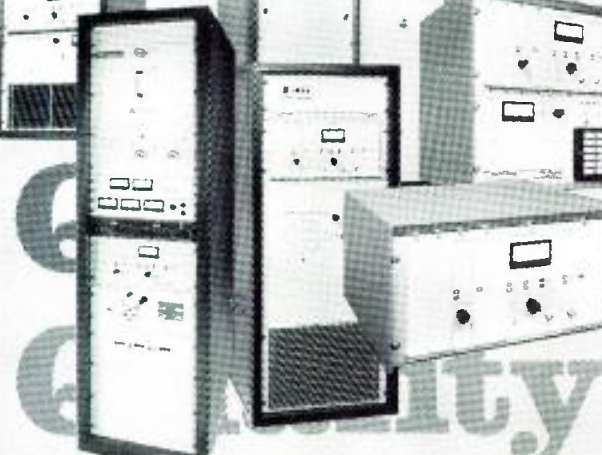
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- Hotronics (1331B)
- Leitch (1021)
- MCI/Quantel (1631)
- Merlin (1023)
- Microtime (1230)
- NEC America/Broadcast (1415)
- Nova Systems (1345)
- Scientific-Atlanta (1017A)
- Sony Broadcast (1200)
- Tektronix (1601)

### TAPE ERASERS

- CMC Technology (1425)
- Christie Electric (1607B)
- Fidelipac (411)
- Garner Industries (1233)
- Int'l Tapetronics/3M (311)
- Mitomo (1509)
- Pacific Recorders & Engineering (113)
- Taber (711)

### TAPE DUPLICATION SYSTEMS

- Accurate Sound (632)
- Inovonics (304)
- Otari (601)
- Sprague Magnetics (705)
- Tascam (1304)
- Telex (600, 1605A)

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More than 1,000 CSI AM and FM transmitters are spread throughout the world, featuring innovative design features for today's broadcaster.

CSI transmitter design is straight forward, using time-proven stable circuits and mechanical design features, assuring many years of superb performance.

CSI transmitters are designed for the broadcaster, with standardization of parts so that all are interchangeable for ease of operation; simplicity of design to control maintenance cost; and proven reliability.

You can count on CSI transmitters for many exceptional features, such as front panel circuit breakers, lighted pushbutton switches, high-low switch and local-remote switch that enables the operator to disable the remote control for safety purposes.

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Tentel (1613)  
TV Equipment (1216)

#### TAPE RECORDING (Audio)

Ampex (1400)  
Audio Broadcast Group (637A)  
Bradley Broadcasting (186)  
Broadcast Cartridge  
Service (611)  
Capitol Magnetics (206)  
Fidelipac (411)  
Fuji Photo Film USA (1413)  
Int'l. Tapetronics/3M (311)  
Maxell (1624)  
Procart (112)  
Sony Tape (1200)  
3M Magnetic (1002)  
Telex (600, 1605A)

#### TAPE RECORDING, (Video)

Ampex (1400)  
Eastman Kodak (1214)  
Fuji Photo Film (1413)  
Maxell (1624)  
Plastic Reel (170)  
Sony Tape (1200)  
Spencer Broadcast (406)  
System Associates (1331E)  
3M Magnetic (1002)

#### TELEPHONE HYBRIDS, INTERFACES

Channelmatic (328)  
Datatronix (1504)  
Gentner (636)  
Pacific Recorders &  
Engineering (113)  
R-Columbia (1111)  
Studer Revox (201)

#### TELETEXT/CAPTIONING EQUIPMENT

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EEG Enterprises (1155)  
Harris Broadcast (401)  
IBM (1607)  
Macrotel (1702)  
Norpak (2236)  
Quickscan (1405B)

#### TEST EQUIPMENT (Audio)

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Amber Electro Design (422)  
B&B Systems (1336)  
Brüel & Kjaer (511A)  
Continental Electronics (101)  
Electronic Systems Labs (406A)  
Eventide (323)  
Inovonics (304)  
Leader (1349)  
Marconi (1615)  
Potomac 100)  
ROH (1634)  
Rohde & Schwarz (1203)  
Selco/Sifam (438)  
Sennheiser (1137)  
Sound Technology (500)  
Tektronix (1601)  
Tentel (1613)  
White Instruments (1318C)

#### TEST EQUIPMENT (RF)

ASACA (1017)  
Bird Electronic (1625)  
Continental Electronics (101)  
Delta Electronics (105)  
Dielectric (455)  
Electro Impulse (117)  
Holaday (206A)  
Leader (1349)  
Marconi (1615)  
Potomac (100)  
Rohde & Schwarz (1203)  
Sound Technology (500)  
SWR (1644)  
Tektronix (1601)  
Telemet (1202)  
Varian (1605)

#### TEST EQUIPMENT (Video)

ASACA (1017)  
Broadcast Video Systems (1326)  
Eastman Kodak (1214)  
John L. Fluke (227)  
Grass Valley Group (1207)  
Leader (1349)  
Leitch (1021)  
Lenco (1419)  
Marconi (1615)  
Minolta (1113)  
Philips T&MI (1408A)  
Rohde & Schwarz (1203)  
Sigma Electronics (1333)  
Tektronix (1601)  
Telemet (1202)  
Tentel (1613)  
Thomson-CSF Broadcast (1001)  
TV Equipment Associates (1216)  
Videotek (1633)

#### TEST CHARTS, PATTERNS

Eastman Kodak (1214)

Porta-Pattern (1427)

SMPTE (1632)

#### TIME TAPES (Audio & Video)

Ampex (1400)  
Fidelipac (411)  
Sound Technology (500)  
Sprague Magnetics (705)  
Taber (711)  
Tascam (1304)

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Adams-Smith (1508)  
Amtel Systems (1745)  
Applied Digital  
Technology (1730)  
Arriflex (1421)  
Audio + Design (2115)  
B&B Systems (1336)  
Cipher Digital (1606)  
Datum (1708)  
EECO (1775)  
ESE (116, 1757)  
Evertz/Microsystems (1745)  
For-A (1306)  
Giese (327)  
Gray Engineering (1755)  
Otari (601)  
QSI (1325)  
Shintron (1417)  
Skotel (1126)  
Sony Broadcast (1200)  
System Associates (1331E)  
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Videomedia (1308)

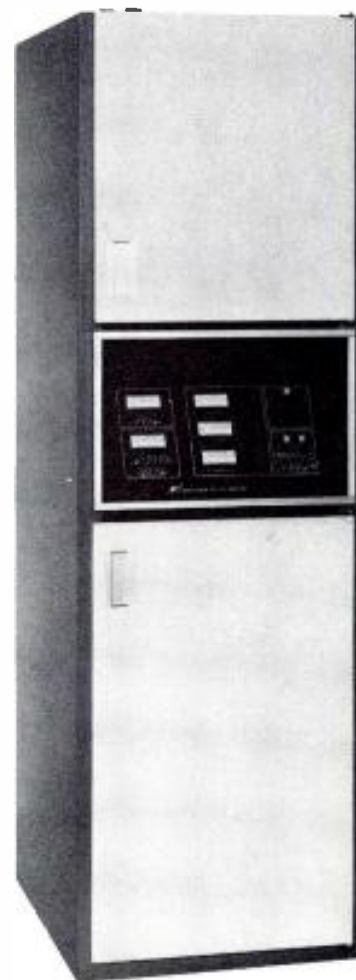
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# The Professional Cassette Decks



Tandberg's new Series TCD 900 is a superior and cost-efficient alternative to the (unprofessional) practice of using inferior home tape decks for Professional applications. These new Professional Cassette Decks offer unparalleled sound capability, advanced mechanical and electronic design, plus extraordinary control flexibility based on an 8-Bit microprocessor with 32K of EPROM memory. These are the type of quality products for which Tandberg is well known, and are designed and built in keeping with the company's more than 50-year reputation for quality, performance and long-term owner loyalty.

## **TCD 910 Master Cassette Recorder**

TCD 910 is designed to replace both reel-to-reel and cartridge machines in many applications, and is capable of producing tapes at sound and silence levels beyond that required by broadcast and studio requirements. Combined with its extremely

accurate real time counter and sophisticated autolocator functions, this machine is truly a multipurpose cassette recorder.

Features include:

- High precision, rugged 4 motor tape transport with direct load, instant access cassette positioning.
- Discrete three head system with built-in record azimuth adjustment is combined with Tandberg's proprietary Active Phase Correction Circuitry, exclusive discrete, wide band electronics, plus the highly regarded Actilinear II and Dynec systems. In addition, the latest generation Dolby B and C noise reduction processors are utilized.
- All audio circuitry uses high spec polypropylene capacitors and metal film resistors.
- Built-in autolocator with 10 cue points in real time, auto cut search and cue/review.
- Auto stop and/or rewind after cut.
- Electronically balanced XLR input/output connectors.
- Front panel bias and record

current adjustment, with built-in oscillators.

- Optional RS 232 computer interface, infrared wireless and hard wire remote with fader start.
- Wide range of options and accessories.

## **TCD 911 Cassette Playback Deck**

The TCD 911 offers the same quality of construction and design as the TCD 910. Its special features include:

- Playback pitch control.
- External playback azimuth control, for optimum performance from *any* pre-recorded cassette.

In a multi-deck studio situation, the TCD 910, combined with the TCD 911, makes for the ideal match of performance, reliability and price.

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Channelmatic (328)  
ESE (116, 1757)  
GEC McMichael (1514)  
Kinometrics/Truetime (115)  
Leitch (1021)  
Torpey Controls (465)

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Atlas Tower (443)  
EG&G (1327)  
Flash Technology (1619)  
Fort Worth Tower (1010)  
LeBlanc & Dick (1149)  
Magnum Towers (119)  
ROHN Towers (103)  
Stainless (1315)  
United Ropeworks (126)  
World Tower (519)

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Celwave RF (202)  
Chester Cable (1320A)  
Comark (1217)  
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Dielectric Communications (455)  
Electro Impulse (117)  
Global Systems (1123A)  
M/A-COM Video (1004)  
Marti (501)  
Micro Comm (1014A)  
Shively (623)  
SWR (1644)  
Vectortech (440)

## **TRANSMITTERS (AM & FM)**

ANT Telecommunications/  
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Bayly (2351)  
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CSI Electronics (507)  
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Intelco (1338)  
LPB (405)  
Larcan (1626)  
Marconi (1217)  
McMartin (701)  
Nautel Maine (216)  
NEC America (1415)  
Philips TV (1500A)  
QE1 (307)  
Radio Systems (213)  
Rohde & Schwarz (1203)  
TTC/Wilkinson (305)  
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## **TRANSMITTER, TV (UHF, VHF)**

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Comark (1217)  
EMCEE (1621)  
Global Systems (1123A)  
Harris Broadcast (401)

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Larcan (1626A)  
Marconi (1217)  
Mitomo (1509)  
NEC America (1415)  
Philips TV (1500A)  
Piher Electronics (1409A)  
RCA (1000)  
Rohde & Schwarz (1203)  
Telemet (1202)  
Thomson-CSF Broadcast (1001)  
Townsend Associates (1420)  
TTC/Wilkinson (305)

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ATI/Audio Technologies (420)  
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Broadcast Electronics (303)  
Broadcast Supply West (112A)  
Dwight Cavendish (442)  
Continental Electronics (101)  
Electro-Voice (1159)  
Pacific Recorders &  
Engineering (113)  
Panasonic/Industrial (437)  
Ramko (415)  
Russco (413)  
Shure Brothers (1401A)  
Stanton Magnetics (102)  
Straight Wire Audio (408)

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Calvert (125)  
CeCo (313)  
Motorola (309)  
RCA (1000)

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Calvert (125)  
ECD Industries (229)  
EEV (1335)  
Hitachi Denshi (1402)  
RCA (1000)

## **TUBES**

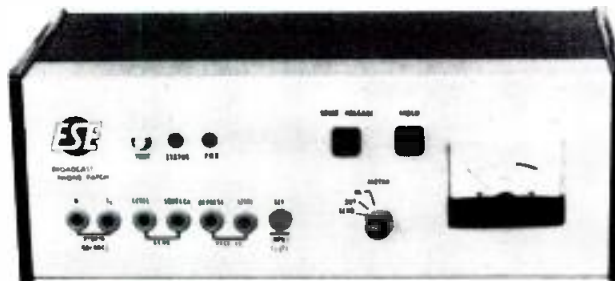
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Calvert (125)  
CeCo (313)  
Continental Electronics (101)  
ECD Industries (229)  
Econco (1759)  
EEV (1335)  
Intelco (1338)  
RCA (1000)  
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ABP Systems (1607A)  
AF Associates (1611)  
CBX (160)  
Centro (1101)  
Fiberbilt (232)  
Gerstenslager (1347)  
Gray Communications (1618A)  
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Environmental Satellite (1509A)  
Interand (1016)  
Kavouras (1635)  
R/Scan (1740)  
Thomson-CSF Broadcast (1001)  
WSI (1104)  
Weather Bank (223)

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Com-Tek (1122B)  
HM Electronics (1130)  
Marti (501)  
Micron Audio Products (1122C)  
Moseley (301)  
Nady (1133)  
R-Columbia (1111)  
RF Technology (171)  
Samson Music (324)  
Sennheiser (1137)

Sony Pro Audio (605, 1200)  
Stage Lighting (1128)  
Swintek (1503)  
Telex (600, 1605A)

### DISTRIBUTORS (RF Equipment)

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Audio Broadcast Group (637A)  
Barrett Associates (107)  
Bradley Broadcast (186)  
Broadcast Systems (1500)  
Calvert Electronics (125)  
Continental Electronics (101)  
Gray Communications (1618A)  
David Green Broadcast (417)  
Marcom (306)  
Midwest (1710)  
Samson (324)  
Shively Labs (623)  
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Taft Broadcasting (136)  
TV Engineering (1700)

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Alan Gordon (1726)  
Gray Communications (1618A)  
James Grunder (1760)  
Interand (1016)  
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Laumic (1771)  
Listec TV Equipment (1406)  
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MZB & Associates (1507A)  
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PEP (1408)  
Schneider (1403)  
Spencer Broadcast (406)  
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Calvert (125)  
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David Green Broadcast (417)  
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Landy (1747A)  
Logitek (613)  
MPCS (112)  
MZB & Associates (1507A)  
Marcom (306)  
Midwest (1710)  
Music Director (511)  
Pacific Recorders &  
Engineering (113)  
Samson Music Products (324)  
Spencer Broadcast (406)  
Straight Wire Audio (408)  
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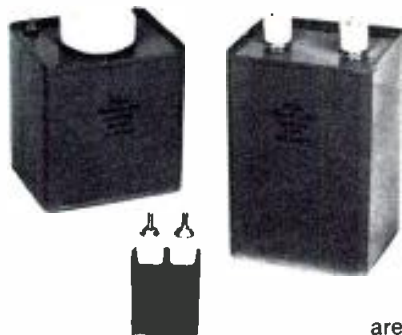
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Agfa-Gevaert Inc.	21	13	201/288-4100	Crosspoint Latch Corp.	326	294	201/688-1510
AKG Acoustics, Inc.	90		203/348-2121	CSI Electronics	314	287	813/647-1904
Alamar Electronics USA, Inc.	198	304	408/866-9573	Datatek, Inc.	267	207	201/654-8100
Alexander Mfg. Co.	192	135	515/423-8955	Delta Electronics	310	286	703/354-3350
Allen Avionics, Inc.	249	187	516/248-8080	Dielectric	294	228	800/341-9678
Alpha Audio	58	33	804/358-3852	Digital Entertainment	37	20	203/743-0000
Aluma Tower Company	294	224	305/567-3423	Digivision, Inc.	274	215	619/458-1111
Amco Engineering Co.	187	131	312/671-6670	Dolby Labs, Inc.	155	115	415/392-0300
Amperex Corp. (Klystron Div.)	271	211	800/227-1613	Dorrough Electronics	240	180	818/999-1132
Amperex Electronic Corp.	102-103	62	401/762-3800	Dubner Computer Systems	89	53	201/592-6500
Ampex Corp. (AVSD)	18,19		818/240-5000	Duncan, Victor Inc.	228	168	313/589-1900
Ampex Corp. (MTD)	59	34	415/367-3809	Durcom	308	274	203/677-6306
Anchor Audio, Inc.	308	269	213/533-5984	Dynair Electronics Inc.	183	303	619/263-7711
Andrew Corp.	193	136	312/349-3300	EEV, Inc.	115	72	914/592-6050
ANT-Nachrichtentechnik GMBH	100	60		Eagle Hill Electronics, Inc.	304	277	301/778-1667
Anvil Cases, Inc.	122	76	818/575-8614	Eastman Kodak Co.	205	144	212/930-7500
Apert Herzog	256	195,295	408/225-1425	ECD Industries International, Inc.	318	305	800/421-7152
Apex Systems Ltd.	298	250	818/765-2212	Electrex Company	290	236	305/651-5752
Aristocart Div.	196	138	604/687-2844	Electro-Voice Inc.	61	37	616/695-6831
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Audio Development	309	270	818/843-7567	ESE	317	290	213/322-2136
Audio Technologies Inc.	171	127	215/443-0330	ESE	319	293	213/322-2136
Audio-Video Engineering Co.	300	253	516/546-4239	Ferno Salesmaker	130	102	513/382-1451
Auditronics, Inc.	287	231	901/362-1350	Fidelipac Corp.	85	51	609/235-3900
B&B Systems	252	190	805/257-4853	Fluke Mfg. Co., Inc.	129	140	206/356-5400
B&K Precision	223	162	312/889-9087	Forge Recording Studios, Inc.	112	306	800/331-0405
Barco Industries, Inc.	211	149	704/392-9371	Fort Worth Tower Co.	225	164	800/433-1816
Bayly Engineering	311	258	416/683-8200	Fortel Inc.	277	218	404/449-4343
Beaveronics, Inc.	242	182	516/883-4414	Fostex Corp. of America	254	193	213/921-1112
Belar Electronic Labs	308	267	215/687-5550	Frezzolini Electronics Inc.	302	257	201/427-1160
Belden Electronic Wire & Cable	111	68	317/983-5200	Fujinon Inc.	73	44	914/472-9800
Benchmark Media Systems	263	203	315/452-0400	Garner Industries	91	54	800/228-0275
Beyer Dynamic Inc.	289	235	516/935-8000	GEC McMichael	259	198	602/948-7255
Bogner Broadcast Equipment Corp.	309	278	516/997-7800	GEC McMichael	258		416/421-5631
Bosch-Fernseh	65,68	40	801/972-8000	Geleco Electronics Ltd.	302	285	201/268-1177
Broadcast Electronics	25	15	217/224-9600	Gentner Engineering Co., Inc.	60	32	801/268-1177
Broadcast Microwave Services, Inc.	279	220	619/560-8601	Gentner Engineering Co., Inc.	58	291	916/273-8412
Broadcast Video Systems Ltd.	308	266	416/497-1020	Graham-Patten Systems Inc.	318	150	916/273-8421
BSM Broadcast Systems Inc.	95	58	509/448-0697	Grass Valley Group, Inc.	213	6	916/273-8421
Cablewave Systems	207	146	416/844-1242	Grass Valley Group, Inc.	188	132	916/273-8421
Cal Switch (Pro Sound)	304	280	800/421-2471	Grass Valley Group, Inc.	182	128	916/273-8421
Calvert Electronics Inc.	101	307	800/526-6362	Gray Engineering	60	157	714/997-4151
Camera Mart, Inc.	281	223	212/757-6977	Grumman Aerospace Corp.	241	181	516/435-6001
Canon USA Inc., Broadcast Lens	108-109	67	516/488-6700	Hannay Reels	236	176	518/797-3791
Capitol Magnetics	250	188	213/462-6252	Harris Corp.	55	30	217/222-8200
Celwave RF, Inc.	75	45	201/462-1880	Harris Corp.	145	107	217/222-8200
Centro Corp.	191	134	619/560-1578	Harris Corp.	200-201	310	217/222-8200
Cercone-Vincent Assoc., Inc.	257	196	412/922-0900	Harris Corp.	71	43	217/222-8200
Cetec Antennas	79	47	916/383-1177	Harris Corp.	164	121	217/222-8200
Cetec Gauss	232	172	213/875-1900	Harris Corp. (Video Systems)	285	229	408/737-2100
Cetec Vega	210	148	818/442-0782	Harrison Systems	23	14	615/834-1134
Christie Electric Corp.	44	24	800/421-2955	Hipotronics, Inc.	264	204	914/279-8091
Chyron Corp.	209	147	516/249-3296	Hitachi Denshi America Ltd.	5	5	800/645-7510
Cine-60	274	214	212/586-8782	Hitachi Denshi America Ltd.	237	177	800/645-7510
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Circuit Research Labs, Inc.	9	7	800/535-7648	Horizon International	195	137	602/437-3800
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CMX Orrox	97	59	408/988-2003	Howe Audio	238	178	800/525-7520
Colorgraphics Weather Systems	31	17	608/274-5786	Hughey & Phillips	311	261	213/849-1104
Com-Tek Communications Technology, Inc.	168	124	801/466-3463	ICM Video	234	174	405/232-5808
Comark	3	4	215/822-0777	IGM Communications	133-138	105	206/733-4567
Comark	113	71	215/822-0777	Ikegami Electronics Inc.	105	64	201/368-9171
Conrac Corp.	86-87	52	818/966-3511	Ikegami Electronics Inc.	118,119	74	201/368-9171
Continental Electronics Mfg. Co.	106	65	214/381-7161	Ikegami Electronics Inc.	197	139	201/368-9171
				Ikegami Electronics Inc.	215	152	201/368-9171
				Ikegami Electronics Inc.	81	48	201/368-9171



Ikegami Electronics Inc.	41	22	201/368-9171	QEI	315	288	609/728-2020
Interactive Systems Corp.	245	185	303/447-2013	Quanta Corp.	231	171	801/974-0992
Interphase	220	158	412/367-3775	RCA Solid State (Tubes)	165	122	800/233-0155
Intl. Tapetronics Corp.	299	251	800/447-0414	RCI	300	252	301/587-1800
ITT Cannon	161	119	800/845-7000	R-Columbia Products, Inc.	278	246	312/432-7915
JBL Inc.	43	23	818/893-8411	Research Technology Inc.	268	208	800/323-7520
Jensen Tools	304	260	602/968-6241	Rohde & Schwarz Sales Co. (USA)			
Jensen Transformers Inc.	301	255	213/876-0059	Inc.	84	50	516/488-7300
JVC Company of America	83	49	800/582-5825	Ross Video Ltd.	255	194	613/652-4886
K & H Products, Ltd.	216	153	802/442-9118	RTS Systems, Inc.	243	183	818/843-7022
Kliegl Bros.	262	202	718/786-7474	Ruslang Corp.	104	243	203/384-1266
L.W. International	302	256	818/522-3284	Schwem Technologies	239	179	415/935-1226
Laird Telemedia	203	143	801/972-5900	Sencore	32A, 32B		800/843-3338
Lake Systems Corp.	230	170	617/244-6881	Sencore	33	18	800/843-3338
Lamp Technology Inc.	132	104	516/454-6464	Sennheiser Electronic Corp.	222	160	212/944-9440
Lang Video Systems Corp.	308	273	415/364-1287	Sescom, Inc.	310	283	800/634-3457
Larcen Communications	288	234	416/245-9970	Shallco, Inc.	278	248	919/934-3135
LEA Dynatech Inc.	300	254	213/944-0916	Shively Labs	170	126	207/647-3327
Leitch Video Ltd.	227	167	804/424-7290	Shook Electronic Enterprises, Inc.	158	312	512/653-6761
LEMO USA Inc.	121	75	707/578-8811	Shure Brothers Inc.	151	112	312/866-2553
Lenco Electronics	7	8	314/243-3147	Shure Brothers Inc.	270	210	312/866-2553
Lerro Electrical Corp.	17		215/223-8200	Sitler's Inc.	302	283	800/426-3938
Listec	224	163	516/694-8963	Solid State Logic	184-185	130	212/315-1111
Logitek Electronic Systems	272	212	800/231-5870	Sony Corp. of America	34-35, 140-141		
MCG Electronics, Inc.	16	11	516/586-5125	Sony Tapes Product Sales Co.	293	241	
MCL, Inc.	154	114	312/354-4350	Sound Technology	39	21	408/378-6540
3M Broadcast & Related Products	283	226	800/792-1072	Soundcraft Electronics	99		213/453-4591
M/A Com MAC, Inc.	199	309	617/272-3100	Sphere Electronics	292	239	818/349-4747
Magna Tech Electronics Inc.	303	259	212/586-7240	Stainless, Inc.	297	249	215/699-4871
Magnetic Technologies, Inc.	226	165	612/944-7660	Standard Tape Laboratory, Inc.	308	271	415/788-3546
Maxell Corp. of America	221	159	201/440-8020	Stantron/Unit of Zero Corp.	235	175	800/821-0019
Micron Audio Products	202	142	914/761-6520	Studer Revox America Inc.	162-163	120	615/254-5651
Microprobe Electronics Inc.	309	276	312/295-2606	Surcom Associates Inc.	284	227	619/722-6162
Midwest Communications Corp.	76-77	46	800/543-1584	Switchcraft Inc.	233	173	312/792-2700
Midwest Communications Corp.	1	3	800/543-1584	Symetrix, Inc.	70	42	206/624-5012
Modular Audio Products	94	57	516/567-9620	Tandberg of America	316	289	914/273-9150
Modulation Sciences	295	245	718/625-7333	Tascam Div Teac Corp. of			
Monroe Electronics, Inc.	150	111	716/765-2254	America	131	103	213/726-0303
Moseley Associates, Inc.	15	10	805/968-9621	Tech Labs, Inc.	302	281	201/944-2221
Moseley Associates, Inc.	291	238	805/968-9621	Tecpro Inc.	304	219	800/562-5872
Nady Systems Inc.	290	237	415/652-2411	Tektronix Inc.	11	9	800/452-1877
Nakamichi	IBC	2	213/538-8150	Telemetrics Inc.	286	230	201/825-3386
Nalpak Video Sales, Inc.	308	268	213/391-0491	TFT, Inc.	189	133	408/727-7272
National Video Service	260	200	415/846-1500	Thomson-CSF DTE	117	73	201/438-2300
NEC America Inc.	57	31	800/323-6656	Thomson-CSF Broadcast	159	117	203/327-7700
NEC America Inc.	70	41	800/323-6656	TOA Electronics, Inc.	143	106	415/588-2538
Neve Inc.	146-147	108	203/744-6230	Total Spectrum Manufacturing,			
Norpak Corp.	148	109	613/592-4164	Inc.	160	118	914/358-8820
Omicron Video	214	151	818/700-0742	Townsend & Associates	260	199	413/568-9581
Omnimount	252	191	818/766-9000	TTC/Ampro Scully	280	222	303/465-4141
Opamp Labs Inc.	309	275	213/934-3566	TTC/Wilkinson	107	66	303/465-4141
Orban Associates Inc.	217	300, 301, 302	800/227-4498	TTC/Wilkinson	261	201	303/465-4141
Orban Associates Inc.	253	192	800/227-4498	Ultimate Corp.	130	141	818/345-5525
Orban Associates Inc.	123	77	800/227-4498	Union Connector	269	209	516/623-7461
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Panasonic	47	26	201/348-7336	Valley People, Inc.	294	225	615/383-4737
Panasonic	49	27	201/348-7336	Varian	29	16	415/592-1221
Panasonic	50-51	28	201/348-7336	Varian	149	110	415/592-1221
Panasonic	52-53	29	201/348-7336	Varian	251	189	415/592-1221
Panasonic Industrial Tape Div.	167	123	201/348-7109	Video International	222	161	516/842-1815
Patch Bay Designation Co.	278	247	818/241-5585	Videotek, Inc.	153	113	602/997-7523
Perrott Engineering	104	244	703/528-5861	Vital Industries, Inc.	273	213	904/378-1581
PESA	219	156	305/556-9638	Ward-Beck Systems Ltd.	BC		416/438-6550
PESA	275	216	305/556-9638	White Instruments Inc.	309	279	512/892-0752
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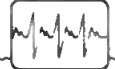
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# ENGINEERING SUPERVISOR

Northeast top 10 network affiliate seeks an Engineering Supervisor with minimum of 5 years' experience in TV station with aggressive news operation and 3 years of maintenance or supervisory experience. Associate's degree in Electronics and Communications preferred. Strong RF background, thorough knowledge of techniques and test equipment required for proof of performance of VHF and microwave transmitters. Please send resume, in complete confidence, to Box 637.

**Broadcast Engineering  
P.O. Box 12901  
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Minorities and females are encouraged to apply.

## Broadcast Sales Video Products

Prominent manufacturer of high-quality Broadcast and Industrial video products seeks a professional Regional Manager for Midwestern Territory. The person we are looking for will have experience in and knowledge of the products sold in our industry and will promote sales through a dealer network and to end-users. The ability to manage other sales and clerical personnel is also required. This position is headquartered in the Chicago area. Considerable travel throughout the territory will be necessary. We offer a salary plus commission, company car and paid benefits package. Interested and qualified candidates should submit their resume in confidence, including salary history, to: **NATIONAL SALES MANAGER**, Box 637, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212.

# TV MAINTENANCE TECHNICIAN

Northeast top 10 network affiliate seeks technician well versed in test equipment operation. FCC General Class license required. Operation experience helpful. Prefer BSEE, 2 years' college acceptable. Will maintain state-of-the-art television equipment. Please send resume in complete confidence to Box 636.

**Broadcast Engineering  
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## Technology, security, career growth . . .

At Grass Valley Group, there are several very good reasons for you to join us. We're using state-of-the-art technology as a jumping-off point toward the next generation of television technology. We offer the security of an established leader in the television industry. And, we have a management policy that spells out your many opportunities for career growth.

Join Grass Valley Group as we continue to provide the television industry with a variety of advanced products. We have the following openings for talented professionals:

### Division Marketing Manager

Requirements include a demonstrated marketing background in the broadcast industry and both a BSEE/MBA or strong business background. Excellent interfacing skills for interdepartment and customer requirements are also necessary.

### Product Marketing Manager

Will direct the development of and recommend overall marketing strategies for assigned product lines, and be responsible for directing the implementation of the approved marketing strategies. Requires 3-5 years' marketing management experience in a related industry.

### Senior Engineers

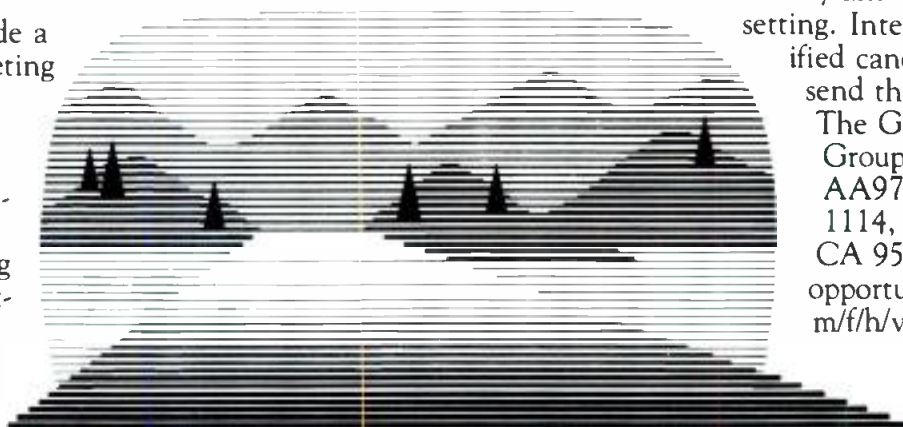
Immediate openings in the areas of hardware design, software development and analog design.

A degree in electronic engineering/computer science or equivalent, plus applicable experience of 3 or more years is required. There's more.

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We offer outstanding benefits, in addition to challenging career opportunities, growth, security and a scenic, rural setting. Interested and qualified candidates should send their resumes to:  
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**MAINTENANCE ENGINEER:** Engineer for growing sunbelt TV station. Uplink facility. 1" and 3/4" tape maintenance a must. Contact John Grandon, Personnel Manager. KAUT-TV, P.O. Box 14843, Oklahoma City, OK 73113. 2-85-11

**BROADCAST TECHNICIAN SUPERVISOR:** \$2015-\$2580 per month. Needed immediately—supervisor position, four-station Washington State University Telecommunications System. Requires: five years of full-time experience in radio or television broadcast technician work which has included one year of lead/supervisory experience. Possession of a first class Federal Communications Commission radio-telephone operator's license. College or technical school training in radio, television or electrical engineering may be substituted year-for-year for up to four years of the required experience. Apply by March 14, 1985, to Staff Personnel, 134 French Administration Building, Pullman, WA 99164-1014, (509) 335-4521. WSU is an EOE. 3-85-11

**DIRECTOR ENGINEERING/TECHNICAL ADMINISTRATION** for VHF television station in highly competitive top 20 market. Ideal candidate will possess at least ten years' experience in commercial broadcasting, strong administrative and interpersonal skills, extensive knowledge of all technical aspects of television station operations, and exceptional ability in long range facilities and capital planning. An equal opportunity employer. Send resumes to Broadcast Engineering, Dept. 640, 9221 Quivira Road, Overland Park, Ks. 66215. 3-85-31

**MAINTENANCE TECHNICIAN** with strong TV/broadcast transmitter background for Radio/TV production center in the heart of the Northern Rockies. Well-funded operation with all new equipment and building. Provide leadership in TV, assist with NPR station serving most of western Montana. Salary competitive. Send resume with names and phone numbers of professional references to: Ken Fielding, Director, Telecommunications Center, University of Montana, Missoula, MT 59812. Review begins March 18 and continues until position is filled. AA/EOE. 3-85-11

**EXPANDING MID-ATLANTIC BASED PRODUCTION FACILITY** accepting resumes for the following engineering positions: **FACILITY OPERATIONAL ENGINEER**—Requires experience in all phases of facility, design operation, repair, and maintenance of cameras, videotape machines, switchers, CG's and editors. **REMOTE FACILITY ENGINEER**—Requires experience in facility operations, and maintenance with component level troubleshooting. Requires travel. Forward resumes to: Engineer, P.O. Box 1945, Chesapeake, Va. 23320. 3-85-11

**ASSISTANT CHIEF ENGINEER:** Videocom®, a major Boston area production house is looking for an Assistant Chief Engineer. Applicants must have General Class FCC, strong Ampex 2" Quad background as well as varied experience in television systems operation, maintenance and repair; supervisory experience preferred. Please send resume and letter of interest to Judith Finkle, Videocom, 502 Sprague Street, Department B/E, Dedham, MA 02026, Equal Opportunity Employer—M/F. 3-85-11

**TEXAS NBC AFFILIATE** needs experienced maintenance engineer for studio and ENG equipment. Requirements include F.C.C. license or S.B.E. certificate and at least 2 years experience maintaining cameras, VTR's, etc. Broadcast Engineering, Dept. 642, 9221 Quivira Rd., Overland Park, KS. 66212. 3-85-11

**MAINTENANCE ENGINEER**—Top Ten Market, PBS Station: Excellent opportunity with growth potential. Min. 3 years maintenance experience, SBE Certification, FCC General Class; College degree preferred; competitive salary. Resumes to: Gilda Jones, KERA TV/FM, 3000 Harry Hines Blvd., Dallas, Texas 75201. 3-85-11

**IMMEDIATE OPENING.** Experienced broadcast engineer with radio, TV or cable background for Washington, D.C. communications consultants. College degree and 3 years experience, with at least 2 years TV technical maintenance. Excellent writing skills and attention to detail essential. Excellent compensation, benefits, opportunity to advance. EOE. Resume and salary requirements to Broadcast Engineering, Dept. 643, P.O. Box 12901, Overland Park, Ks. 66212. 3-85-11

**CHIEF ENGINEER FOR MAJOR MARKET UHF TV.** Major station in mid-west U.S.A., seeking creative, experienced engineer with good theoretical background and ability to administer and communicate with people. Send resume to C.P. Laidlaw, P.Eng., Imagineering Limited, 95 Barber Green Road, Don Mills, Ontario M3C 3E9. 3-85-11

## RADIO VICE PRESIDENTS

National Public Radio, a Washington, D.C. based broadcast organization, is currently searching for exceptional individuals to fill 2 officer level positions.

### VICE PRESIDENT — DISTRIBUTION

Senior management position responsible for planning operations and policies associated with the management of a satellite communication system to distribute non-commercial programs to over 300 stations.

In order to adequately serve our member stations and public radio listeners, we are seeking an individual with senior management level experience with public broadcasting organizations or equivalent background with other entities. A familiarity with telecommunication and broadcast systems is highly desirable, as well as a college degree or equivalent experience.

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Public radio listeners expect technical excellence in the delivery of their programs. NPR needs a person with extensive experience in managing large technical organizations or divisions to meet these expectations. Although a BSEE is desirable, equivalent experience with a primary emphasis in broadcast and/or production management are acceptable. A knowledge of telecommunication and data processing systems are a definite plus.

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**EDITOR:** CMX or Sony 5000 experience preferred, but we'll train right person. Creativity a must. Upstate New York production house. Resume and salary requirements to: Broadcast Engineering, Dept. 641, 9221 Quivira Rd., Shawnee Mission, KS 66215. 3-85-11

**ENGINEER VIDEO STUDIO;** maintenance and technical support for equipment such as: Sony 1" VTR's, Convergence computer editor, Grass 1600, Chyron. Salary commensurate with experience. Call 212-696-1575. 3-85-11

**CHIEF ENGINEER** for WGUS AM FM, P.O. Box 1475, Augusta, GA 30913. Combo Considered. Full Maintenance duties. Manager 803-279-1380; Don Kern 504-641-1560. 3-85-21

### POSITION WANTED

**CHIEF ENGINEER,** radio—looking for midwest location. 12 yrs. experience. AM FM high power. Experienced with automation and satellite. Excellent with audio. P.O. Box 550004, Birmingham, AL 35255. 3-85-11

**WANTED:** Engineer for 5kW AM and 50kW FM in Sacramento Valley. Call Paul Moore, G.M. (916) 742-5555. 3-85-11

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**The King Faisal Specialist Hospital and Research Centre,** a 250-bed acute care facility located in Riyadh, Saudi Arabia, has an opening in the Audio-Visual Department. The AV Department is responsible for the education and television needs of the Hospital's employees and their dependents.

Requirements include a Bachelor's degree in Communications, Radio-T.V., Journalism or related field and 5 years of production experience directing production crews.

Salary and benefits are attractive and include: 30 day annual leave, furnished housing, transportation, bonus pay and more. The selected candidate will be employed by and have a contract with the Government of the Kingdom of Saudi Arabia.

For further information and/or to apply, please call our toll-free number (800) 251-2561 or send your resume to: **HCA International Company, Dept. BE-0385, P.O. Box 550, Nashville, TN 37202** or **HCA International Company, Dept. BE-0385, 500 Airport Blvd., Suite 110, Burlingame, CA 94010.** HCA is an Equal Opportunity Employer.

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The Model 8000 locks two video tape recorders to one another. For the first time in the history of Video Editing, it is now possible to have state of the art TBC performance in an A-B roll system, with a **single** TBC.

### **THE 8000 IS A REVOLUNTIONARY CONCEPT IN TIMEBASE CORRECTORS**



### **TO BE UNVEILED AT NAB**

The 8000 is a very remarkable device. Though it locks two machines to one another, it produces clearly recognizable pictures even when the machines are running at high speed in opposite directions. In a post production environment, it is necessary to be able to monitor the signals of VTR's while the tapes are winding in either direction. In a system containing an 8000, with a switcher showing the two VTR's in a split wipe, both pictures are clearly visible even when one VTR is in "fast forward" and the other is in "rewind".

It is not necessary to use a single 8000 to lock two VTR's. The 8000 can be installed as a regular TBC, one for each VTR, (with a stable sync source as a reference). Used in this manner, it's simply a very high quality TBC.

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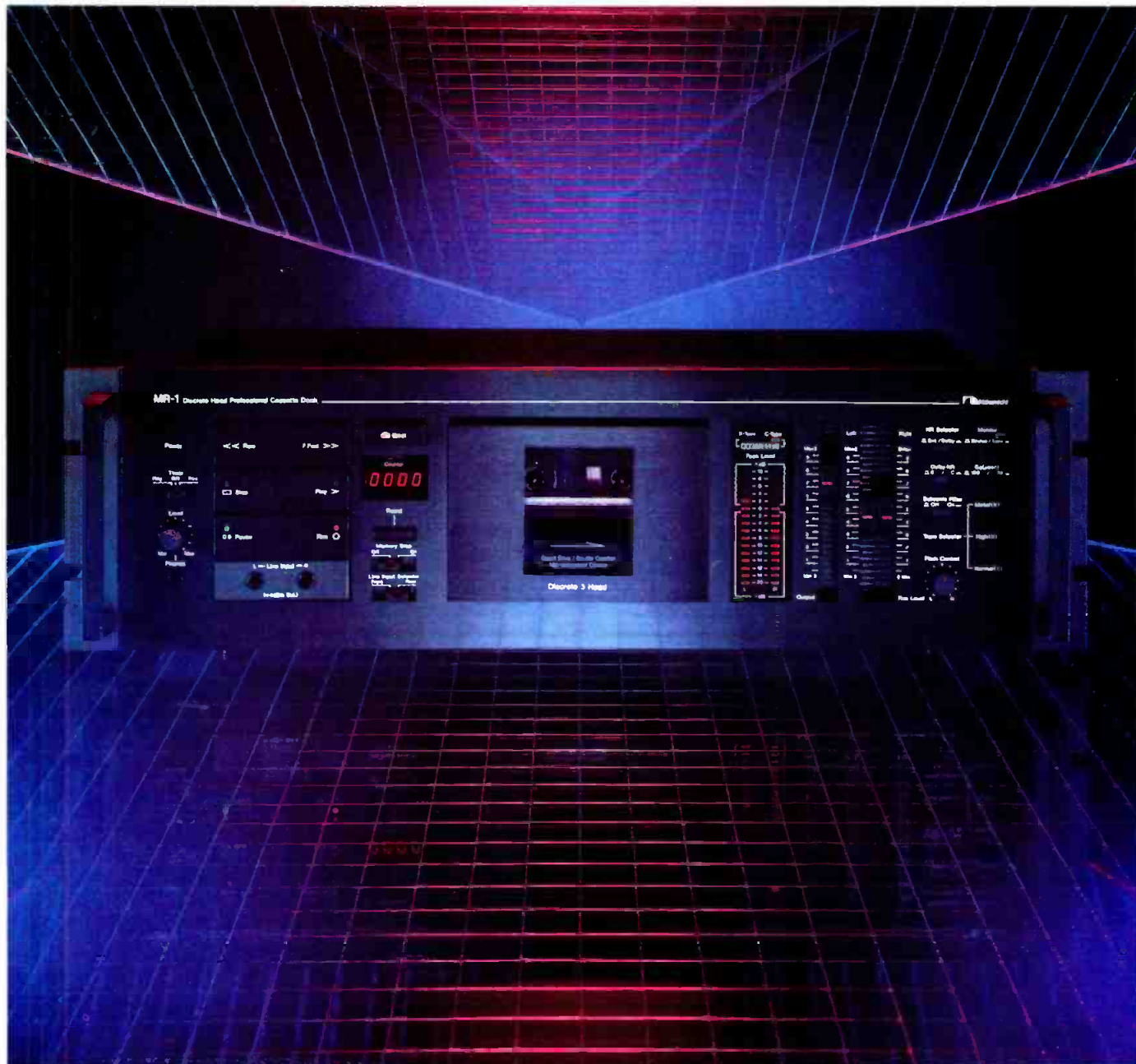
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