BROADCAST engineering

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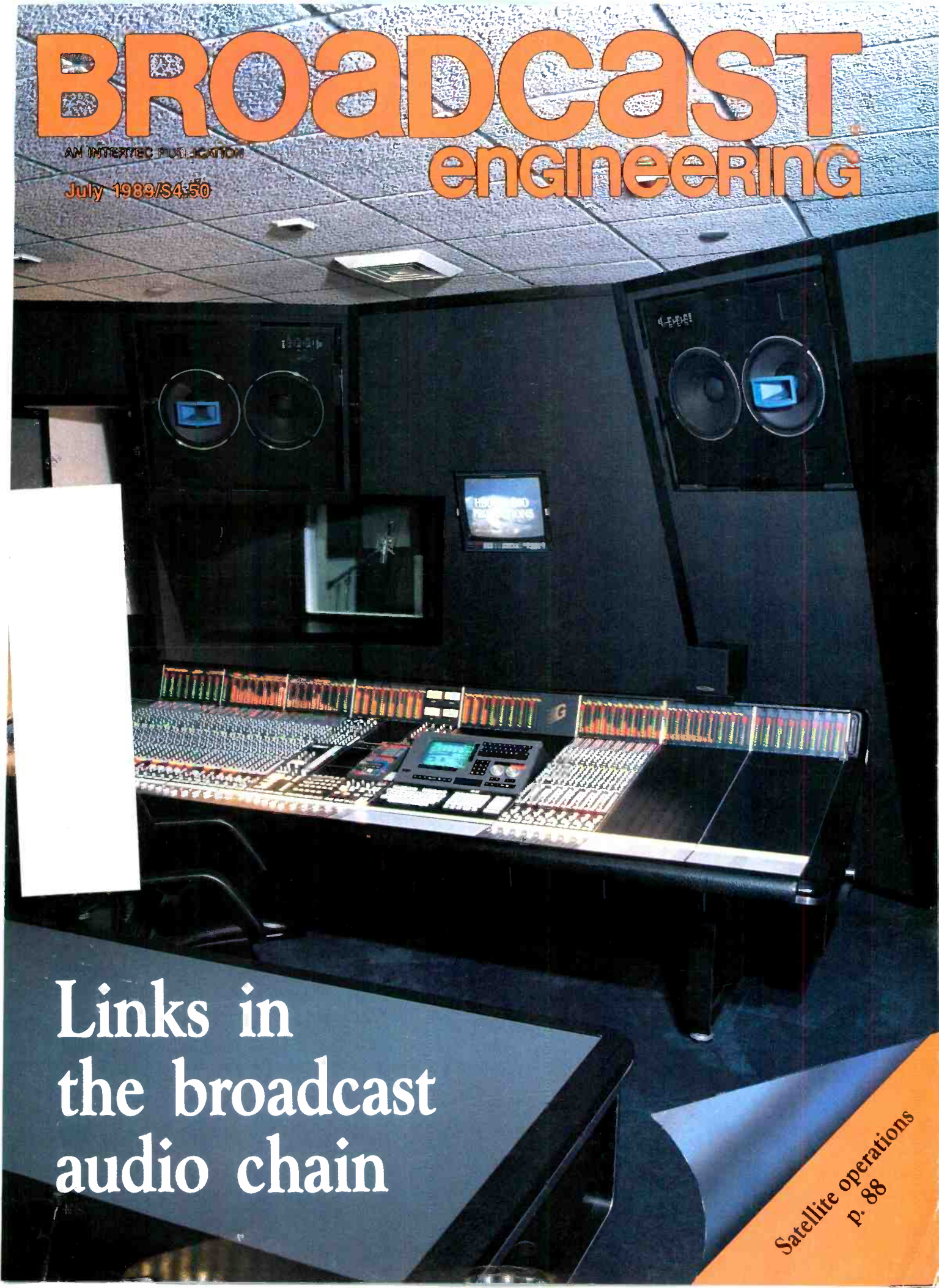

# Links in the broadcast audio chain

Satellite operations p. 88

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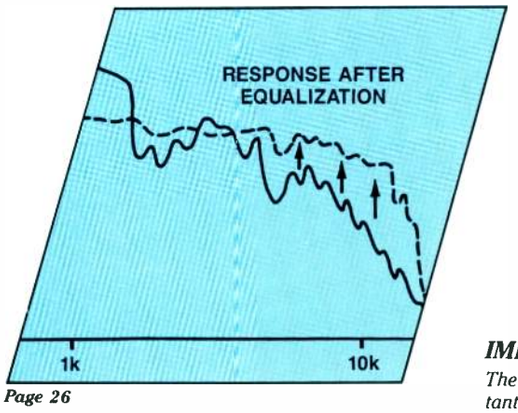


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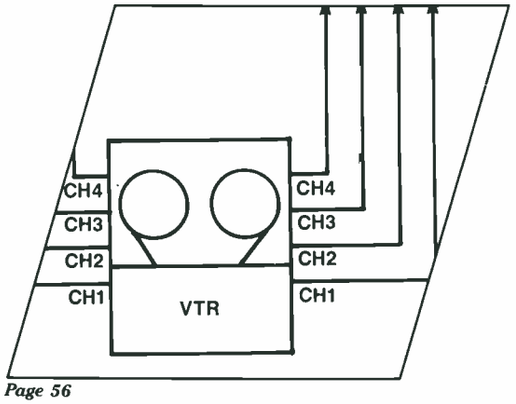


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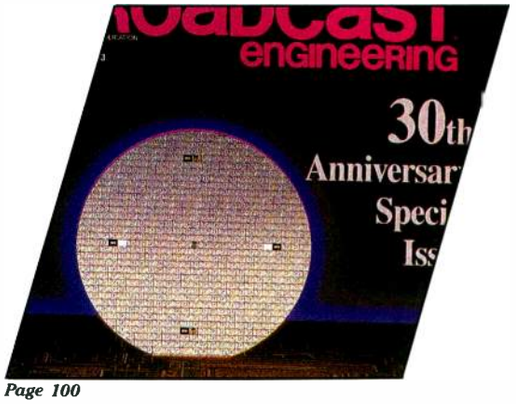


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BROADCAST engineering

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By Paula Janicke, staff editor

## NAB takes position on lottery proposal

The National Association of Broadcasters has stated its opposition to the FCC proposal to use a lottery system in the selection of applicants for new broadcast stations. The association suggested that the commission reform its comparative licensing process instead.

Expressing concern that a lottery system would leave the selection of licensees to a "roll of the dice," NAB said the modifications that already have been enacted or proposed for the license application form would be enough to eliminate sham applications and reduce the backlog. The association fears that a lottery system, which would allow preferences only for diversity of ownership and minority ownership, would "handicap daytime-only licensees, local residents and female applicants."

According to the NAB, the lottery procedures should not apply to pending applications, including Docket 80-90 cases, because of the adverse effect they would have on existing applicants.

## Waiver urged for reducing interference

In response to an FCC notice of rulemaking proposing acceptance of "contingent applications" filed by co-channel or adjacent-channel AM stations, the NAB has urged adoption of a waiver policy. In such an application, a station would agree to expand or reduce service in conjunction with another's application. Although the association agrees with the commission's goal of reducing interference on the AM band, it says that the interference problems would be better solved by a waiver policy, not rule changes.

NAB also reiterated its opposition to "negotiation of interference rights," whereby service area size and station-to-station interference patterns would be determined by broadcasters rather than by the commission. If it took the proposed waiver approach, the commission would accept and process only certain AM "contingent applications" meant to decrease interference. The agency would be required to make a full public interest evaluation, assessing the amount of AM interference to be reduced as well as how the levels of broadcast localism would be affected by the granting of contingent applications.

The association recommends that the applications be reviewed by the commission on a case-by-case basis, and only when one of the applicants proposes to cease broadcast operation.

## Megapower short-wave transmitter goes on air

The world's most powerful, privately owned short-wave transmitting station, completed as part of a turnkey project in Cypress Creek, SC, has been turned over

*Continued on page 54*

**BROADCAST engineering**

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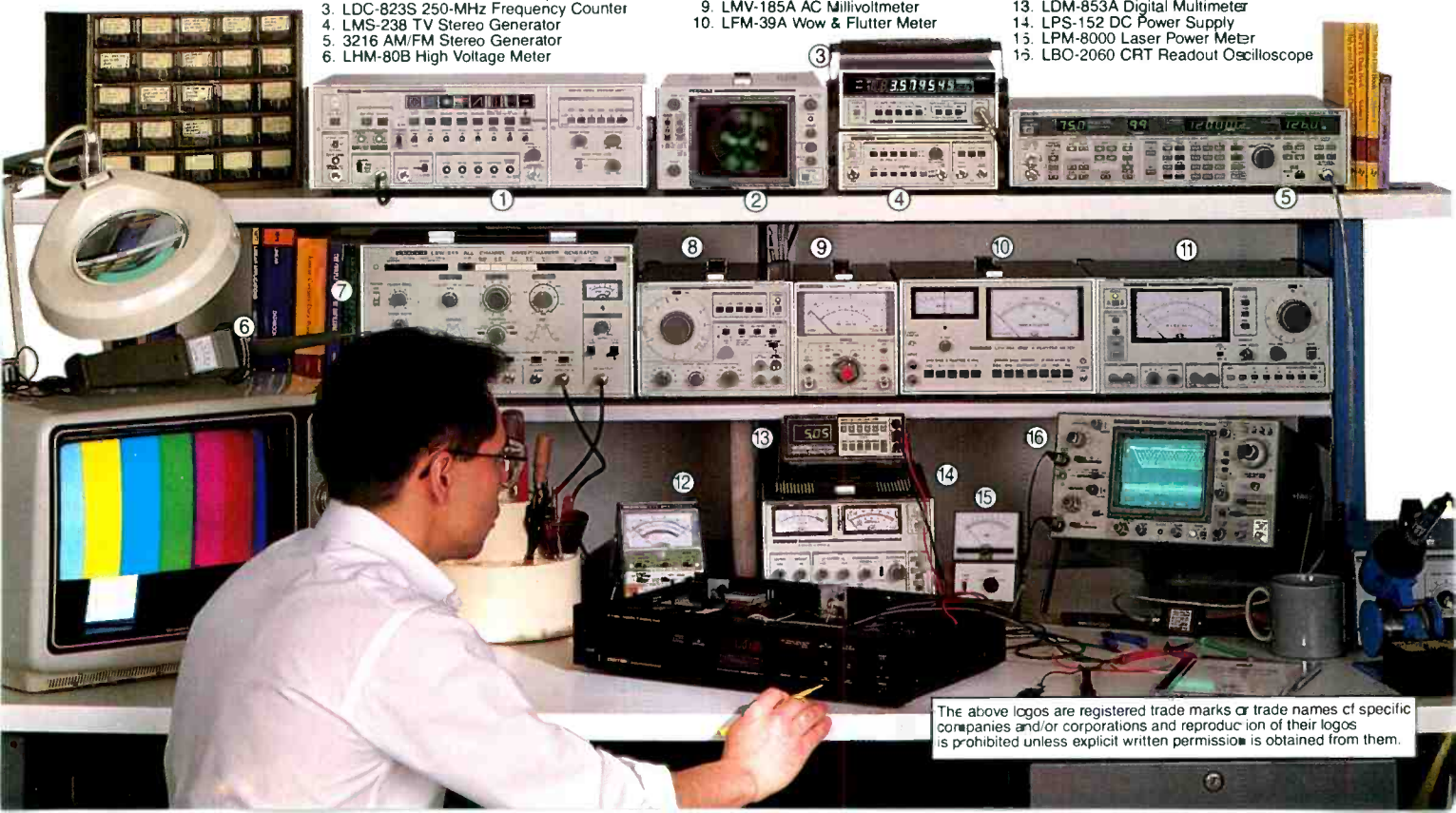

# Managing the future together

Trying to stay ahead of broadcast technology is like running in front of a moving freight train — pause for a second, and you get run over.

Broadcast engineers face a formidable challenge today in maintaining their technical skills. As broadcast technology advances, so too must the abilities of those who install, repair and manage the system. Without continued education, the engineer does not learn how to deal with today's equipment.

Unfortunately, the need to refresh one's skills and perspective sometimes falls a distant second to just keeping the station on the air. It now requires a major effort for many engineers and technical managers to keep abreast of the constantly changing state-of-the-art. The Society of Broadcast Engineers recognized this problem years ago and has worked hard to develop programs that help its members keep up with technological advancements.


For the past three years, the SBE has held a national convention, a major part of which is the highly successful **Broadcast Engineering** conference. At this year's convention in Kansas City, MO, the **BE** conference again will offer attendees the opportunity to expand their knowledge and improve their engineering management skills.

The seminars will cover both radio and TV issues, ranging from automation to video, and they are designed to address the key issues facing today's engineers. Attendees will receive practical and useful information that can be applied immediately at their stations. Because the radio and TV sessions are scheduled concurrently, attendees will have more presentations to choose from than at previous SBE conventions. Also, the seminars are scheduled so as not to conflict with exhibit floor hours, meaning attendees don't have to choose between participating in seminars and visiting exhibits.

Another component has been added to this year's convention. The Ennes Education Foundation is sponsoring a series of special workshops to be held Wednesday, Oct. 4, the day before the convention opens. The workshops are designed to meet a long-standing need for equipment-specific, hands-on training.

The daylong workshops will be conducted by broadcast equipment manufacturers and others who are familiar with what engineers and technical managers need to know to perform their jobs. The workshops provide what, until now, has been missing from other conventions: hands-on factory training on broadcast equipment. Attendees will receive the same kind of training they would get at a manufacturer's technical school.

And, as if that weren't enough, the 1989 SBE convention will mark the society's 25th anniversary. It's the perfect opportunity to celebrate! A festive silver anniversary party is planned, including a special dinner speaker, live entertainment and even a present for everyone who attends.

The convention committee has assembled a winning combination of educational and fun-filled events for the celebration. Combine business and pleasure by attending the 1989 SBE Convention and **Broadcast Engineering** Conference, Oct. 5-8 in Kansas City.

Brad Dick

Brad Dick,
technical editor


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# A/B cable switch requirement imposed

By Harry C. Martin

Beginning Nov. 1, cable TV operators must notify their subscribers that cable systems are legally required to make available an input (A/B) switch that will permit subscribers to choose between cable programming and off-air television.

The A/B switch rule was adopted several years ago as part of the package that included must-carry rules for local TV signals. The must-carry rules, however, were struck down as unconstitutional in December 1987 by the U.S. Court of Appeals, Washington, DC. In its decision, the court remanded to the FCC the issue of whether the A/B switch requirement, as well as accompanying rules requiring consumer education about the switching system, still should be imposed.

The A/B switch and related consumer education requirements are controversial because most dwellings do not have outdoor antennas. Citing this fact, commissioner James Quello dissented from the decision, saying that the switch requirements will not accomplish their purpose and will needlessly burden cable systems with an obligation that will not be effective in making local on-air signals available.

The commission also has revised its rules dealing with the way off-the-air broadcast programs are carried. Under the new rule, cable systems must carry in full all programs they pick up off the air. The previous rule, Section 76.62(a)(1), required that each signal carried by a cable system must be carried in full, without deletion or alteration.

Quello criticized this new rule also, saying the Court of Appeals ruling did not preclude the commission from imposing manner-of-carriage requirements for signals that are carried voluntarily by cable operators. He said the new rules would permit cable systems to "cherry pick" specific local programs, thereby creating a composite channel consisting of only the best programming from each local station.

### EEO standards enforced

In a decision involving the renewal applications of an AM/FM licensee in Maryland, the commission imposed a short-term renewal, reporting conditions and a $15,000 fine because the stations repeatedly failed to comply with equal employment opportunity requirements.

The commission's rules require broadcasters to establish and maintain an affirmative action program reflecting positive and continuing efforts to recruit, employ and promote qualified women and minorities. To comply with these rules, stations must keep detailed records of their recruitment sources, and the race and sex of each person referred by each source. These records must be used to conduct self-evaluations of minority recruitment programs and to report the results of such programs at renewal time.

Stations who can show their recruitment efforts have produced a reasonable number of minority and female job applicants will be considered as having complied with the EEO rules, even if their employment profiles do not fully meet FCC guidelines. On the other hand, stations whose employment profiles do not meet the guidelines and who cannot show that they have tried to recruit minorities or women will face EEO reporting conditions, short-term renewal, fines or license revocation.

The Maryland stations subject to these sanctions operated in an employment area where 19.1% of the work force was black. But the stations' annual employment reports (Forms 395) revealed an absence of blacks on the stations' full-time staffs. The reports also revealed that two blacks on the full-time staff in 1986 had left and that no other blacks had been hired.

In response to an FCC inquiry, the licensee indicated that it had used minority recruitment sources for only 14 of the 33 positions that had opened in 1987 and 1988. These contacts resulted in only two minority referrals and no minority hires. Further inquiry from the commission staff indicated that the licensee did not begin using minority recruitment sources until the last year of its license term. Because the station failed to seek minority and female applicants and did not engage in continuing self-assessment to evaluate its EEO program, the commission held that it has failed to comply with the affirmative action provisions of the agency's rules.

Based on the commission's action in this and other renewal cases, it is essential that all licensees with full-time staffs of five or more persons implement specific minority and female recruitment programs and keep careful records of the results.

### Changes proposed to comparative process

In response to the commission's Jan. 30 proposal to abandon the comparative hearing process and adopt lotteries to decide among competing applicants for broadcast facilities, the Federal Communications Bar Association (FCBA) has proposed specific reforms that would eliminate many of the problems the commission says would be solved by lotteries.

The FCBA's comments on the lottery proposal included the following specific reform proposals:

- Unlimited settlement payoffs and nonparty buyouts should be stopped for all future filings.
- In future comparative proceedings, the commission should award management "integration" credit on the basis of equity interests rather than voting power.
- The commission should apply its new Form 301 disclosure requirements to all pending AM, FM and TV applications. The new form, which will become available this summer, requires disclosure of integration plans, the source of financial commitments, and the identity of all equity owners (whether or not they are "passive").
- Comparative grantees should not be permitted to transfer their licenses before two years of operation.
- The commission should impose upon itself a limited time period for review of appeals in comparative cases. Presently, appeals from decisions of the FCC's review board often are not decided by the full commission for one or two years.

Because of the announced departure of FCC chairman Dennis Patrick, as well as the other vacancies on the commission, action on the lottery proposal is not expected for many months.

Martin is a partner with the legal firm of Reddy, Begley & Martin, Washington, DC.

**Editor's note:** For additional FCC information, IGO BPFORUM on CompuServe. |:(=)))|

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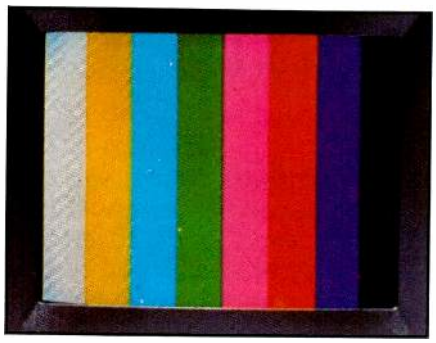

# VBI heats up

**By Rick Lehtinen,**
**TV technical editor**

Progressive telecasters long have looked to the vertical blanking interval (VBI) as a prime piece of "real estate" in which to package extra signals. VBI signals can ride for free, because the VBI always is transmitted, whether or not there are extra signals. Marketing the ancillary signals, however, has proved frustrating. Even though closed captioning for the hearing-impaired has been moderately successful, other forms of teletext seem to have suffered a slow start. This may be changing, however, because teletext producers have refined their techniques and capabilities so that they now can distribute valuable information in a timely manner.

### Extravision

One pioneer on the teletext trail, KSL-TV in Salt Lake City, recently has begun acting as the program source for the entire CBS Extravision network. At this time, KSL's teletext system benefits viewers by accessing some of the power of the station's Newstar newsroom computer. International news briefs, for instance, are played back on teletext as quickly as the wire service dispatches them. Sports briefs are updated frequently. The S&P 500 stock issues, additional stocks of local interest and 32 key commodities issues are transmitted continuously. During elections, comprehensive results are transmitted as quickly as they are assimilated by the station's election system. The interface to wire information adds a dimension of timeliness to the teletext service, which is beginning to attract sponsor attention.

An additional market for teletext is "point-to-multipoint" data distribution. RS-232 ports on certain teletext decoders allow data transmission to either a printer or computer at the customer's location. A company with a message to transmit, such as a list of price updates or a list of bad-check passers known to be in the area, can dial into the teletext headquarters and transmit information via modem. The teletext system automatically transmits this information on special closed pages of the teletext magazine. Decoders in the field, modified to receive such messages in addition to regular teletext services, then deliver the data.

KSL is investigating a way to allow teletext decoders to receive the closed captioning transmitted as part of the Extravision teletext package, as well as the line-21 captioning used by National Closed Captioning Institute standard decoders. Such a system would add great utility to teletext, because one box could serve many different types of users.

For the viewer's convenience, the current decoders, which are manufactured by Samsung, include TV volume, channel selection and "on-off" controls. The decoders connect to the TV antenna and output to the receiver on channel 3 or 4. They also provide an audio and video output.

It is hoped that future versions will incorporate multichannel TV sound decoders, which would further increase viewer utility.

### VBI pictures

The vertical blanking interval is thought of as a place without images, but Colorado Video, Boulder, CO, has come up with a way to transmit slow-scan television on an unused line in the VBI. Two current uses for the images are "distance education" and weather information.

For the distance education usage, Utah State University, in Northern Utah, transmits slow-scan representations of classroom lectures and blackboard notes to viewers in various locations across the state. In the transmitting classroom, a simple control panel switches one of two cameras onto the line. One camera monitors classroom notes on a copystand. The other monitors the classroom. A freeze button on the transmitter grabs the image when it is satisfactory. A transmit button sends the frozen image down the line. To prevent operator error, the freeze button is deactivated during transmission. It takes approximately eight seconds to transmit a 512×240 pixel image.

The receivers monitor the baseband video input, including the encoded slow-scan image, obtaining input from a TV tuner, microwave signal or satellite. The encoded lines are detected and gradually fill the video memories, which are scanned to feed monitors. As the memories fill, the image appears to wipe onto the screen. Multiple memories are available, so that one monitor can hold on blackboard notes while another is following the instructor.

### More to come

As technology moves forward, more and more uses will be found for VBI and other "resources" in the broadcast signal. Anything that increases the utility of the TV signal is good news.

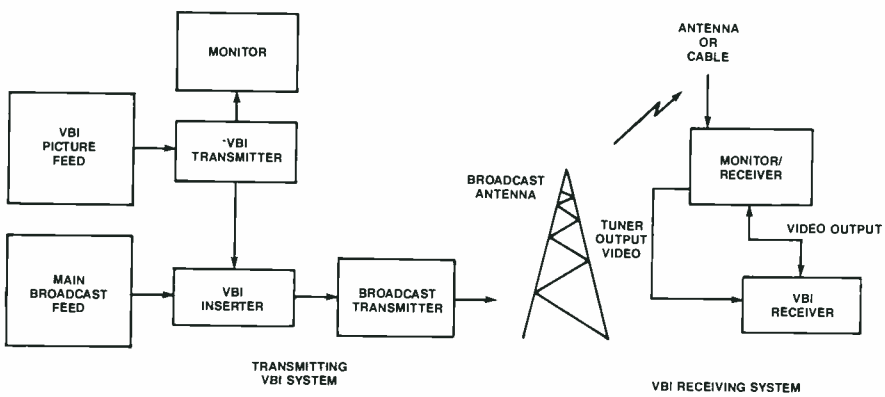


*Figure 1. Vertically swept slow-scan transmission system uses vertical blanking interval to transmit an image every eight seconds.*

# Not for amateur radio.

You're no amateur at this game, so why play around with amateur CD players in the studio? You've tried consumer models in the past, just to see if they'll work long enough to make sense. We can understand that. But in the long run, they *don't* make sense. And you know it. Even modified or beefed up versions have given you headaches. . . wrong levels, hifi connectors, too many buttons or the wrong ones. Not to mention skips, mutes and breakdowns. Why take chances playing around with an amateur deck in a pro application? Leave that home player at home where it belongs. Check out the Studer A727 and A730—pro players for radio pros.

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| FEATURE | A727 | A730 | "Brand X" Player | FEATURE | A727 | A730 | "Brand X" Player |
|---|---|---|---|---|---|---|---|
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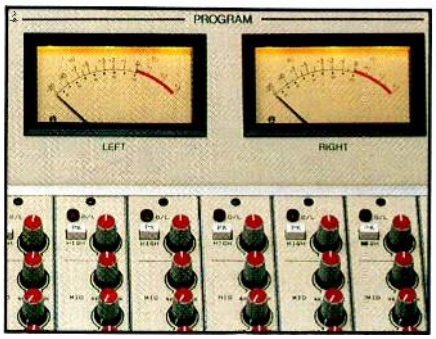
Part 2

# re: Radio




## Beyond the coverage map

By John Battison, P.E.

When clients tell the sales staff that they can't hear the station anymore, you can expect the engineering staff to get the blame. If you ran the radials mentioned in last month's "re: Radio" column and found poorer coverage or coverage vastly different than you anticipated, you should discuss it with the manager. Outline the cause for the problem, if you can find it. If you don't know the reason, roll up your sleeves and do some detective work.

### Make some tests

Measure the antenna operating impedance. Remember the power formula is $I^2 \times R$. This means that a small change in R can make a big difference in P. A small change in I can make an even bigger difference in the output power.

Has the antenna current changed without your knowing it? Check input power vs. output (antenna) power to see whether the efficiency is normal and reasonable. Sometimes meter calibrations change. Be especially careful if you have a remote-reading base current meter. It pays to have the base meter calibrated regularly or to at least borrow one to compare against yours.

Confirm that the antenna operating base impedance is still the same value that appears on your license. If you have a directional system, do the same for the common point.

By far the most satisfactory method of checking antenna impedances is by means of an operating in-line bridge (OIB). Beg, borrow or buy one, and insert it at the base of the antenna on the tower side of the base current meter. Turn on the transmitter at low power, and read the actual operating base impedance. A note of caution: be sure that both ground leads on the OIB are grounded. The meter gets RF hot if these leads are not grounded properly.

If you can't get an OIB, use one of the good old GR bridges. This will give you cold values rather than actual operating impedances. However, unless your system is extremely far out of tolerance, the difference should not pose a problem. After all, for years before the OIB was developed, we used the GR and a BC-221 oscillator with a sensitive receiver to do the job!

Even if you have a DA and must check the common point, the cold method generally is satisfactory, unless there is a component that changes value with power, hence heat. You can use a heat gun on suspect components in this case or even with an OIB to speed up changes.

Remember to check the bridge before use, and be sure that its own calibration is still good. If you can't find a standard resistor, a 1% or ½% composition resistor generally will suffice. There should be no reactance with the resistance measurement. If you have a standard capacitor, or one whose value you know, there should be no resistance reading on the bridge. Recall that the FCC accepts the OIB measurements, but the bridge must have a 2% calibration accuracy.

If you find the operating impedance has changed, and it remains the same after an overall check, you must file a new Form 302 with the commission. Provide the new values of impedance and current.

Read the line current at each end of the coax between the transmitter and the ATU. The current should be approximately the same at each end unless the line is very long or the line has a fault.

### Top-loaded antennas

A frequently overlooked possible cause of poor radiation is broken or damaged top-loading. Today, top guy wires tied to the tower seem to be the most popular form of top-loading. The old capacitive, or top hat loading device with its crown of aluminum tubing, rarely is seen. However, if you have one, be sure to regularly check its condition and performance. Eyeballing is about the only way to check mechanical condition. Sometimes this means getting the tower inspected for electrical continuity or insulation. You could compare past with current performance, but if your station is like many others, you don't have records.

If the top-loading has changed, the base impedance will, of course, change too. A reverse situation occasionally occurs in which the top guy insulator breaks, thereby connecting the top guy to the antenna top. The result of this unplanned top-loading normally will be a rise in the operating impedance.

### Misleading appearances

The transmitter then will have to struggle to maintain the licensed base current into a higher resistance. This would show up as lowered efficiency because, with the licensed antenna resistance and current, the output power would calculate to be the same. However, the output stage would have to work harder to produce the higher base current.

The system would appear to need more output stage power to produce the licensed power. This is a case in which apparent lowered efficiency in the final can mislead you, unless the antenna operating parameters are known to be correct. Of course, you would expect signal strength to increase in this case because of greater RF output.

### Record the results

Designate monitor points in a list with number, distance, description, time of day, weather conditions and measured field strength. Make it a point to check these monitor points and to record the results every six months. If the levels are off in one direction, look for an increase in another. Then look at the area, and determine what has caused the change. It might be a new building, trees that have grown around the site, lots of metal objects near the antenna, or even a guy wire that has become grounded through insulator breakage and RF field distortion.

In any case, once you have made your checks by means of the field intensity meter, be sure to record them for posterity. Keep a complete file in a loose-leaf book with numbered pages. Log everything that was measured and the results of any tests performed. You'll thank yourself later, when it comes time to recheck the station's coverage pattern.

Battison, **BE**'s consultant on antennas and radiation, owns John H. Battison and Associates, a consulting engineering company in Loudonville, near Columbus, OH.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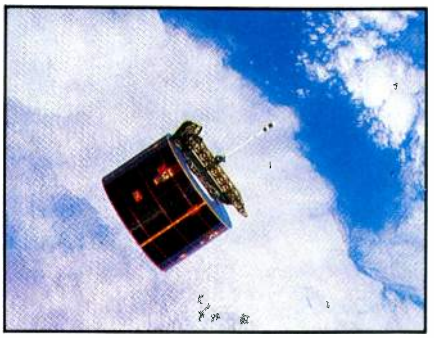

# Sunspots affect communications

By Elmer Smalling III

Sunspots or solar flares are referred to simply as solar activity by astronomers. Solar activity is definitely predictable; the complete sunspot cycle lasts 22 years, and sunspot activity diminishes every 11 years, followed by a change in magnetic field polarity for the successive half-cycle.

Sunspots are caused by intense magnetic fields, which disrupt the normal convective flow of heat from within the sun to its outer surface. These highly magnetic areas, deprived of heat, cool by radiation into space and become dark spots or sunspots.

Three major types of sunspots occur:

- *Prominences* appear dark against the solar disk and bright against the dark sky. They occur in regions of the sun's surface where there are horizontal magnetic fields that prevent bursts of prominences from being pulled inward by the sun's gravitational field.
- *Plages* occur when strong magnetic fields change from horizontal to vertical polarity and solar material is swept up. Plages generally are brighter than prominences.
- *Flares*, the most spectacular of the solar activities, may last only a few minutes, but are much brighter than the plages with which they are associated. The source of solar flare energy is the magnetic fields surrounding sunspots. When these magnetic fields are twisted strongly, they set up currents that stabilize the twisted fields until they become unstable and jump to a lower energy level, producing flares. This process somewhat resembles the quantum physical effect of electrons jumping to lower levels and emitting photons.

### Communications flare-ups

Solar activity has a significant effect on terrestrial communications, especially on the systems that bounce radio signals off the ionosphere, a region of ionized gas above Earth. The amount of refraction or reflection of this region varies with both the frequency of the radio signals and the degree of ionization occurring at the time.

Four basic layers or regions of the ionosphere exist:

- *The D region* is the lowest of the four layers, at about 70 miles above Earth. This layer usually is highly absorptive, reducing long-range communications. The D region, when present, is a daytime phenomenon.
- *The E layer*, another daytime phenomenon, depends on the sun's ultraviolet radiation, and its greatest density is directly under the sun. It is located about 100 miles above Earth and varies with the seasons.
- *The F1 layer* is another daytime phenomenon, averaging 200 miles above Earth. It also tends to follow the sun. At sunset, the F1 layer rises and merges with the highest layer, the F2.
- *The F2 layer* exists in both daytime and nighttime. Solar heat causes it to vary in height, so it is higher in the winter. Unlike the other three layers, the F2 layer is influenced by the Earth's magnetic field.

Ham radio operators know that these layers can bounce radio transmissions back toward Earth one or more times. Hams depend on this "skip" effect for long distance (DX) communications. Layer ionization is normally a function of the sun's ultraviolet light emission, but particle radiation from sunspots, cosmic rays and meteor activity also can cause ionization. A period of excessive solar noise can directly affect terrestrial radio communications.

### Microwave effects

Because the upper frequency for propagation via the ionized zones is in the low VHF band, microwave and satellite transmission, which does not depend on natural signal reflection, will not be disturbed by the ionizing aspects of solar activity. However, during periods when the solar activity is high, galactic noise, generated mostly by the sun, extends from 15MHz to 100GHz. It is limited by ionospheric absorption on the low end and atmospheric absorption on the high end.

Under normal "quiet sun" conditions, the galactic noise probably is lower than the receiver noise at microwave and satellite communications frequencies and goes unnoticed. During a period of high solar activity, however, the galactic noise can exceed 295°K, and extend up into the millimeter bands.

This year of high solar activity should produce problems for those microwave systems whose paths generally are aligned where the sun passes through the receiver boresite during its arc. Microwave systems located in the northern areas of the country, where the sun's angle is shallow, may experience more outages than those closer to the equator, where the sun's arc steepens. Solar noise will cause prolonged periods of satellite sun outage when activity is at its peak. Broadcast engineers would be wise to keep a close watch on the radio propagation prediction charts over the next few years.

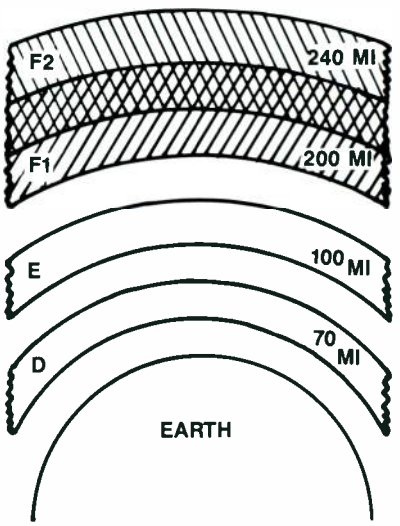


***Figure 1.*** *Earth's ionospheric layers, which are responsible for radio propagation, can be affected by sunspot activity.*

Smalling, BE's consultant on cable/satellite systems, is president of Jenel Systems and Design, Dallas.

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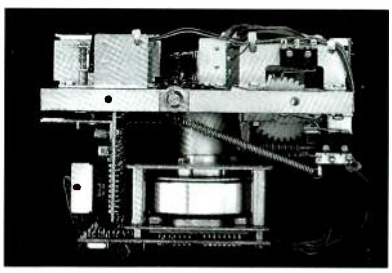

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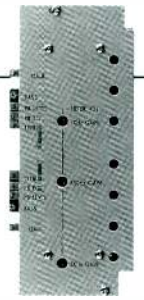

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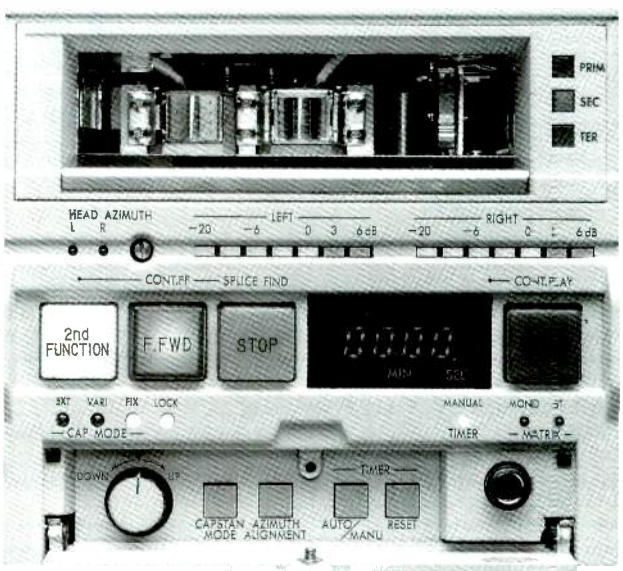
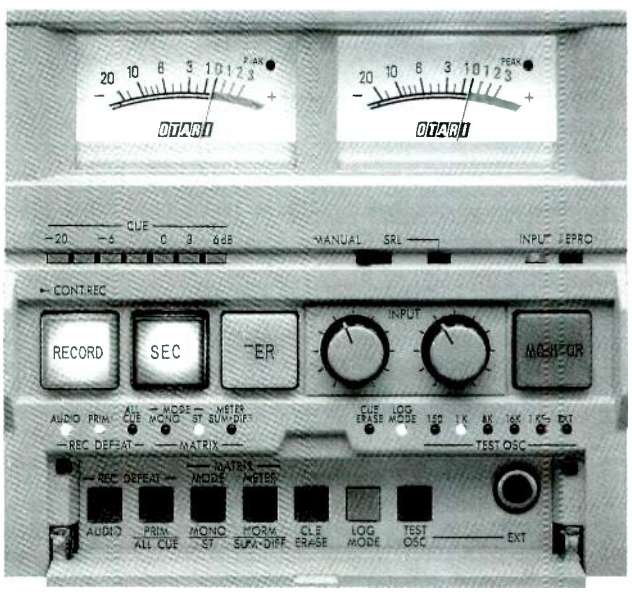
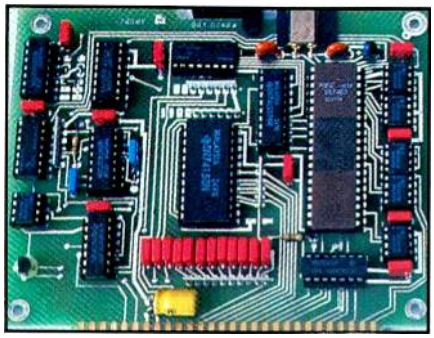



*HX-Pro is a trademark of Dolby Laboratories Licensing Corporation



# ISDN to bring better service

By Gerry Kaufhold II

An entirely new type of telephone service, the Integrated Services Digital Network (ISDN), is scheduled for on-line access in the United States by 1991-92. It already is used in Japan, Germany and France, with Great Britain to follow. An all-digital telephone service, ISDN provides for a variety of transmission speeds over existing phone lines and dramatic improvements to today's phone service.

Probably the most important aspect of ISDN is the extremely wide data-transmission bandwidth, which will allow feasible distribution of high-definition television (HDTV) by landlines. For example, wide-bandwidth ISDN links between the studio and the transmitter site could replace existing microwave STLs, easing the current problem of spectrum saturation. However, this capability means that ISDN could be used to distribute HDTV to the home, which makes ISDN a natural threat to broadcasters. Therefore, it is important that broadcast engineers understand what ISDN is and how it works.

## Basic-rate ISDN

For distribution of signals to subscriber homes, ISDN provides basic-rate services over existing twisted-pair telephone lines. This service provides two digital channels, called B channels, each with a data rate of 64kb/s. Because a single voice channel takes 64kb/s, ISDN can provide each subscriber with two independent telephone audio lines over the wire pair that currently supports only a single analog channel. (See Figure 1.)

A third channel, the D channel, operates at 16kb/s. This channel always is active and sends call-control information for billing and other data, such as home security or energy-management information.

The total data rate for the two B channels plus one D channel of basic-rate ISDN service is 64 + 64 + 16 = 144kb/s.

Using the two B channels, a subscriber could engage in a voice telephone conversation while sending or receiving faxes, or participate in a slow-scan TV videoconference. Meanwhile, the background D channel could be sending home energy-management control data to the power company, and the central office would be monitoring usage of the two B channels, accumulating charges for each service provided.

## Primary-rate ISDN

For businesses that require more data bandwidth, the primary-rate services provide for some combination of 64kb/s B channels, plus one or two 64kb/s D channels. For example, a credit card clearing house might have 23 B channels and one D channel, for a data rate of 1.536Mb/s.

Note that the primary-rate D channels operate at 64kb/s because more control data must pass between the business subscriber and the central office.

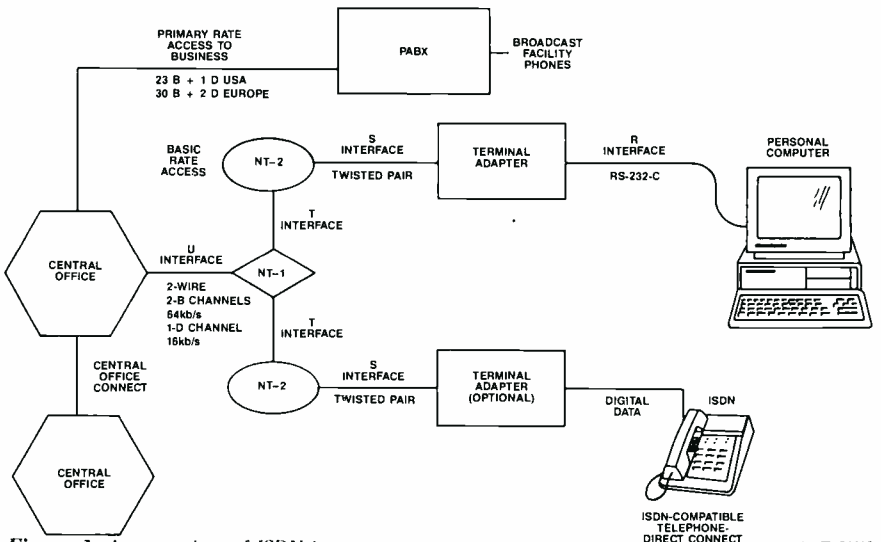



*Figure 1. An overview of ISDN interconnects.*

Kaufhold is a market development engineer for SGS-Thomson Microelectronics, Phoenix.

**Here are several key definitions for parts of ISDN. Please refer to the figure.**

- ***U interface***: The circuitry, wires and software used to transport data between the central office and the home (basic-rate) ISDN subscriber.
- ***Network terminator 1 (NT-1)***: The junction box and circuitry that terminate the U interface at the entrance of the subscriber's residence.
- ***T interface***: The circuitry, wires and software that connect between the NT-1 junction box and several NT-2 junctions in the home.
- ***Network terminator 2 (NT-2)***: The junction box and circuitry that connect between the T interfaces and the S interfaces.
- ***S interface***: The circuitry, wires and software that connect between each NT-2 and each terminal adapter. The equivalent of the twisted-pair wires and modular connectors of existing in-home telephone wiring.
- ***Terminal adapter***: The junction box and circuitry that connect between each S and R interface.
- ***R interface***: The circuitry, wiring and software that connect between each terminal adapter and the serial data port of an ISDN terminal.
- ***Terminal equipment (TE)***: Typically an RS-232-C serial port of a personal computer or all-digital telephone set.
- ***LAPB (link access protocol for B channels)***: The definition of each bit and byte of a B-channel signal. Can support digitized audio for voice or can be direct digital information such as a fax machine or personal computer.
- ***LAPD (link access protocol for D channels)***: The definition of each bit and byte of a D-channel signal. Supports passage of control information between subscriber and central office switching system, as well as background data such as home energy management or security system information. Similar to a typical local area network.

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**John Alan, KLOL-FM, Houston, TX:** "Unit works well; no add tional multipath, even in Houston!"

**Egidio Giani, WLR South East Radio, Waterford, Ireland:** "Nice overall stereo sound which does not *sound* enhanced when in fact it is."

**Unnamed Source (at user's request), Columbus, OH:** "Good job at a great price. Subtle intensity!"

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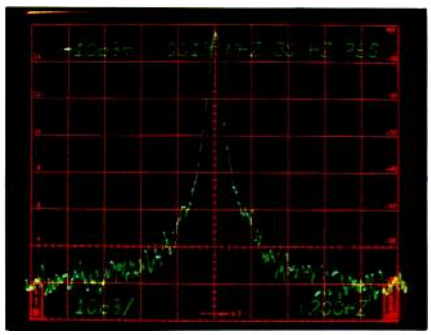
Part 2

# Troubleshooting

## CD troubleshooting

**By Brad Dick,**
**radio technical editor**



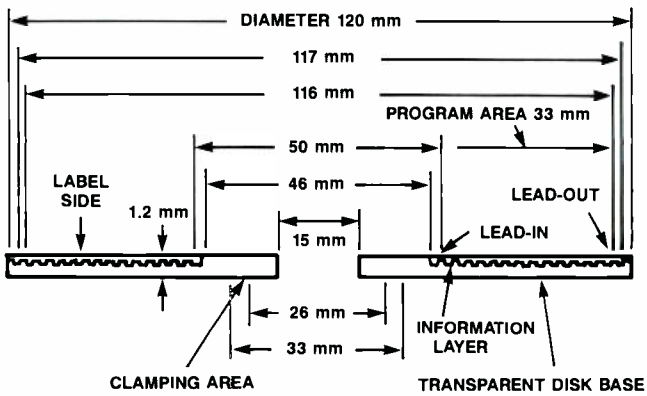



***Figure 1.*** *The mechanical specifications of a CD require extremely precise manufacturing. The 1.6μm-wide spiral track is more than 3.5 miles (5.7km) long.*

Before you open up that CD player for repair, stop and think. Are you sure the player is the problem? Many of the problems encountered with the use of CDs can be traced to the disc. Let's take a closer look at the construction of the compact disc.

The compact disc is a marvel in technology, capable of providing excellent performance. The price for such high quality is the requirement for extremely tight mechanical tolerances. Compared with the precision required for reliable CD reproduction, aligning an analog tape recorder is child's play.

Figure 1 shows some of the important dimensions of a CD. The overall diameter is 120mm (a little less than five inches). The program area occupies a band 33mm wide between diameters of 50mm and 116mm. If you include the lead-in and lead-out areas, this dimension increases to 35.5mm.

To appreciate how compactly the information is stored on the CD, consider the following. The track pitch, the distance between the centers of two adjacent tracks, is 1.6μm. The pits stamped in the disc have a width of 0.4μm to 0.5μm. To get an idea of how small a CD track really is, consider that a human hair is approximately 50 times larger than one CD track and that 60 CD tracks could fit in the space of a single LP groove.

Unlike a floppy or hard computer disk, the CD track is continuous from the inside to the outside. Using a bit of math, you can compute the approximate length of this track.

$$\frac{35.5 \times 1{,}000}{1.6} = 22{,}188 \text{ tracks}$$

This represents the number of tracks crossing the 35.5mm radius of the CD. The length of the track can be computed this way:

$$2 \times \pi \times \frac{117 \times 46}{2} \times \frac{1}{2} \times 22{,}188$$

= 5.7km (more than 3.5 miles)

It's difficult to imagine, but a CD may contain six billion bits of information.

### Manufacturing process

The CD manufacturing process is ultimately responsible for the quality available from the disc. Compact discs are manufactured through a process similar to that used for conventional records using injection-molding techniques.

A clear polycarbonate is injected under high pressure into a stamper, pressed and allowed to cool. The process takes from 10 to 15 seconds.

Occasionally, stress occurs in the manufacturing process, resulting in disc warp or *birefringence*. Disc warp can affect the player's tracking ability. As the pits move up and down with the warp, the focus servo has to change. Depending upon the type and severity of warp, the focus servo may not be able to follow the changes. The result is mistracking or lost data.

Birefringence is basically a measure of the disc's optical quality. If, for some reason, the disc's molecular structure is degraded, birefringence may increase. The result then can be a reduction or change in the intensity or angle of the laser beam received by the optical pickup. All discs have birefringence, but it's the level that is important to the manufacturer and the consumer.

After stamping, the disc is coated with a layer of aluminum 50nm to 100nm thick (50 to 100 billionths of a meter). This fragile coating then is protected with a layer of acrylic resin 30μm thick. The disc is allowed to cure under air or ultraviolet light. (Recall from last month's "Troubleshooting" that the cause of CD rot was suspected to be the use of air-dried lacquer.) The label is printed on the disc and cured again under UV light. The manufacturing process is now complete.

Each CD manufacturer now subjects the discs to various quality-control procedures. Despite these efforts, defective discs will reach the market. You may expect as few as 0.5% to perhaps 5% of the discs manufactured today to be defective when purchased. Considering the precision required to make a CD, that's really quite good.

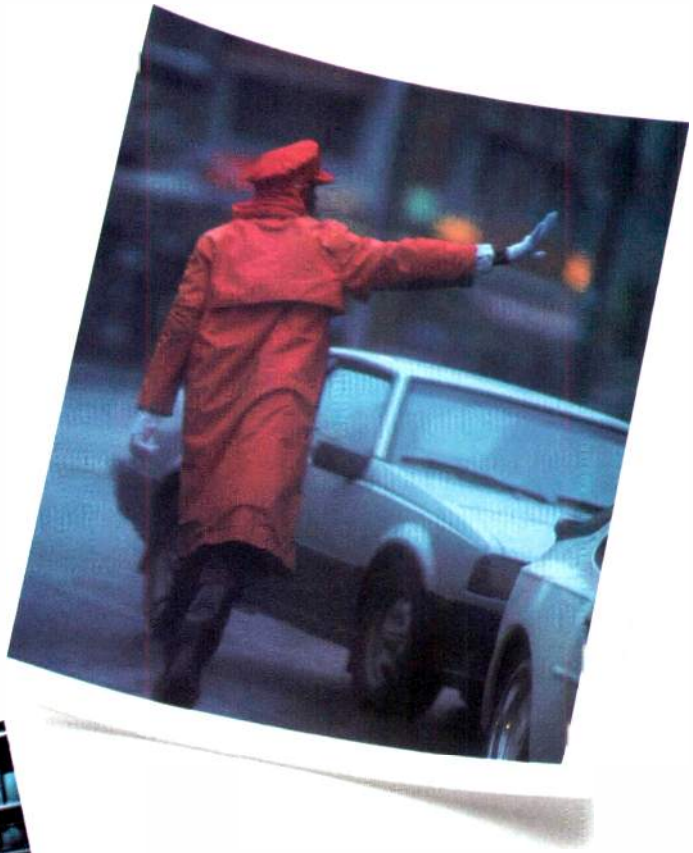
### Manufacturing defects

Because of the precision required, it's easy to see why even small variances in manufacturing or in player tolerances can cause problems. The CD manufacturer is responsible for maintaining the disc parameters as outlined in the standards, or the Sony/Philips "Red Book." This book contains the official CD manufacturing specifications.

We will discuss specific defects next month.

**Acknowledgment:** Appreciation is expressed to Laura Tyson, sales engineer, Denon America; Martin Ledford, quality control manager, Denon Digital Industries; and Dave C. Bowman, director of professional products, Studer Revox, for their help with this article.

# Directing Traffic In The Heart Of NYC.




# Directing Traffic In The Heart Of NBC.

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Part 4

# Management for engineers

## On being a leader

**By Brad Dick,**
**radio technical editor**

Building a management team is crucial to effective leadership, especially in technical management. Using the concept of management teams within a broadcast station makes more sense today than ever before. The concept is especially suited to the engineering department, where technology changes so rapidly. It's impossible for any engineer to be completely familiar with all the equipment used in a TV station. Even in the radio station, the complex digital hardware is treated as so many black boxes. No longer does the engineer have the luxury of knowing how each circuit works, much less have the skills to service every device.

The team is composed of several persons involved in completing similar tasks. If you're a supervisor, you would be the team leader of the people you supervise. In a smaller operation, your team may consist of your peers in other departments. In this case, the team leader would be the general manager or station manager.

### Building a team

Let's look at some reasons for using management teams within your station. Remember, even if you don't supervise a staff, the technique still can be employed. The difference is that you are a team member, not a team leader. Some of the reasons to use management teams are listed in Table 1.

In many situations, teams are determined by organizational structure. Look at your station's organizational chart. The major teams that can be developed will be obvious. The engineering department is an example of a team. Additional teams, such as maintenance, operations or remote crew teams, can be developed from this group if needed.

In every case, there will be people who want to be a part of the management team and others who couldn't care less. Even if some employees seem apathetic, it's important to invite all of them to participate. Respect the wishes of anyone who chooses not to take part.

In some situations, however, you might apply a bit of pressure if someone is hesitant to become a part of the team. One instance is when the team is small, and another is if someone who possesses critical knowledge or skills doesn't want to be a team member. In both cases, strongly encourage participation. It's important to help employees understand their value to the overall team effort. Usually, that kind of approach is sufficient to get them to cooperate. When they finally agree, be sure you acknowledge their input and advice. Ignoring the comments of reluctant team members is a sure-fire way to get them to stop participating.

### Manage the meetings

The effectiveness of the management team depends greatly on the skills of the individual members, especially the leader. It's up to the leader to ensure that certain support activities are carried out. Minutes must be taken at meetings and distributed to team members. If you are in charge of the meeting, be sure it starts and ends on time. Develop an agenda before the meeting. If time permits, have it distributed along with the meeting notice. This informs your team about the topics of discussion.

During the meeting, stick to the agenda. State your opinions and feelings honestly. Encourage similar participation by members. Use active listening techniques. There is perhaps no better way to ensure communication than to ask questions, then paraphrase the speaker's answer. If you didn't understand fully, the speaker can rephrase the answer or expand it so that you comprehend it.

Avoid disruptive communications and actions. Although the meetings should be pleasant, it is not a time to exchange the latest stories or jokes. The leader must move the meeting forward continually. When the group begins to go astray, direct it back to the agenda. Be sure the minutes convey the who, what and when of all job assignments.

**The team approach:**

- **brings individual members to more closely identify with goals of the organization.**
- **helps members develop a better understanding of the station's entire operation.**
- **provides members a feeling of greater control over their lives.**
- **satisfies the higher-level needs (Maslow's hierarchy of needs).**
- **breaks down status barriers among members.**
- **allows the leader to "exhibit by example" proper management behavior.**
- **results in well-thought-out decisions.**

***Table 1.*** *Using the management team approach in your station has many advantages, some of which are listed here. A significant benefit is that the process helps team members develop support for the entire operation.*

### Being a good leader

Being an effective management team leader is not easy. Good leaders must exhibit the following behavior:

- Avoid prestige-seeking.
- Encourage team members to become independent decision-makers.
- Become members, not simply group leaders.
- Refrain from making unilateral decisions at all costs.
- Find the appropriate balance between listening to others and contributing their own ideas.

One of the most difficult aspects of being a leader is to acknowledge the necessity of allowing the group to make decisions. For a lot of people who wear the title of supervisor or manager, it seems to go against the grain to let a group hammer out a decision. If you are a group leader who's having difficulty accepting this approach, consider this: the best way to ensure support is to involve others. If you don't seek the advice and counsel of your team members, you may be sawing off the branch you're sitting on.

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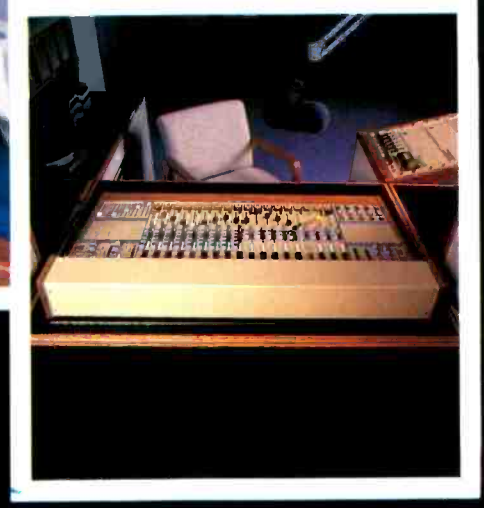

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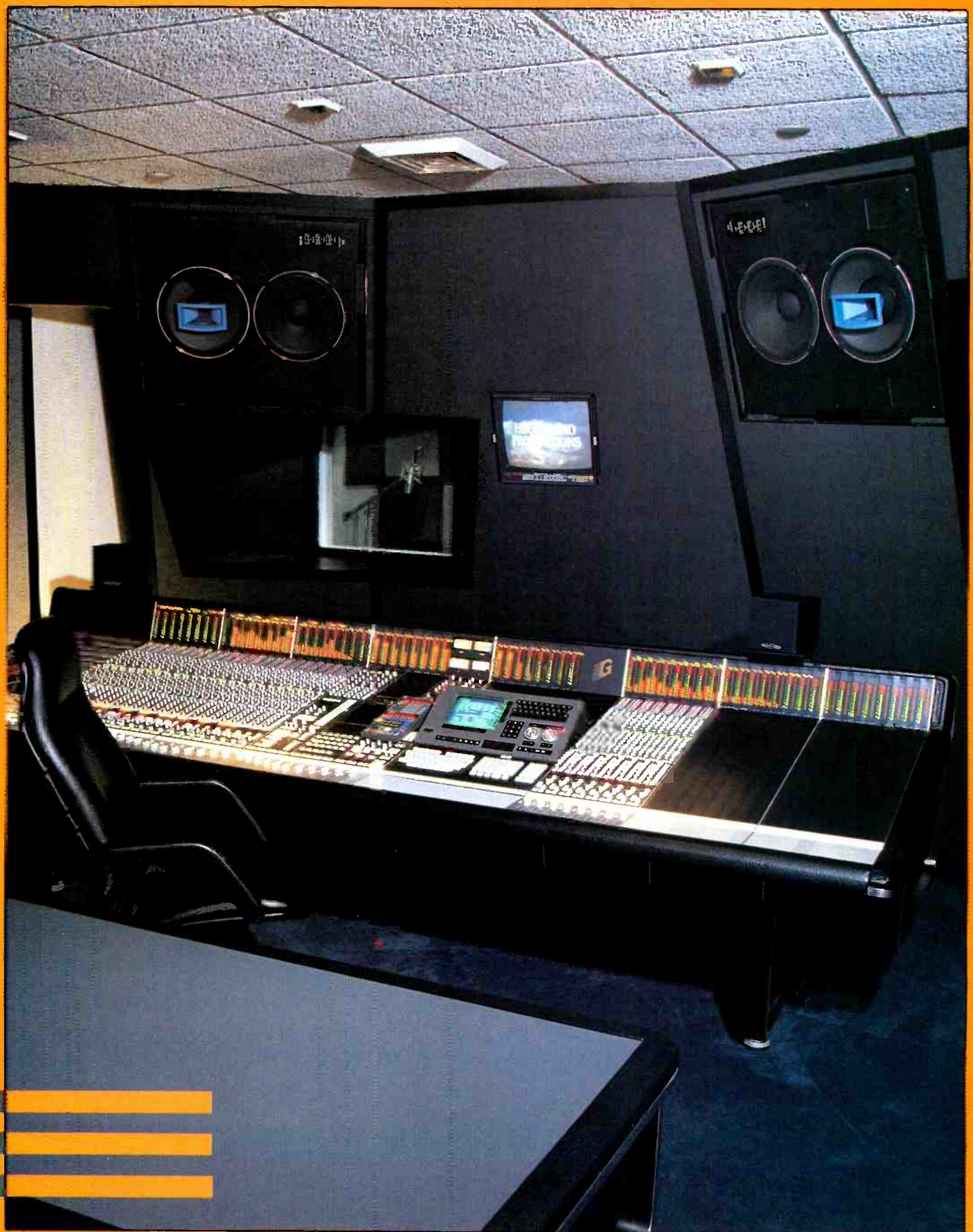

# Improving your audio product

**Consumers won't settle for mediocre audio. Neither should broadcasters.**

Today's audiences have access to a wide variety of alternative high-quality audio and video sources. Broadcasters must recognize that as the competition increases, the quality of the transmitted audio becomes even more important.

High-quality audio sources are available everywhere. The consumer now can buy a CD player for less than $150. Stereo TVs are available for about $250. Theater sound systems have been improved greatly in recent years. Audiences now expect high-quality audio to accompany the visual images. Ask yourself whether your listeners may be disappointed in what they hear from your station.

Consumers are more quality-conscious than ever before. This, combined with competing high-quality audio and video sources, requires the broadcaster to re-examine the entire broadcast audio chain. When was the last time you really considered the quality of your audio product? And I don't mean the last time you ran a proof of performance. Have you compared your broadcast signal against a CD or hi-fi stereo videotape recently?

The competition comes in many forms: CDs, videotapes, laserdiscs, movie theaters and cable. As your listeners experience the high quality available from many of these sources, they will come to expect your product to be equally good.

Unfortunately, many broadcasters are behind the times in this respect. Obsolete equipment or improper maintenance are frequent causes of poor-quality audio. Improving the quality of your audio need not be complex or even expensive.

When upgrading your station's audio, begin with the monitoring system. The first step in eliminating audio problems is being able to hear them. This month's feature section contains two articles on monitoring systems: "Control-Room Monitoring Systems" and "Using Close-Field Monitors." They will help you evaluate your current monitoring system and determine whether changes are needed.

A second important area within today's stations is signal routing and switching. Radio and TV stations have more sources and destinations than ever before. Properly routing these signals without degradation is critical to maintaining a high-quality audio signal. The feature article titled "Planning for an Audio Routing Switcher" will help you determine how to best take advantage of this technology.

A radio station's only product is sound. Television broadcasters know that without audio, video won't sell either. In today's broadcast environment, a smart, simple business plan is "Don't let your competition sound better than you." Broadcasting began with sound. Shouldn't we broadcasters be able to transmit it better than anyone else?

Brad Dick

**Brad Dick,**
**issue editor**

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# Control-room monitoring systems

By Brad Dick, technical editor

**Control-room monitor speakers must be carefully integrated into a room's overall design.**

The sophisticated audio equipment used in today's broadcast control rooms is capable of excellent performance. Low distortion, wide frequency response and reliable operation are not only common, but expected. Can you say the same thing about your monitoring system?

Sometimes an engineer buys speakers, then simply hangs them on the wall or sets them on a shelf in front of the console. The assumption is that the overall acoustical quality will be determined by the speaker. The effects of improper mounting or poor room acoustics have not been considered.

However, even a superior-quality speaker system cannot perform properly when it is mounted incorrectly or used in an inferior acoustical environment. It's important to recognize that the speaker system and the room work together as a *system*. The integration of the speaker into the control room should be planned from the beginning — not treated as an afterthought.

### Studio design

The design of broadcast and recording control rooms often is viewed as occult rather than scientific. Despite the advances in measurement techniques and improved tools with which to objectively evaluate and predict acoustical performance, the ultimate test is: *Do the room and monitoring system sound good?*

It hasn't been that many years since it was discovered that the acoustics have as much to do with the sound in a room as the quality of the speakers used. A lot of engineers have spent a lot of money on high-quality speakers only to be disappointed with the results. Why? Because they failed to consider the room's effect on the produced sound. They learned the hard way that room acoustics play a critical role in creating a high-quality monitoring environment.

### Hidden flaws

Any set of control-room speakers operates as part of a system that includes the acoustics of the room. A good-sounding control room even can affect the on-air sound of your station. If the monitoring system is not flat or improperly equalized, the DJs may mistakenly think that what they hear is identical to what the listener is hearing.

An even bigger problem exists when a monitoring system is loaded with distortion. The distortion may not be noticeable, yet the DJs may feel tired or fatigued after being in the room for a time. It doesn't have to be severe clipping distortion to cause this effect. Such problems as IM, TIM or THD can produce acoustical environments in which people find it fatiguing to work. Low-frequency rumble may not be audible, but it may affect an operator's performance.

These types of problems are especially troublesome because no one usually realizes what's happening. What you may notice is that the announcers are tired or irritable. About the only way to identify these problems is through testing. Unfortunately, few stations take the time or have the equipment and expertise to do so.

There are some inexpensive ways to help ensure that your monitoring environment is as good as possible. In most cases, the key to success is a little planning. Let's look at some basic elements that should be considered for a high-quality acoustical environment.

### Background noise

The first physical parameter you must consider when looking at a control room or studio is background noise. If the ambient noise is too high, no amount of post-signal conditioning can remedy the problem. If the air conditioner rumbles, it can affect everything you do in the studio.

Professional studios strive for a background noise level ranging from 25dBA to 40dBA. It's easy to measure the noise level in your studio. If you don't own a sound-level meter, borrow or rent one. Don't depend on your ears to detect the noise. Although low frequencies are difficult to hear, they can affect a room's overall performance. Use a sound meter, real-time analyzer (RTA) or TEF to measure the noise level.

A common cause of increased background noise is the air handler. Over time, the air handler belts become loose and begin to vibrate. Bearings wear and also cause vibration. These changes can increase the amount of background noise in your studio.

The only way to know whether this is happening is to make noise measurements on a regular basis. Noise has a habit of increasing over time, but small increases usually go unnoticed. In fact, you may not become aware of the additional noise until someone less familiar with your room mentions it.

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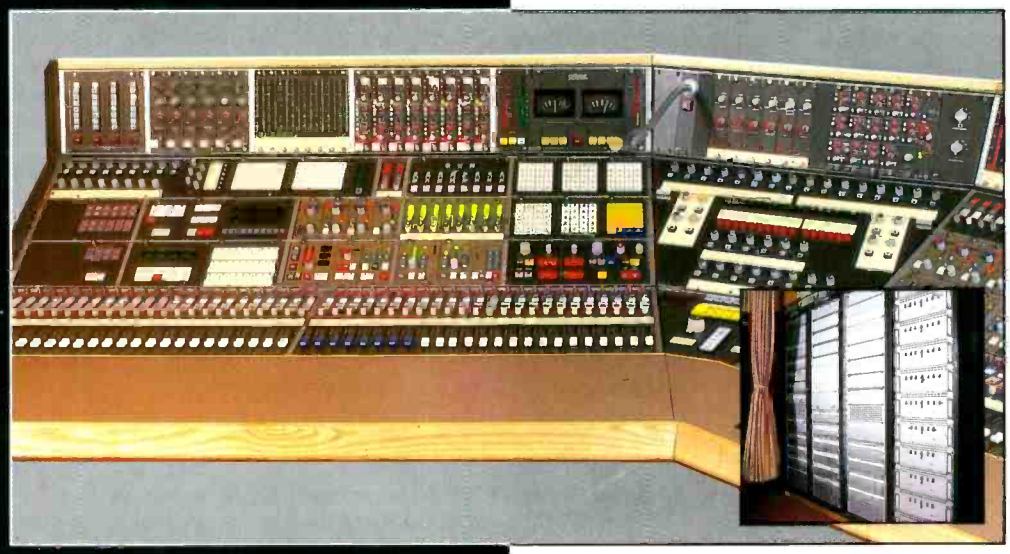

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### Interactive system

Once you know the room is quiet, you still must consider other critical elements before installing the monitoring speakers. Broadcast engineers used to think that the key to a good monitoring environment was a dead (reflectionless) room. After all, a dead room would eliminate troublesome reflections, thereby allowing the speakers to produce optimum sound, right?

That notion was far from correct, as shown by the design principles used in today's studios. A good acoustical monitoring environment should not add coloration or other effects to the sound produced by the speakers. That doesn't mean you need a reflectionless room.

Reflections are only one of the important acoustical phenomena to consider. Complete removal of the room's influence is impossible. Early attempts at removing the room's effects centered on different ways to control reflections. Combinations of absorbent panels, curved surfaces and traps were tried. Each of these techniques helped, but was not totally successful. If you want to get an idea of how these treatments were used, find a 15- or 20-year-old book on acoustics. You'll probably see several photographs of early attempts at reflection control, most of which required much more floor space than typically available today.

Despite the advances in technology, controversy still rages on how to best control these reflections. Combinations of live (reflective) and dead (reflectionless) surfaces often are used. The difference in the acoustical quality depends greatly on how effectively and correctly both types of surfaces are applied.

### Uniform distribution

The sound system should be tuned to provide a broad sound distribution. In other words, you want the sound to be evenly distributed throughout the room. In one studio, the monitoring system was optimized for only one spot. If you moved three feet in any direction, significant changes in the sound occurred.

It's impossible to provide optimum monitoring conditions in every area of the room, but be sure that the important locations are covered. This may mean that only the mixing and producer positions have the best sound. Even so, strive to make these areas as wide as possible.

One good way to check the room's performance is with pink noise and a ⅓-octave RTA. You can use other devices, some much more sophisticated, but the RTA will give you an idea of what's going on in the room.

The amplitude of pink noise decreases 3dB per octave. That's what you want, because on a ⅓-octave RTA, the result appears as equal SPL in each band.

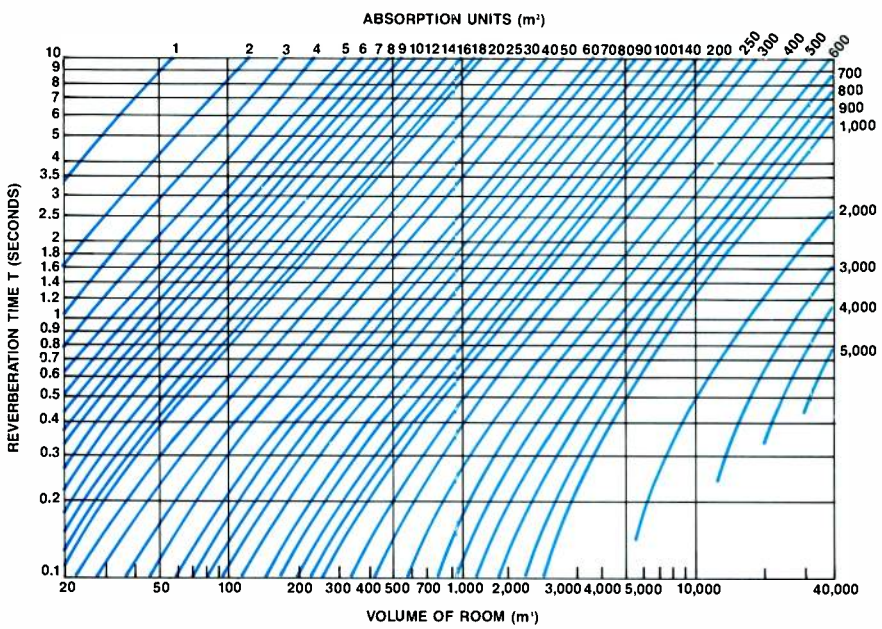


*Figure 1. Relationship between RT, volume and absorption. The formula for developing RT is described in the text.*

Place the test microphone at the primary listening positions, and measure the result. What you'll probably find is that the high-frequency distribution is not uniform. These frequencies are more directional and more likely to be unevenly distributed throughout the room. Make a note of the results because the evaluation process has just begun.

### Reverberation time

Reverberation time is a significant parameter that is often overlooked. It is the amount of time it takes for the sound to decay 60dB. If a control room has too long a reverberation time, the background noise level increases. Speech becomes less intelligible, and music sounds confused and disordered.

A dead room has an extremely short reverberation time. Background noise is reduced, but speech sounds muffled. Music takes on a thin or flat sound.

The primary controllers of reverberation time (RT) are room volume and the amount of absorbent material used. The formula for calculating RT is:

$$\frac{0.161V}{A}$$

V = volume in $m^3$
A = total room absorption in $m^2$

The absorption properties of different materials vary widely with frequency. This means that RT is frequency-dependent. In most control rooms, the low frequencies are less well-absorbed, and the reverberation times are longer.

Calculating the total room absorption may not be as difficult as it at first appears. Armed with a good reference book, you should be able to get approximate absorption coefficients for the various materials used on the walls, ceilings and floors. Plug the values into the equation, and develop an estimated value. The graph in Figure 1 will help you to estimate your studio RT. Some consultants suggest an RT design target of 0.25s for broadcast studios.

It may be easier to use a sound meter to measure RT. The monitors are driven with either white or pink noise or a burst signal. The sound level must be high enough to allow for significant delay.

The sound-level meter measures the decaying SPL of the sound field in the control room. If you want to know the RT at different frequencies, an octave or ⅓-octave filter can be used.

If a burst is used, it may not be possible to get RT directly. It can be developed by using the measured information from the sound meter and some calculations. An advantage of the burst method is that faster, and perhaps more accurate, results are possible than with the noise/cutoff method.

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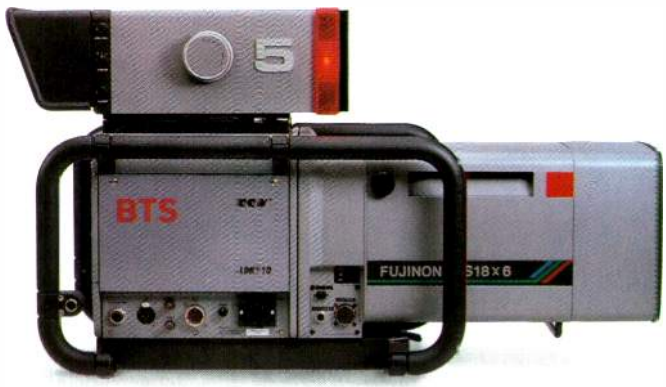


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### Case example

One example of the effect of room acoustics on a control room is shown in Figure 2. The upper graph is the drawing from an oscilloscope showing the decay of a 92.9Hz tone in a small (8′ ×8′ ×9.5′) control room. The sound decreases at an exponential rate. This means the SPL decreases at a constant rate. The middle graph shows the same display with an excitation tone of 99.7Hz. This is the type of decay that would be expected in a room of this size.

The room has two resonant modes of 92.8Hz and 99.8Hz (close to the excitation frequencies). Even so, when played separately, the two tones do not excite the nodes, and the sound decays properly.

However, when a 96.7Hz tone is used, each room mode is excited and decays at its own characteristic rate. The resulting decay produces a beat that sounds like a vibrato when heard in the room. Imagine

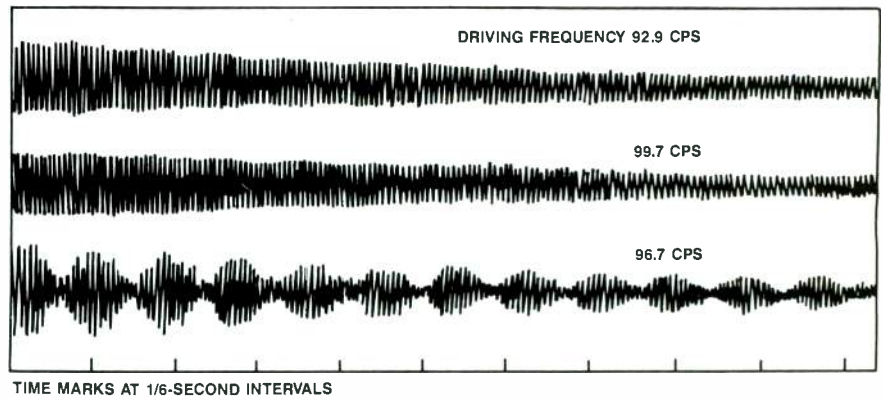


***Figure 2.*** *The decay of sound pressure in a control room. The upper two graphs show normal exponential decay. The lower graph shows what happens when two room modes are excited by a driving frequency. The resulting beat creates a vibrato effect within the listening environment.*

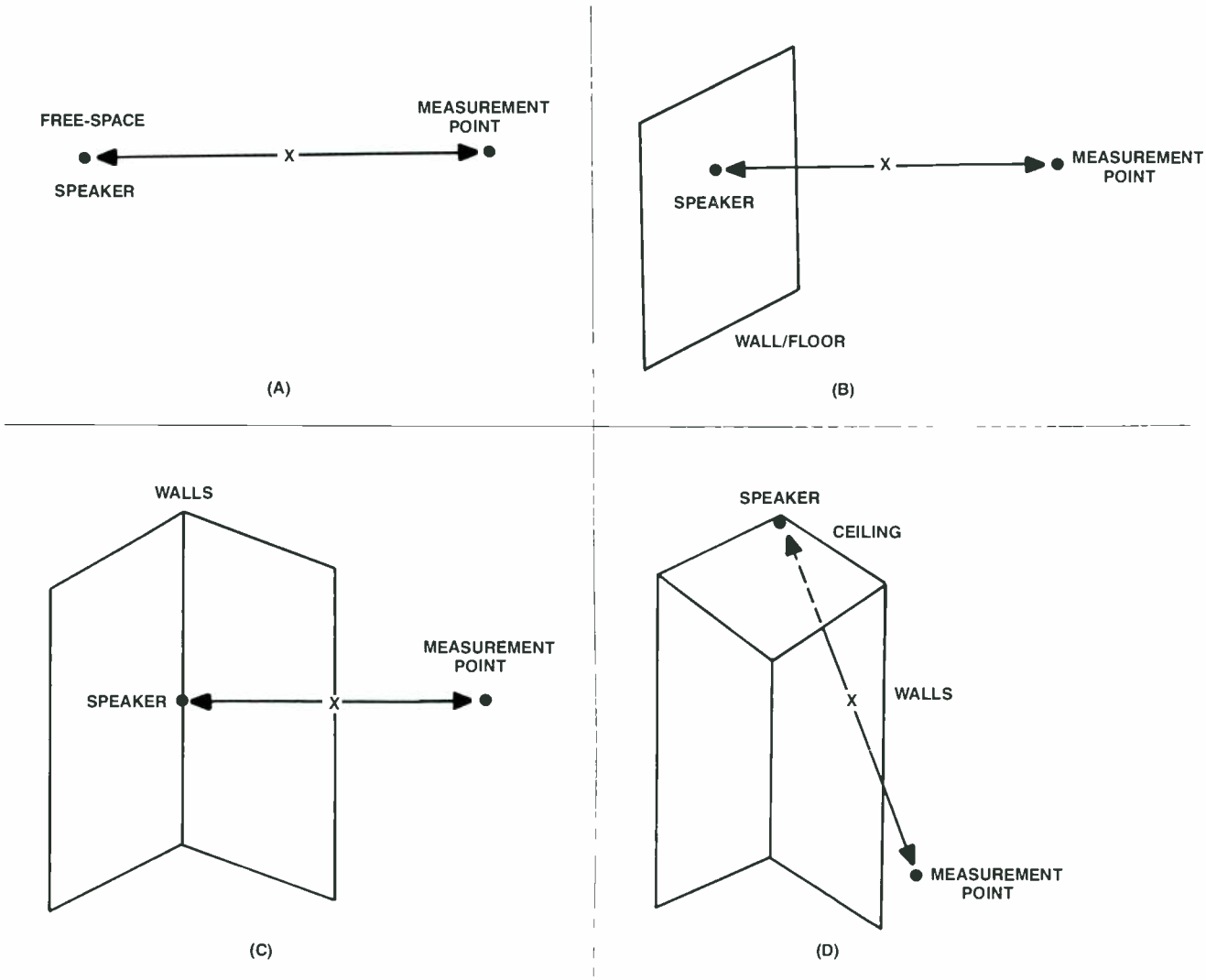


***Figure 3.*** *Boundary effect. In (a), the level of the point-source acoustical radiator in free space is measured at a point X. Placing a relatively large boundary behind the radiator (b) increases the SPL by 3dB (half-space loading). In (c), two boundaries perpendicular to each other result in a 6dB increase in SPL. Three perpendicular boundaries (d) produce a 9dB increase in SPL.*

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how music might sound in such an environment.

Solving such a problem requires a sophisticated knowledge of acoustics and good test equipment. The example does point out how important studio design is to the overall sound of a control room. It also shows that, without adequate test equipment and expertise, problems may go undetected.

### Surface interaction

Before continuing the examination of the room's acoustics, let's review why a speaker operates as part of a system, and not alone. Figure 3(a) shows a speaker mounted in a free space. Assume the measured sound pressure level is 0dB SPL at a reference point X. Next, place the speaker against a large, flat surface, such as a wall or floor. Note that the sound pressure level, measured at the same distance, increases by 3dB. See Figure 3(b).

In Figure 3(c), the omnidirectional sound source (speaker) is placed in the corner of two perpendicular boundaries, as would be the case with two walls. The sound pressure level is now 6dB above the free-space level. Then the speaker is mounted at the junction of two walls and a ceiling, as shown in Figure 3(d). The sound pressure level is now 9dB greater than originally measured in the free-space environment. Why?

In each case in which an additional boundary is added, more of the omnidirectional sound is folded back toward the measuring point. In Figure 3(a), the single boundary prohibits the speaker from radiating its power into the entire environment. The speaker's power is confined in half as much space. This is called *half-space loading*. Continuing the process, the ceiling-corner location results in 8th-space loading and increases the SPL by 9dB.

The loading is, in theory, present at all frequencies. However, speaker design and physics result in the low frequencies being more omnidirectional than the high frequencies. The higher frequencies tend to be more direct, primarily because the speakers themselves rely on cones or horn drivers. The boundaries, therefore, have less of an effect on the high frequencies.

This causes the boundary effect to be frequency-dependent. You can detect the effect simply by placing a speaker against a wall, then moving it several feet away from the wall. Note how the low frequencies appear to decrease as the speaker is moved away from the reflecting surface (wall). If you remain in relatively the same location, you may not notice any change in the high frequencies.

A related problem occurs when speakers are mounted next to walls and ceilings. Figure 4 shows a speaker mounted next to a wall. As the sounds reflect from the wall (or ceiling), they combine with the sound coming from the front of the speaker. Often, the result is phase cancellation, producing a comb-filter effect. Figure 5 shows the resulting frequency response of the speaker mounted against the wall.

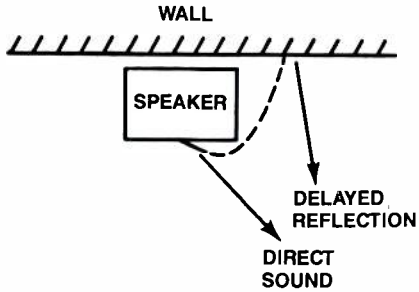



***Figure 4.*** *Placing a speaker against a wall allows reflected sound to combine with the front-radiated sound. The phase cancellations that result produce a comb-filter effect.*

Two solutions are to either locate the speakers near the monitoring position (close-field monitoring) or isolate the speaker from the effects of the walls. The first technique is described in detail in the article, "Using Close-Field Monitors," page 42.

With the second technique, the speakers are flush-mounted and isolated within the control-room wall. This isolates them from resonances and reflections that the wall might produce and reduces problem-causing low-frequency reflections. If you adopt this method, be sure to properly isolate the speakers from the wall with damping materials.

### Room equalization

A monitoring system often benefits from equalization. Although the process is called *room equalization*, it's really little more than a form of frequency predistortion. An equalizer is used to compensate for speaker and room deficiencies and interactions. Although the process appears simple, room equalization is a complex and difficult process, especially for the first-timer.

The solid line in Figure 6 shows the frequency response for a speaker system when first mounted in a control room. Notice the low-frequency bump at about 150Hz. Note also the rapid rolloff in the high end and irregular response pattern.

The key here proved to be moving the speaker away from the wall in combination with the use of an equalizer. The dotted line in Figure 6 shows the response after both approaches were implemented. This example points out the occasional need to combine techniques to obtain satisfactory performance.

Room equalization involves both electronic and acoustical factors. If the measuring microphone happens to be in the null of a standing wave pattern when the measurement is made, the results will be invalid. Move the microphone a short distance, and repeat the test.

Engineers often make at least three common mistakes when trying to equalize control rooms for the first time. The first is trying for perfect results. Be cautious about trying to compensate for large fluctuations in response with the equalizer. The cause for a deep notch might be driver misalignment, and no amount of equalization will help. Be sure you are compensating for room anomalies, not speaker problems.

The second common mistake is using excessive amounts of boost to solve frequency-response problems. In some cases, every channel of the graphic equalizer is in the boost range before the engineer finally gives up. Boosting frequencies is not a natural acoustical phenomenon. Careful analysis may show a significant peak to be caused by a speaker, rather than room, problem. You are usually far better off trying to use small amounts of cut to bring the room into balance.

Measure the room's response several times before you start, and average the results. Some RTAs will perform this function for you. If the individual test runs are not similar, move the microphone and try

*Continued on page 36*

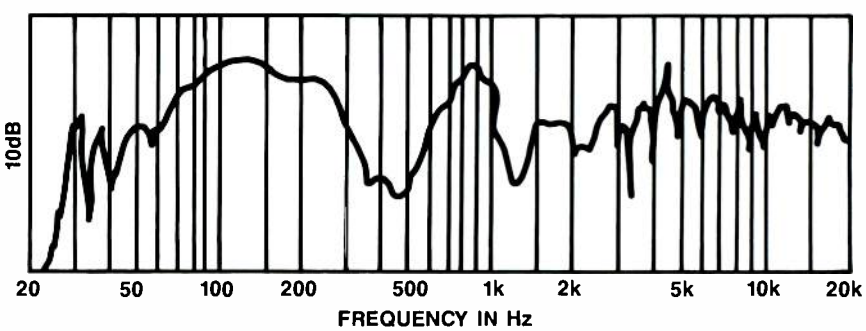
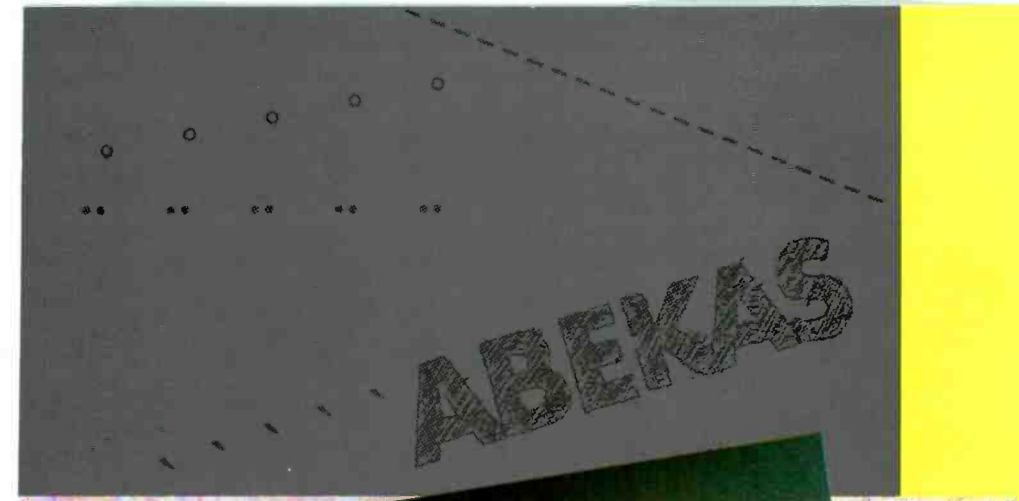
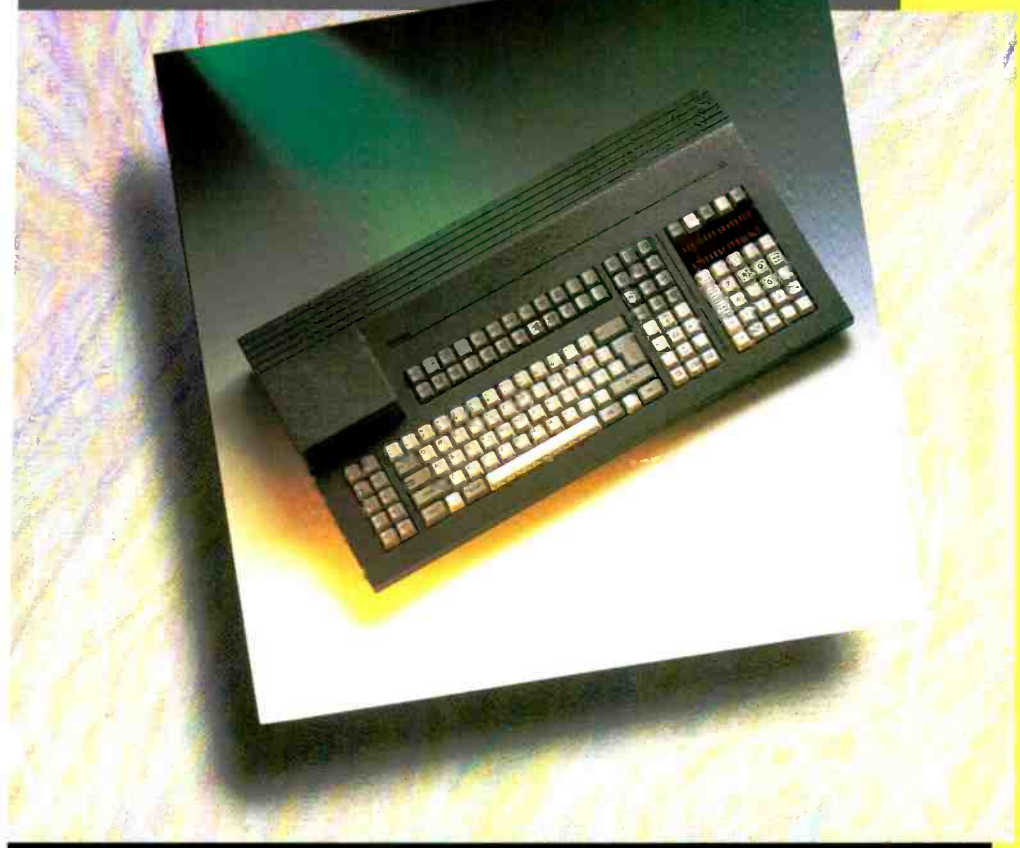



***Figure 5.*** *A graph of the frequency response that results when a speaker is mounted on a wall. The irregular frequency response was produced by comb-filtering that resulted from wall-reflected sound combining with sound radiating from the front of the speaker.*



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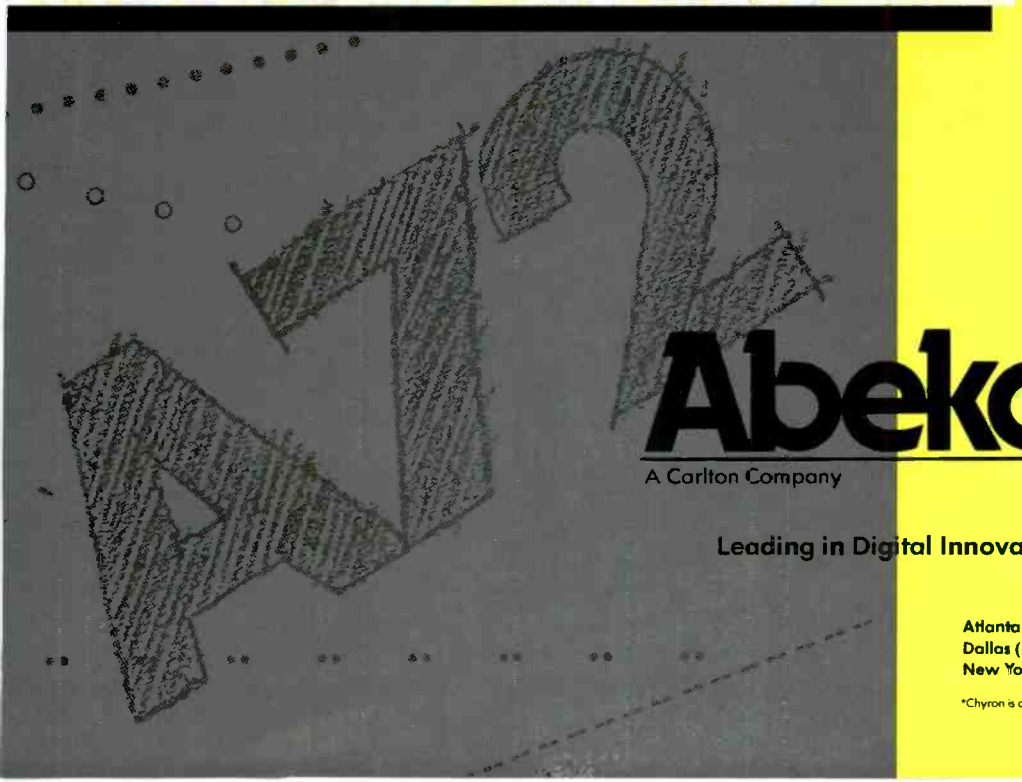


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*Continued from page 32*

again. Before you quit, check the equalized response in several locations. Then, listen to the system. You may have to strike a balance between what appears correct on the RTA and what your ears tell you.

### Speaker selection

So, what if you're faced with installing a new monitoring system? First, define your particular requirements. Don't plan on using a small bookshelf system to power a large studio. Conversely, the typical radio studio probably doesn't need a monster-sized set of monitors.

Second, look for a low-distortion, acoustically flat-response speaker system. Buy the most acoustically transparent system you can afford. Remember, no amount of acoustical treatment, equalization or post-installation fixes can make an inferior speaker system sound good.

Third, don't skimp on the amplifier. You stand a better chance of creating a low-distortion, low-noise system if the amp is conservatively oversized for the speakers.

If you really need top-notch sound, consult with someone who does this kind of work for a living. Don't be afraid to seek outside expertise. The resulting sound may be better than you could accomplish, and it will almost certainly be achieved in less time.

**Bibliography**

Davis, Gary, and Ralph Jones. "Sound Reinforcement Handbook." Yamaha.

Dick, Brad. "Inside Monitor Loudspeakers." **Broadcast Engineering**, June 1987.

Knudsen, Vern O., and Cyril M. Harris. "Acoustical Designing in Architecture." American Institute of Physics for the Acoustical Society of America.

Mapp, Peter, and Gaston Goossens. "The Audio System Designer Technical Reference." Klark-Teknik.

Weidmann, Adrian. "Acoustic Measurement Techniques." *Recording Engineer/Producer*, May 1989.

**Acknowledgment:** Appreciation is expressed to Bill Calma, sales manager, Tannoy, for his help with this article.

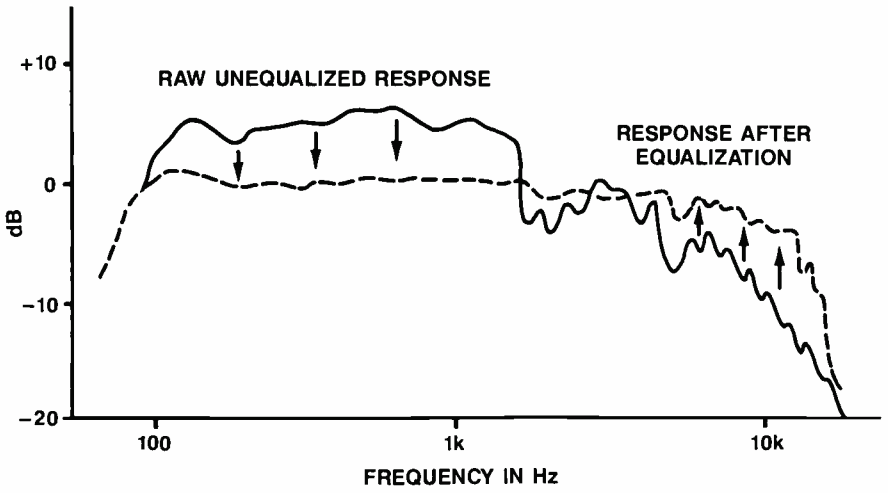


***Figure 6.*** *The solid line represents the frequency response when a speaker is installed on a control-room wall. The dotted line shows the response after the speaker is moved to a different position and room equalization has taken place.*

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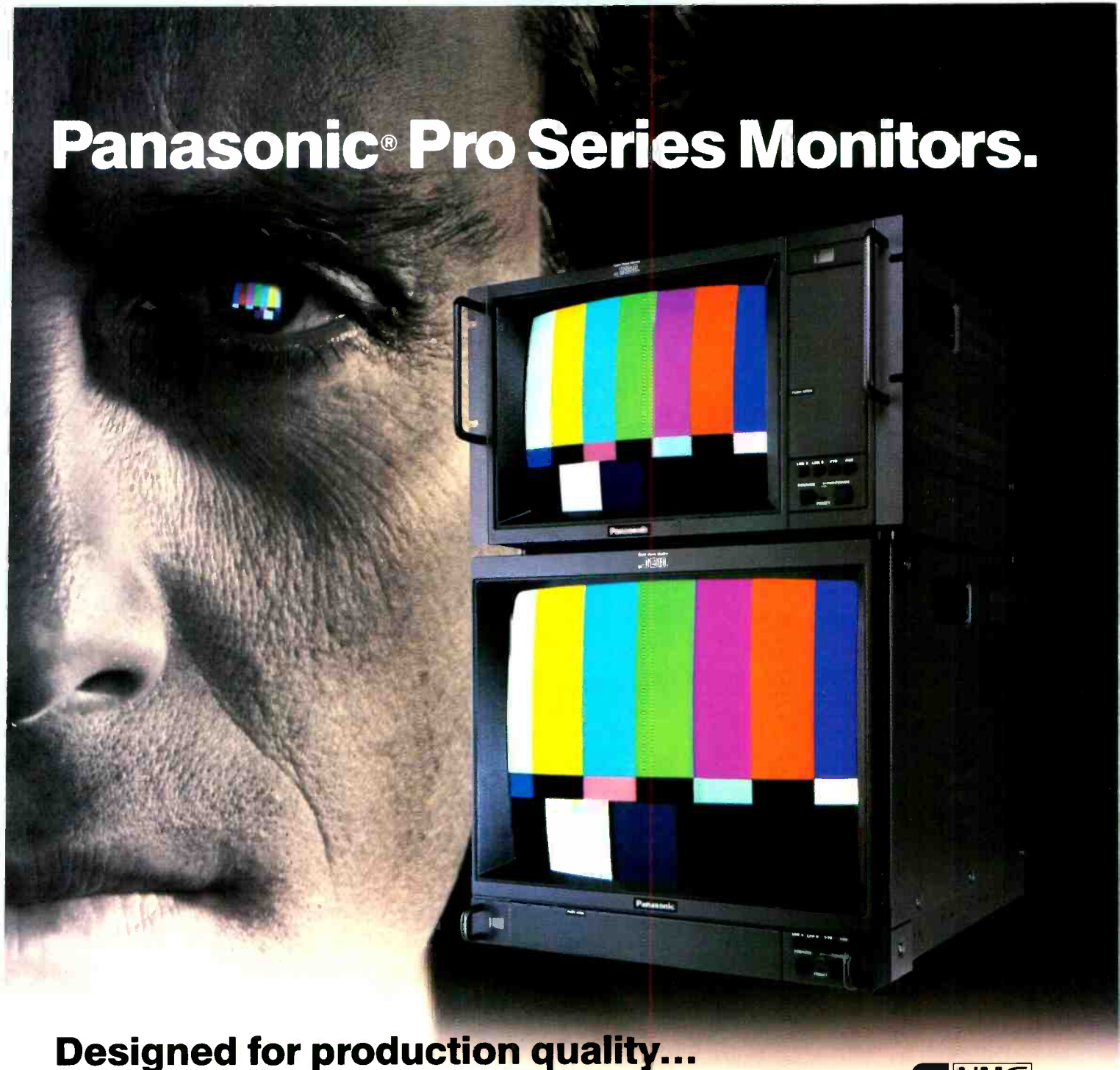

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# Using close-field monitors

By Jeff Blenkinsopp

**Small speakers can provide big advantages in studio monitoring.**

Photographs of contemporary recording studio control rooms usually show at least one pair of small speakers perched on the top of the console. These small speakers are commonly referred to as *close-field* monitors. Although they may look as if they were placed there as an afterthought, the speakers are often the primary listening source.

Close-field monitoring is not a new phenomenon, but it is a changing one. With this evolution, engineers are re-evaluating the strengths and weaknesses of this monitoring technique.

### Reference standard

In TV production or recording studios, where a variety of people will be working, a standard listening reference is a necessity. Without such a reference, it is difficult to accurately evaluate the sound. That audio reference often is provided by the small close-field monitor speakers sitting on the console.

Close-field monitoring requires a speaker that can be positioned and selected by the listener and a listening point that is within the direct-sound field. Close-field monitoring reduces the effect of the room's acoustical anomalies (such as the boundary effect, resonances and reflections). The closer you are to the speakers, the more direct sound you hear, and the less the reverberant field affects the sound.

When wearing headphones, you hear only the direct sound. The room you are listening in has no effect on the sound. In a sense, it is this headphone effect that you are trying to achieve by having the speakers close to the listener.

It's important that the listener have control of the positioning. This may seem obvious, but it is a unique factor because the monitor selection and positioning can be controlled by the engineer — a detail that is often overlooked.

The acoustical power generated by the speakers also should be optimized so the room is not driven. Again, the desire is to reduce the effect of room anomalies and also to reduce the speaker distortion that can occur at high-output levels.

Speaker size also is a factor. If the monitors are too large, they become impractical, affecting the sight lines or interfering with the direct sound from the large monitors. Small speakers allow engineers and producers to easily bring in whatever reference system they think is most accurate for their style. The flexibility to bring in your own electro-acoustic ears is making close-field even more popular. The ability to reference any job or environment to your known standard is a great advantage.

### Limitations

Despite the advantages offered by close-field monitoring, there are some drawbacks. The biggest problems are the lack of bass and undistorted acoustical power. Getting enough low end out of a small monitor cabinet is difficult, and if you don't know what is happening in those frequencies, your whole project could be ruined. For these reasons, large monitors are still important in the control room.

Also, getting the feel of the music is important, and sometimes, close-field monitors just will not give you that. A good example might be where you're recording a heavy-metal band or remixing a dance single. For these situations, rely on the main studio monitors.

### Mounting and location

Close-field monitors usually are free-standing and are not mounted in soffits or against walls. However, even placing the monitors on the console can affect their sound. The acoustical coupling between the speaker and the console should be taken into account. The coupling may cause a slight increase in the low-end response, which often is desirable. Placing the speakers on small risers will reduce the effect.

As with the main monitors, the high frequencies will tend to splash off the console, causing coloration and affecting the stereo image. The degree to which this is a problem depends on the shape of the console and the position of the speakers. This is why it's important that the speakers can be repositioned to reduce the number of high-frequency reflections off the console.

The monitors should be matched pairs, and the manufacturers often mark the cabinets "left" and "right." If a component in one cabinet is destroyed, it is best to replace the same part in both cabinets simultaneously. The remaining good part can be kept as an emergency replacement.

It is important to follow this one

Blenkinsopp, an audio consultant in New York, is currently involved in the design of a new concept in musical instrument speaker cabinets.

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guideline: The distance between the speakers should equal the distance from slightly behind the listener's head to the center of the cabinet. (See Figure 1.) The speakers should be the same height or slightly higher than the listener's ears. (When the listener is seated, that's a height of approximately 42 inches.)

**Wiring, powering and protection**

Don't skimp on the cable just because the speakers are small. Care should be taken that the cable termination at the cabinet is satisfactory. If the connector hole is too small for the wire to go through, don't cut the wire down. Instead, tin it and wrap it around the terminal. Spade adapters also can be used to fit around the binding posts.

Use high-quality amplifiers with sufficient headroom for transients. If the transient drives the amplifier into clipping, the speaker may be destroyed. For example, a 250W amplifier connected to a 50W cabinet often is preferable to a 50W amplifier that's operating continuously at or near its rated output.

The speakers used for close-field monitoring usually cannot handle a large power input. Yet, because it's common to connect them to high-power amplifiers,

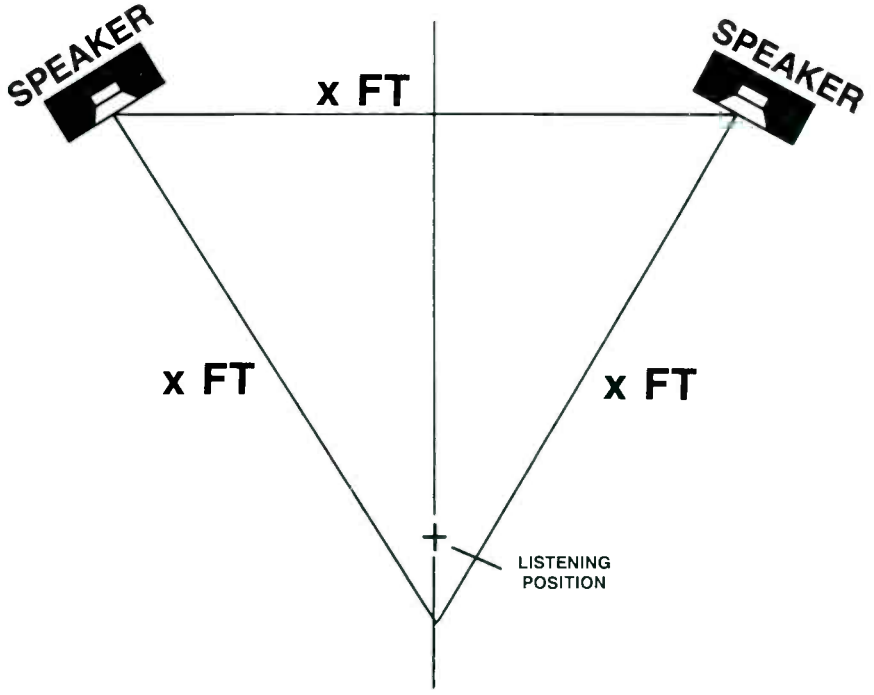
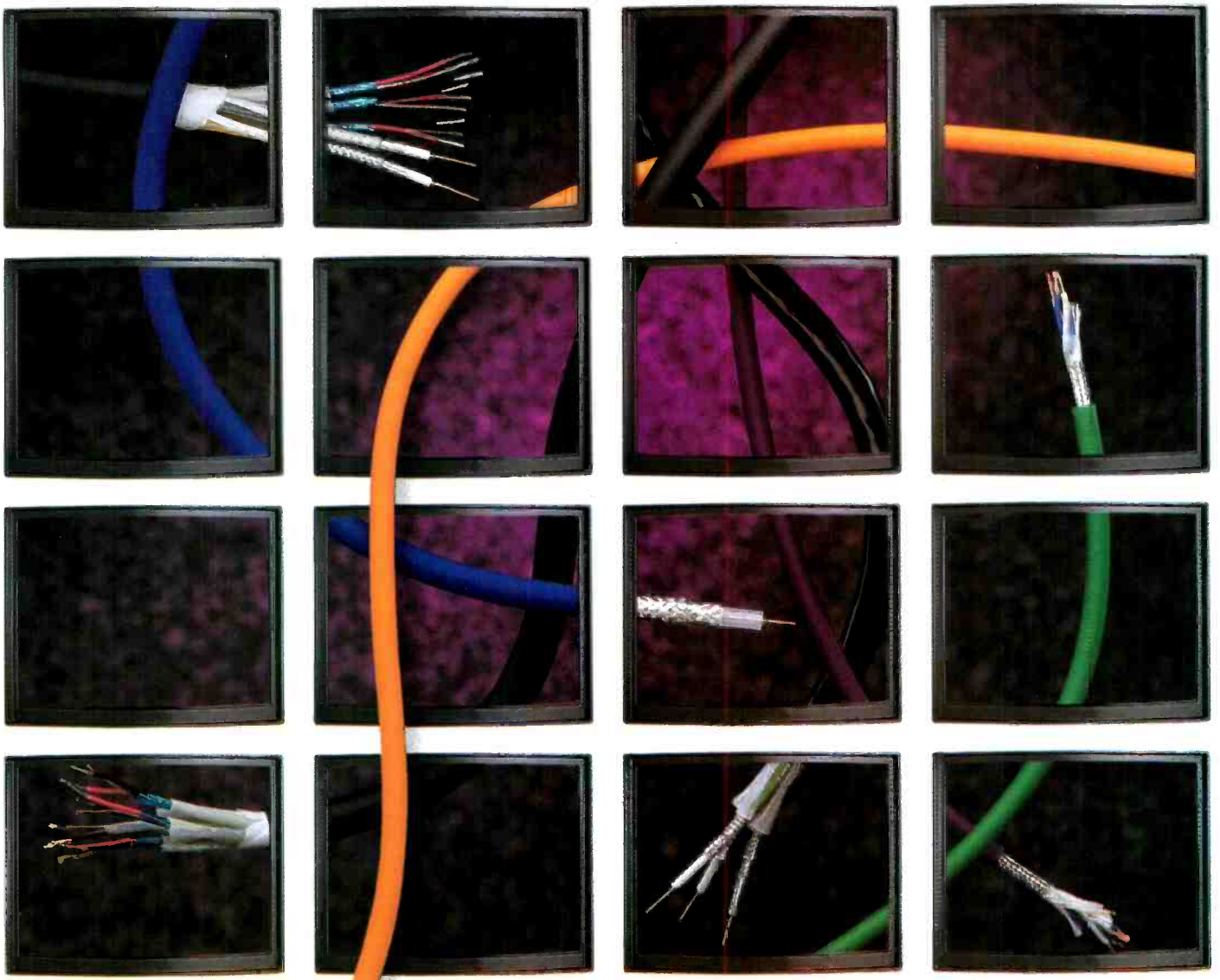



***Figure 1.*** *Close-field monitoring requires careful positioning of the speakers. Fortunately, easy placement is one of the advantages of using small speakers.*



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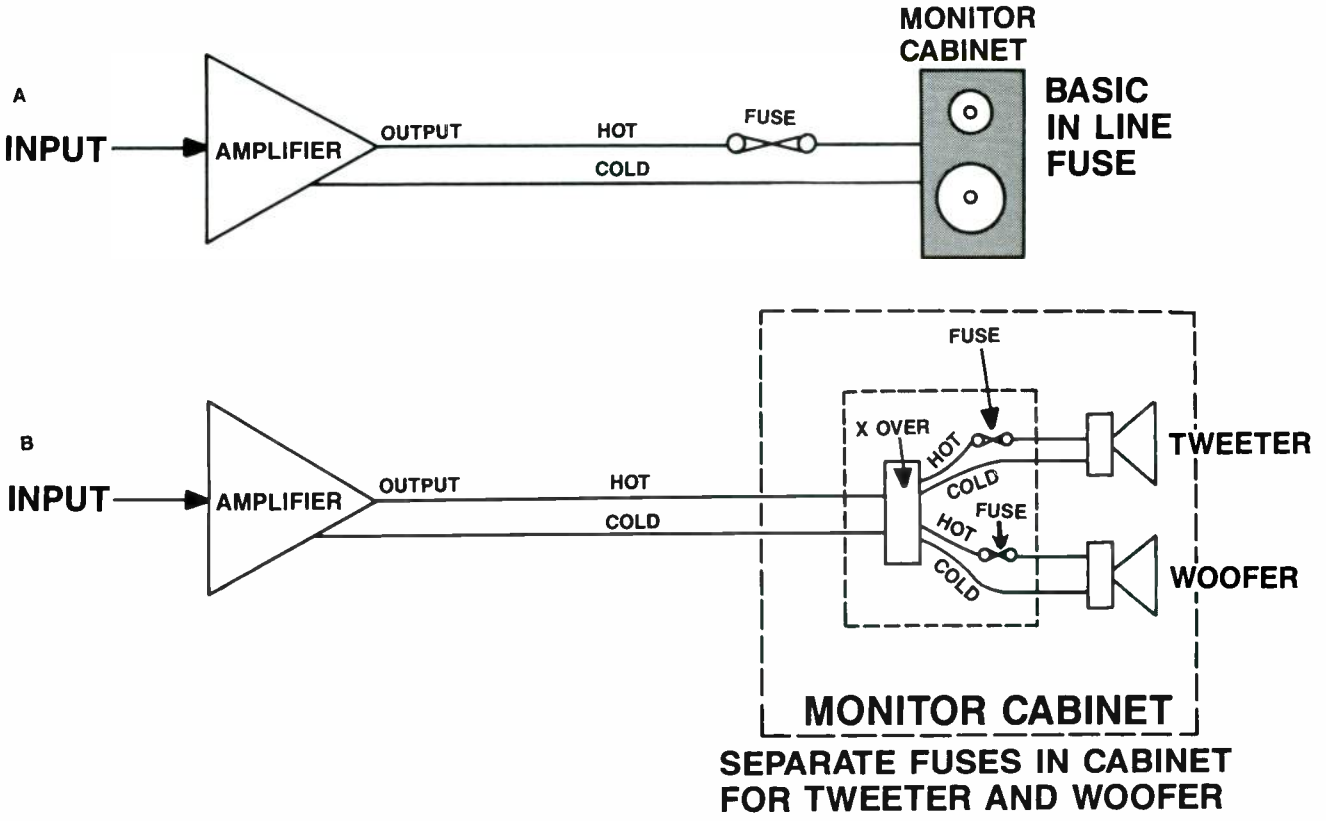


***Figure 2.*** *It's important to protect the speakers from overload damage. In (a), a single fuse protects the system. In (b), separate fuses are used for the tweeter and woofer.*

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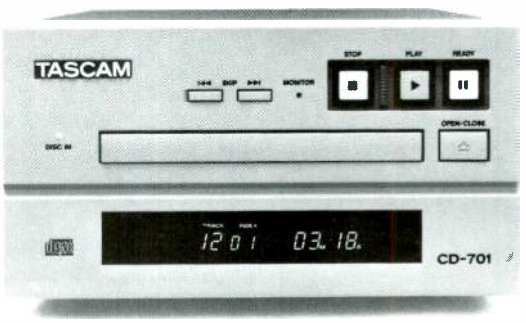




*Radio Technology* Component Grand Prix '88, CD Division, *Stereo Sound* Component of the Year (1988) & Best Buy (1988)

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the possibility of blowing the monitors is real. The speakers can be protected either by a fuse or electronic switch. The most common protection method is an in-line fuse located between the amplifier and the monitor, as shown in Figure 2(a).

The fuse should be a fast-blow type, AG series. The easiest way to determine the fuse rating is by trial and error. Start by installing a low-value fuse (typically 1A), then turn up the gain. If the fuse blows before the listening level is comfortable, replace it with the next higher value. Continue replacing fuses until you have enough level, but the fuse doesn't blow. This may sound unscientific, but it works.

Some studios install the fuses inside the cabinets. The woofers and tweeters can be fused separately, as shown in Figure 2(b). Mounting the fuse in the cabinet causes no problems if the cabinet is sealed around the fuse holders and the correct fuse values are used.

The type of fuseholder used also is important. The two basic types of fuseholders are screw-top and quick release. The screw-top fuses seem to be more reliable because they are mechanically stronger. Although it may take a little longer to change the fuse, it's well worth the effort.

The speakers also can be protected electronically. With electronic protection, the input to the speaker passes through a relay, and the circuitry senses the incoming power. (See Figure 3.) If the current is too high, the relay is tripped. Some consumer hi-fi speakers have these circuits installed internally. If the speakers are used in a professional setting, a low setting of the trip point can cause a lot of irritation. Because of this, the overload circuits often are bypassed.

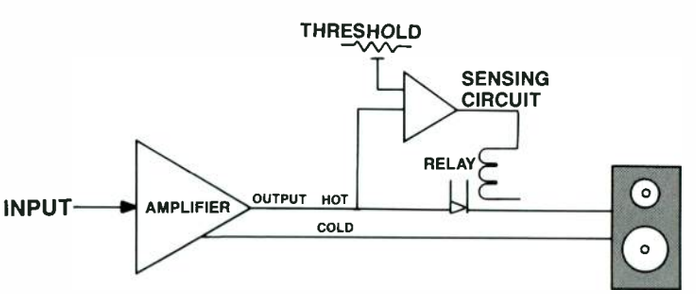
It's also possible to help reduce the chance of speaker damage by filtering out the lower frequencies. Although the small speaker systems do not reproduce much audio below 40Hz-50Hz, the presence of these frequencies often can destroy the monitors. A low-frequency rolloff filter will prevent these frequencies from getting to the monitors. (See Figure 4.) This is an effective approach, providing the filter's effect is inaudible to the engineer.

Adding this protection to the speakers may seem like a lot of work. However, it is probably well worth the time, energy and cost to protect the monitors. Replacing drivers is both costly and aggravating. It is much easier and less nerve-racking to replace a fuse during a session than to hunt up a replacement speaker.

### New approaches to monitoring

Because of the popularity of close-field monitoring, further development and improvement of this technology should be pushed. Speaker manufacturers continually are trying to develop new products that will improve the low-end frequency response and power-handling capabilities. Even so, perhaps the whole monitoring scheme needs to be re-evaluated. Here are some steps manufacturers might take with new speaker-system designs:

- *Bass or sub-bass systems*: One of the problems with close-field systems is the lack of bass response. It's possible to compensate for this by adding a separate bass system. Because the low end is not as directional as high frequencies, bass cabinets could be located away from the existing close fields — possibly under the console. The crossover system (probably electronic) would have to compensate for phase and time alignment, but the technology is available. Although the use of separate bass/sub-bass systems is common in live-sound systems and in home hi-fi designs, it has yet to find much acceptance in the studio. Also, it should be determined whether stereo bass is needed. It might be possible to use mono bass instead.
- *Multiple cabinets*: Use two close-field cabinets next to each other with each cabinet providing a different response and wired in such a way that the engineer can listen to one or both. One cabinet could be the standard reference; the other would have characteristics to compensate for the reference.
- *Multiple systems*: It is common in today's studios to have musicians, especial-




**BASIC ELECTRONIC PROTECTION**

***Figure 3.*** *Electronic protection sometimes is provided inside the speaker cabinet. Studio applications often bypass the feature if it proves too sensitive to tripping.*

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ly keyboard players, working in the control room. To be effective, this practice requires more than one monitor system. Although it's rare that a second or third pair of monitors is used, there is really no reason multiple systems can't work in tracking sessions, especially if the overall levels are not saturating the room.

• *Hi-fi systems*: The use of a home hi-fi cabinet as an engineer's own personal monitor is not uncommon. Yet, the use of these cabinets in the control room seems to have been dismissed without an in-depth evaluation.

• *Control room environment*: Close-field monitoring opens a whole new range of studio-design options. For electronic production, the division between control room and live room can disappear. This would allow the control room to more closely resemble a home hi-fi environment. The result would be a more comfortable, flexible and cost-effective studio.

Close-field monitoring can solve many of the problems created by poor monitoring room acoustics. It is an inexpensive, high-quality approach to the need for an accurate acoustical monitor.

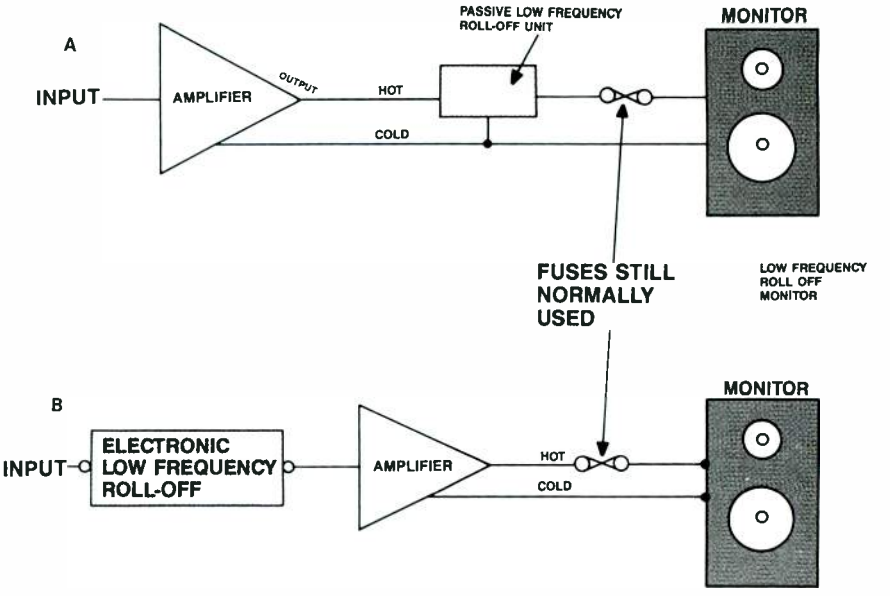
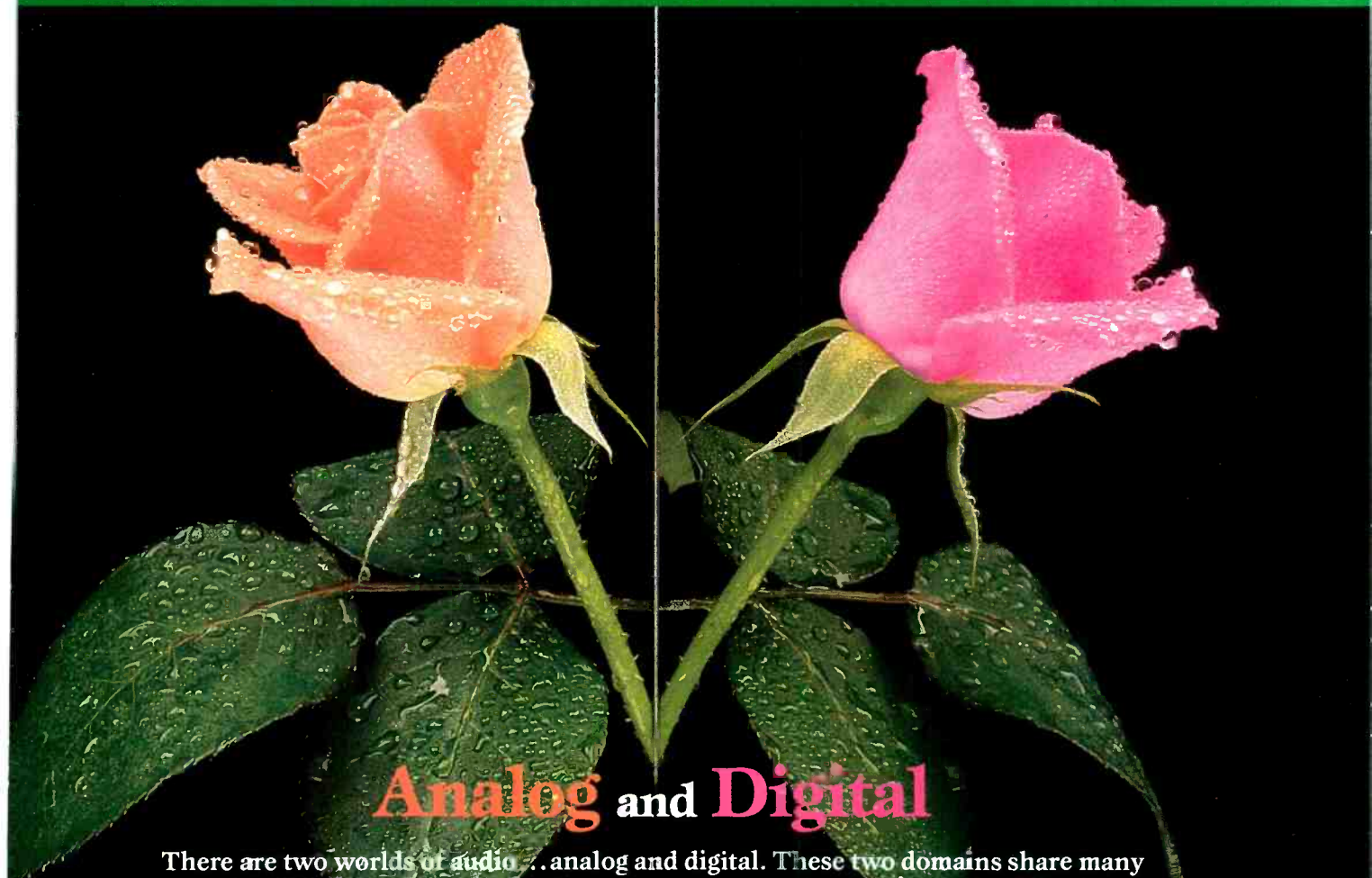



***Figure 4.*** *Low-frequency components are responsible for most of the damage to small speakers. A low-frequency rolloff filter, passive as shown in (a) or electronic as shown in (b), installed before the speaker prevents these frequencies from damaging the speakers.*

# Dual Domain Audio Testing



## Analog and Digital

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# Remote applications

**By Brad Dick, radio technical editor**

Close-field monitoring need not be limited to the production studio. Remote broadcasts are challenging enough without having to try to design high-quality monitoring systems. This is where close-field monitor speakers can be effective.

Stations often rely on old pairs of junk speakers (after all, they're going to get beat up anyway) to provide audio for the DJ or engineer. In some cases, the same speakers are used to provide ambient sound for the audience. Such an installation provides poor acoustical monitoring. This makes mixing decisions difficult and compromises the sound received by the radio audience.

### Dual systems

A better approach is to rely on dual monitoring systems. Use a pair of close-field monitors for the DJ or engineer and a separate system for the audience. This allows the mixer to work in the direct-sound field, where the effects of ambient reflections, echoes and noise are reduced greatly. In addition, the audience feed can be optimized as desired.

The close-field monitors should be the same speakers used in the production studio. Even though the outside environment will be quite different from the studio, the speakers can be the same. Knowing how the speakers sound in the studio eliminates much of the confusion resulting from the remote broadcast location. This will enable the DJ or engineer to better evaluate the quality of the mix.

A second set of speakers then can be used for PA applications. If you want to rely on regular PA speakers or whatever, fine. The audience probably won't know the difference or care. The advantage is that no matter what compromises you have to make in the audience sound, the mixing position still has a high-quality environment. With careful positioning, the quality of the PA sound will have no effect on what the DJ or engineer hears.

There is an additional advantage to using small monitors at the mixing position. It is sometimes difficult to control the levels of the PA mix and the monitoring mix separately. The monitor amps in remote consoles seldom have enough power to drive large PA speakers. This means the mixer has to rely on headphones for the mix and use a separate amp for the PA mix.

The close-field monitors usually can be powered by the console's internal amplifier. This permits the mixer/engineer to use speakers instead of headphones. It also allows a separate PA system to be used for audience feeds.

There are a number of advantages to using close-field monitoring for remote broadcasts. The next time you're faced with a remote, take along those little speakers. They may save you from lugging along big cabinets, separate amplifiers and a ton of wire. Besides, not having to wear headphones all day can save a lot of wear and tear on your ears.

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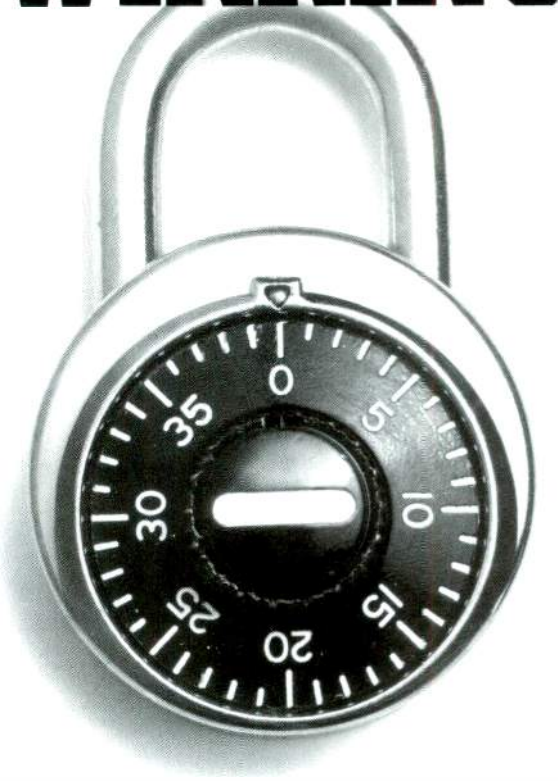


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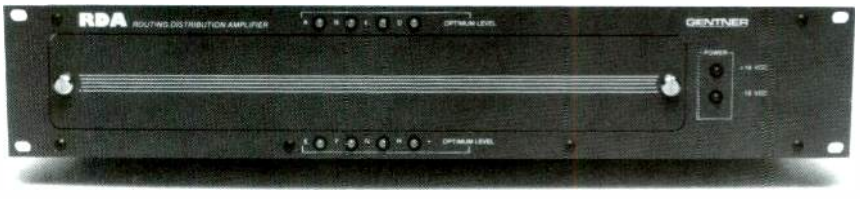


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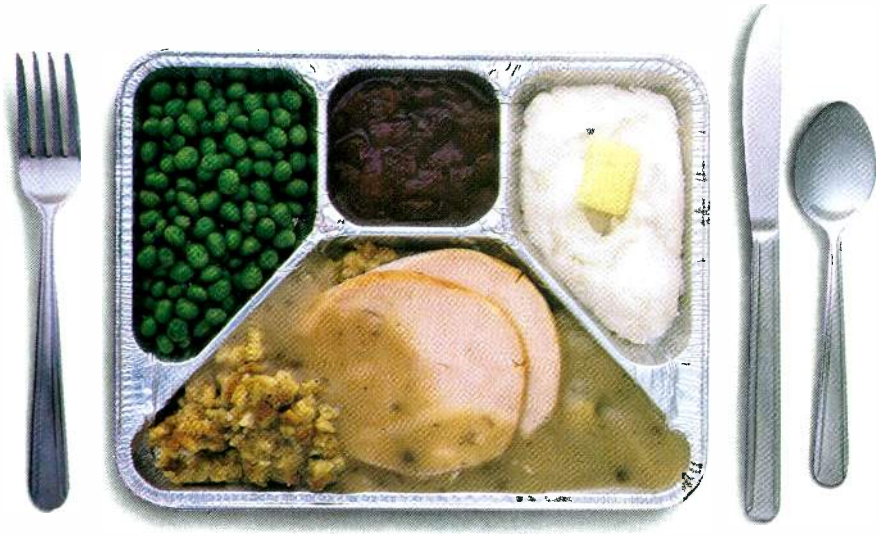

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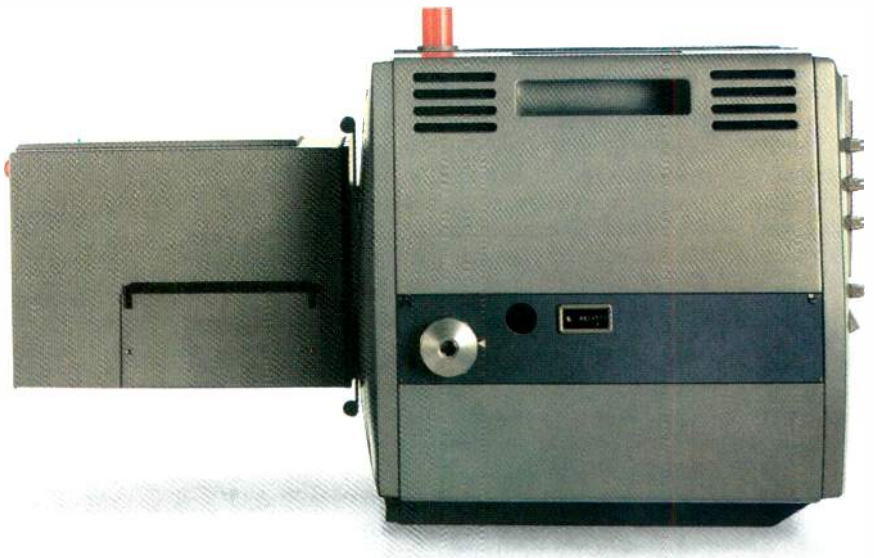

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*Continued from page 4*

to World Service Herald Broadcasting (WSHB), a division of "The Christian Science Monitor" syndicate. With 1,000kW of carrier power, the station is one of only a handful of short-wave stations in the megapower bracket.

Ordered by The First Church of Christ, Scientist, in Boston, the Cypress Creek station will be the most powerful, most modern religious broadcasting station in the world. In addition to news, religious programs will be broadcast in English and Spanish to Mexico, Central America and South America.

The station consists of two 500kW superpower, short-wave transmitters, manufactured by Asea Brown Boveri, that incorporate the feature of dynamic carrier control. The outputs are fed into phased, high-gain, short-wave curtain antennas. The transmitters are the newest generation of frequency-agile, fast-tuning, high-efficiency pulse step modulation (PSM) design.

Licensed in 1930, "The Christian Science Monitor" was the first religious broadcaster in the United States. Religious broadcasting has become the fastest-growing sector in international short-wave broadcasting, with spectacular growth in the United States, the Middle East and the Far East.

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***News from Europe***

**By John Blau,**
**European correspondent**

## Commercial TV may come to Netherlands

The Netherlands might have two privately owned commercial TV stations as early as next year. The Dutch government has agreed, in principle, to the introduction of commercial television, but the issue still is being debated. Meanwhile, two broadcasting groups have emerged with plans to circumvent current restrictions by uplinking their services from Luxembourg.

One group, known as Radio-Tee-Veronique (RTV), is scheduled to begin transmitting at the beginning of 1990, and will transmit via satellite to Dutch and Belgian cable systems. The other, TV10, plans to begin broadcasting later this year.

A recent decision by the Ministers of the European Community forced the Netherlands to drop its controversial ban on foreign-based commercial television.

## Applications filed for Greek commercial TV

More than a dozen applications have been filed for licenses to operate a private commercial TV channel in Greece. Deregulation of the Greek broadcasting system, announced in March by Prime Minister Papandreou, will require a change in the constitution. Until then, the state-run ERT is the only organization allowed to broadcast television in Greece.

## BT experiments with optical fiber

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# Planning for an audio routing switcher

By David L. Bytheway

**Audio routers can increase productivity and minimize problems.**

Does your station ever have stereo/mono compatibility problems? Would a stationwide audio-distribution system based upon a routing switcher help? The answer to the first question is probably yes, and the answer to the second is almost certainly a resounding yes. With the introduction of TV stereo, many broadcast engineers face the need to upgrade their audio-distribution systems. Radio stations also can benefit from centralized audio distribution.

The selection and configuration of an audio-distribution system presents many challenges. Let's begin our discussion by looking at two major points:

- A routing system can provide increased flexibility, if this feature is considered from the beginning.
- The sound quality of any audio system is directly dependent upon the performance of the routing switcher and distribution amplifiers. The reward for careful equipment selection is excellent sound quality.

### What is a routing switcher?

Large patch panels can be used to provide easy signal interchange. However, as a broadcast facility increases in size, the number of patches and the resulting panel can become quite large. Switchers are designed to replace patch panels, especially for signals that are changed many times a day.

Audio switchers can provide signal performance that is equal to or better than that of the patchbay. The real advantage is the greatly increased flexibility. Audio switchers and distribution amplifiers together form the heart of an audio-distribution system. Today, it's possible to build audio-switching systems large enough to handle all the signals in a broadcast station.

Audio switchers usually are configured as an X×Y matrix. That is, they have X number of inputs and Y number of outputs. Switchers come in many different sizes, ranging from a small 10×10 matrix, up to 300×300 and even larger. A broadcast-type switcher can be used to connect any of its inputs to any or all of its outputs. This capability eliminates patch cords, patchbay multiples and plenty of headaches.

A given signal source needs to feed only one input of the switcher to be capable of feeding all outputs. The distribution amplifier function is, therefore, automatic. This feature often can reduce the number of distribution amplifiers needed in a facility.

### Routing procedures

Switchers are used to connect inputs (or sources) of signals to outputs (or destinations). Most switchers are output-oriented. This means that you think of the output or destination device first, then select the source to be sent to this device. Control panels for such systems are called *single output controllers*. Switchers also can be controlled by computers.

Large switching systems allow the use of mnemonic names instead of numbers for the sources (inputs) and destinations (outputs). For example, if the destination is called studio line 1, a mnemonic name such as STD1 could be used. This makes routing much easier for operators because the mnemonic acts as a prompt. The user no longer needs to associate numbers with inputs or destinations.

Such a control panel might be located in studio 1 and would control the outputs of the switcher physically connected to studio 1. Once a destination is selected, so is the source signal, for instance, VTR3. This name is entered on the switcher control panel. To activate the switch, it's usually necessary to press a *take button*. A take is a command sent to the switcher to make the physical connection. Once it is completed, the output of VTR3 is sent to STD1. An indication that the connection has taken place usually will appear on the control panel. If video is associated with the desired audio, both video and audio are connected simultaneously.

### Routing advantages

When selecting a switching system, give some consideration to the use of mnemonics. If a switcher does not provide mnemonics, then separate labeling and look-up tables may be required so operators can find the signals desired.

Most systems allow the switcher control panels to be remotely located. One example of a common use for a switcher is to provide audio feeds to a given studio. Several outputs of a switcher could be connected to the studio. A control panel, located in the studio, then would have control over those several outputs. This permits the studio to have complete access

Bytheway is manager of the switcher hardware engineering department at Broadcast Television Systems (BTS) in Salt Lake City.

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and control over all the audio feeds within the studio.

Switchers usually provide a high degree of isolation between outputs. This means that the switcher's outputs will not be affected by the output you are changing. A routing switcher eliminates the need for large numbers of buildout pads and splitters.

Switchers often improve the overall quality of the audio within a broadcast station. This is possible because well-designed systems are capable of reducing noise through high common-mode rejection. Switching systems also can be used as a stable-ground reference point. If all signals are sent through the switcher, they will be conditioned with common-mode rejection and correct impedance matching and will be highly isolated from other signals. The result is often overall improvement in signal quality.

### Stereo or monaural?

When you plan your system, you'll have to choose from a wide variety of options. Besides the signal specifications, there are many configuration and control possibilities that must be determined.

The first issue that must be addressed is the mono/stereo question. Today's trends dictate that any new facility, or upgrade to an existing facility, includes provisions for stereo audio. Even if you're not implementing stereo now, you should design the system with later conversion in mind. Adapting a monaural system is possible, but it's certainly not the most efficient, or cost-effective, approach.

Anyone who has experience with stereo audio knows of the potential for compatibility problems. These problems usually occur in the tape record/playback process. If tapes are made and played back in house, the house standard format usually prevents problems. However, sometimes outside tapes or old tapes and films will not conform to the standard you've adopted. Typical problems include left and right channel reversals, mono on the wrong channel of the tape, or time code recorded on the audio track.

In addition to these problems, not every audio signal is stereo. Many commercials, network feeds and other programs still rely on monaural audio. Stereo synthesizers sometimes are used to create a stereo signal from mono broadcasts. Your design must take into account all these potential problems.

### Using separate switchers

There is more than one way to build a stereo switching system. The most common method is to use a separate switcher matrix for the left and right channels. In some stations there also may be a matrix for time code and perhaps one for the second audio program (SAP) channel.

These separate matrices are called *switcher channels* or *levels*. In addition to these audio levels, a video level also can be accommodated by many manufacturers. Figure 1 shows this configuration. The use of identical switching systems for the two stereo channels helps ensure phase matching and minimum stereo degradation. Good phase matching does not require that both channels occupy the same matrix. The important thing is that both channels experience the same time delay as the signals pass through the system.

This configuration has the advantage of using the fewest possible crosspoints to implement stereo. Monophonic devices use only the left matrix. The number of inputs and outputs needed for the left matrix will be the number of left-signal sources plus the number of monophonic signal sources. The size of the right-channel matrix will be determined by the number of right-signal sources.

The disadvantage of this method is that there is no way to exchange left and right channels. If a tape has the channels re-

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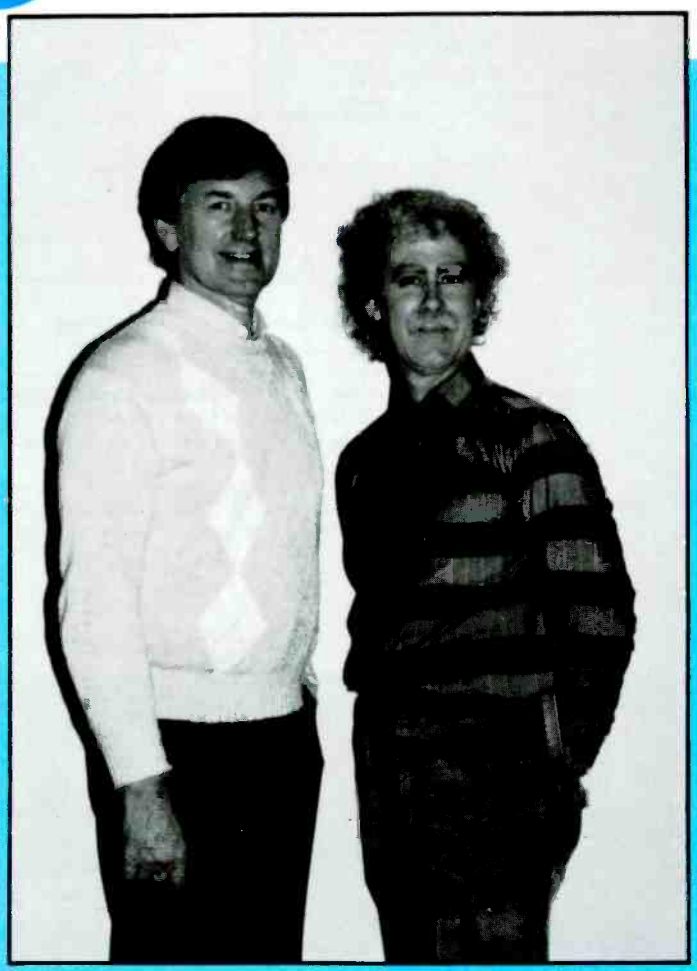

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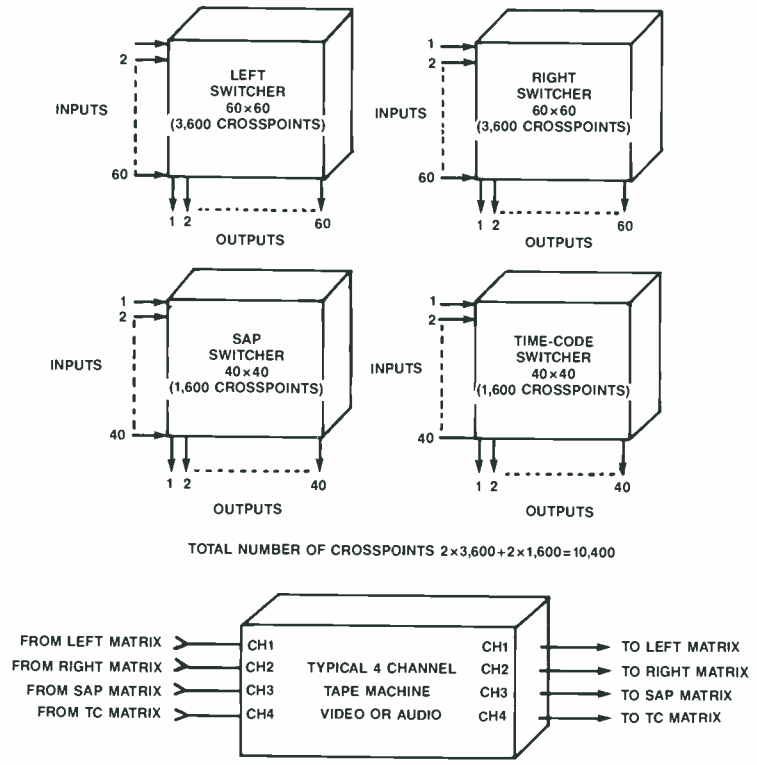


***Figure 1.*** *Standard switcher configuration. Each signal channel or level is a separate matrix. Tape machine channels are hard-wired to corresponding matrix level.*

versed, the switcher cannot swap the channels. If a monophonic feed is desired, it will appear in only the left channel.

A variation of this method relies on identically sized matrices for both the left and right channels. The stereo signals are fed into the matrix as discussed. The mono sources feed both the left and right matrices in parallel. This configuration has the advantage that mono sources now can feed one or both channels of a stereo destination. Stereo sources cannot, however, feed mono destinations.

Another variation uses a monophonic matrix in addition to the left and right channel matrices. Stereo sources are connected to the left and right channel matrices in the conventional manner. Mono signals are connected to the mono matrix. In addition, some mono sources also are connected to the left and right channel matrices, and some stereo sources are connected to the mono matrix. Which sources feed which matrix is determined by the number of sources that feed destinations of a different type.

This scheme has the disadvantage of requiring a large mono matrix, which could be potentially much larger than either the left or right matrix. It also is not possible to interchange left and right channel feeds.

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The advantage is that even when mono or stereo signals are being fed, only one pass through a matrix is needed.

### Using a single, large matrix

One way to solve this problem is to use a single, large matrix for all audio channels. Left, right and mono signals all feed to the same matrix. This switcher configuration is shown in Figure 2. The advantage of this method is that the left and right channels can be fed normally, reversed and mono sources can feed stereo destinations. Some switcher control systems require that you switch each signal individually, while others allow you to switch pairs or groups of outputs. In any case, this method of interconnection provides much greater flexibility in handling stereo/mono problems.

A disadvantage of this method is that it requires many more crosspoints than a separate matrix for each audio channel. To provide the capability to interchange left and right channels, two crosspoints must now be available to connect a left input to a left or right destination. The total number of inputs needed is the total number of left signals plus the number of right signals plus the number of mono signals.

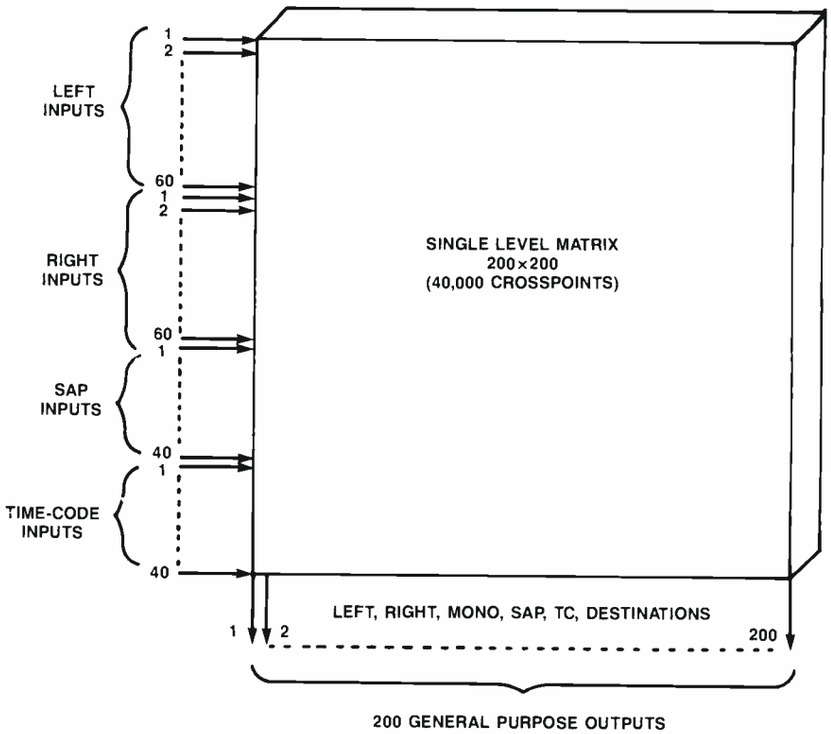
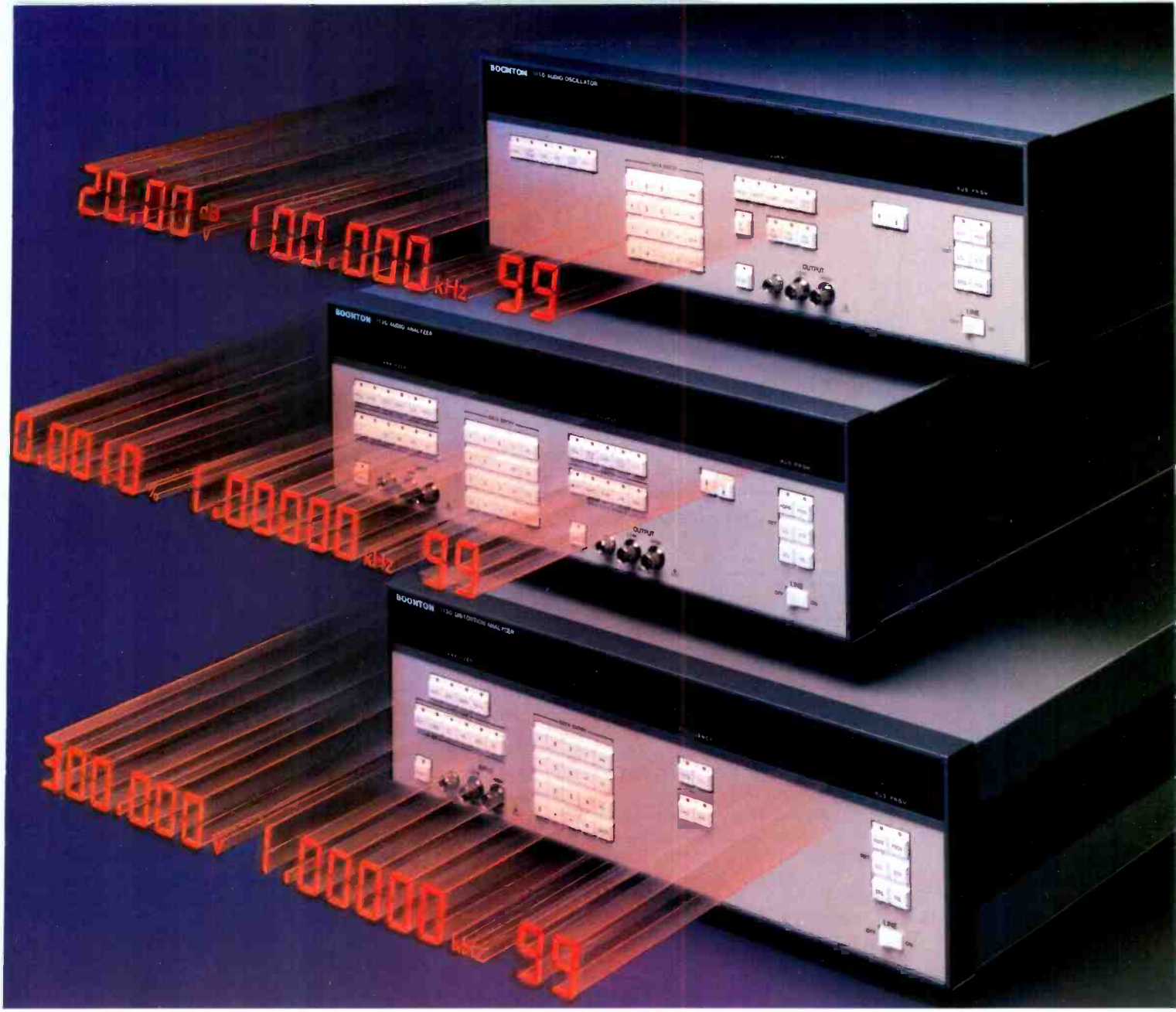



***Figure 2.*** *A large, single-level matrix for all left, mono, right, SAP and time-code signals. This configuration provides increased flexibility by allowing complete channel swapping. A large penalty is paid in the number of crosspoints.*



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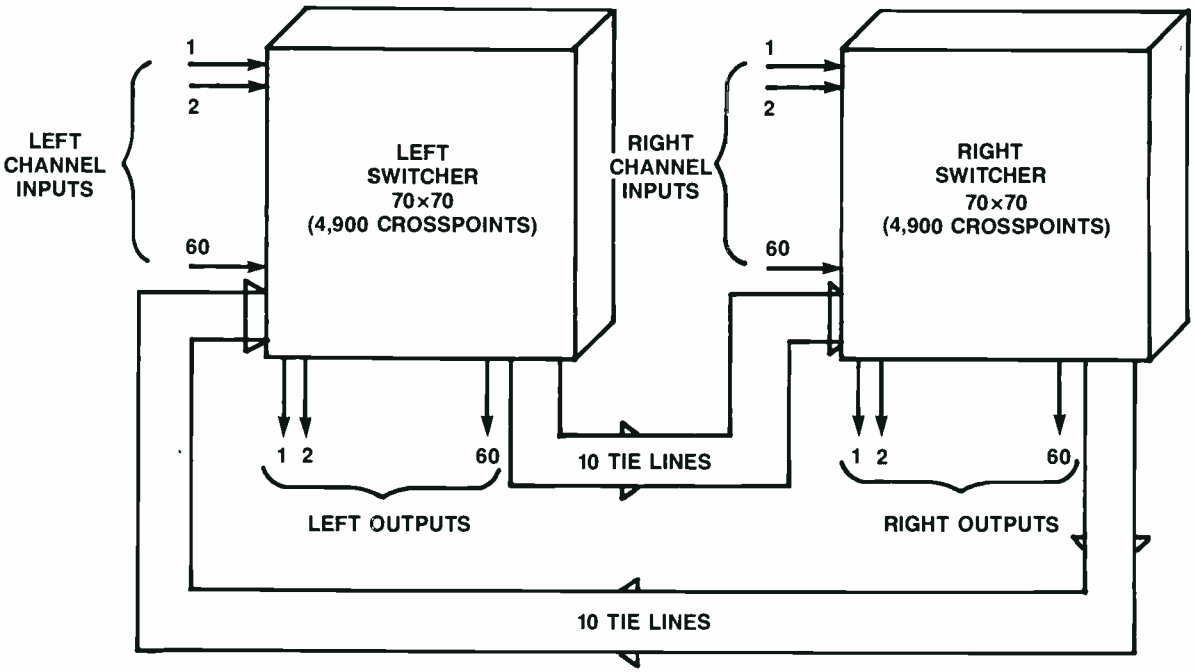


***Figure 3.*** *Two switcher levels cross-coupled with tie lines. This configuration allows left and right channels to be interchanged up to a limit determined by the number of tie lines.*

The number of outputs is computed similarly. Because the number of total crosspoints in a matrix is the number of inputs multiplied by the number of outputs, the total number of crosspoints in such a matrix is many times more than for the standard configuration.

### Re-entry

Another method of routing signals is called *re-entry.* This scheme, shown in Figure 3, provides for the interchange of left and right channels without the penalty of needing many crosspoints. The design relies on the use of tie lines between the left and right channel matrices, which are used in the conventional way. Some of the inputs and outputs of each channel are connected to the other channel.

If a left channel source is needed in the right channel matrix, the left matrix places this signal on one of the tie lines to the right matrix. Then the right matrix switches the signal from this tie line to the destination needing the signal. Some switchers provide outboard mono summing circuits and phase inverters in the tie lines. The signals are switched to outputs containing these circuits, which then are fed back into the switcher.

One disadvantage of the re-entry method is that the number of channel swaps, mono feeds or other functions that can be used is limited by the number of tie lines. Another disadvantage is that all signals so handled must pass through the system twice. The signal quality, therefore, is degraded slightly compared with the quality achieved with single-pass switching systems.

### Problem solver

A better method of handling stereo/mono compatibility problems and channel-switching problems is to use small interconnection matrices located at the signal source. This method provides interconnection among all the audio channels and has the potential to solve a host of other audio problems. Figure 4 shows a system built on this concept.

The advantage of this method is that now any channel can be interchanged with any other. For tape machines, time code, left, right, mono and SAP signals now can be easily interchanged. A further advantage is obtained if these small local matrices have summing or mixing crosspoints. In this configuration, the left and right channels can be summed to derive a mono feed. This is helpful if you need to dub a stereo source to mono. If you need to record or produce a format that is different from the one found in the station switcher, you can use the small matrix at the destination to develop the format desired.

The scheme also solves playback problems such as phase inversion. Placing the various playback channels from a nonstandard tape onto the proper output channels also is easy. The tape operator simply sets up the local switcher to place the correct signals from the tape into the correct channels of the main routing switcher.

This allows all signals in the main distribution system to remain in a standard format. Any source problems are corrected at the source. Any signal correction needs to be handled only once — at the source, not at the destination. All signals in the switcher will be in stereo, or dual-channel mono. Time code and any SAP or auxiliary audio always will appear where they belong. This greatly simplifies the entire routing process.

Some engineers design their own circuits to perform these tasks. Patchbays or passive switches also can be used to complete the channel-switching function. However, a dedicated switcher with mixing crosspoints and phase-inversion circuitry will provide much faster, more flexible correction of compatibility problems.

This routing method uses the fewest extra crosspoints and offers the most flexibility. It also provides features that no other method can provide. The disadvantage of this method is that all signals must pass through more than one crosspoint.

### Control considerations

Switcher control is an area that deserves a lot of careful attention. Large switching systems need sophisticated control if they are to provide the flexibility needed in today's stations. Switchers usually are directed by remotely located control panels.

Some switching systems rely on a single coax or twisted pair of wires to connect control panels to the matrix. The cable may be routed in a star or series configuration between panels. Such a system represents a type of local area network (LAN).

The length of cable permitted between the control panel and matrix varies, depending on the type of control scheme used. Some remote panels can be operated only a few hundred feet from the

*Continued on page 73*


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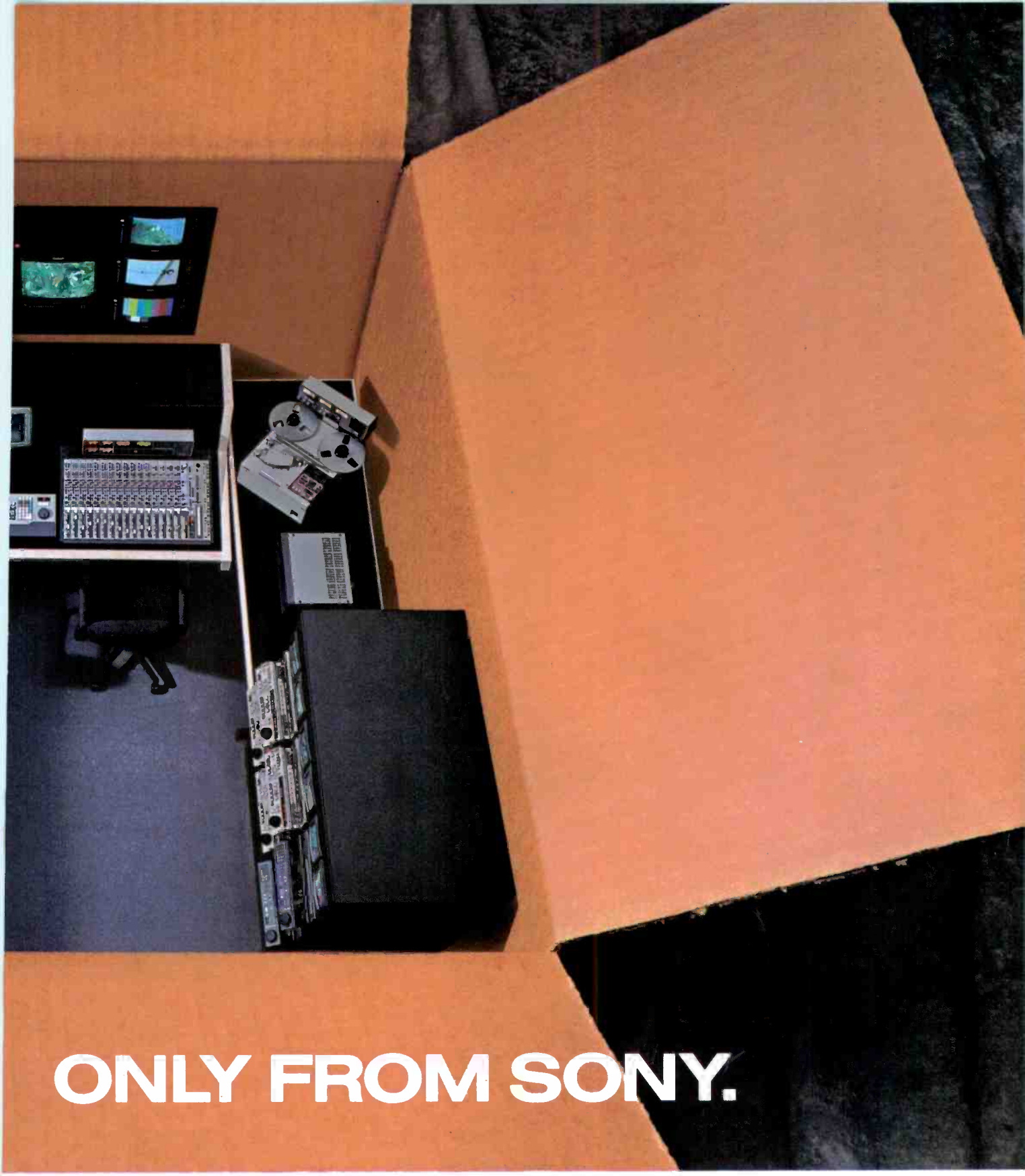

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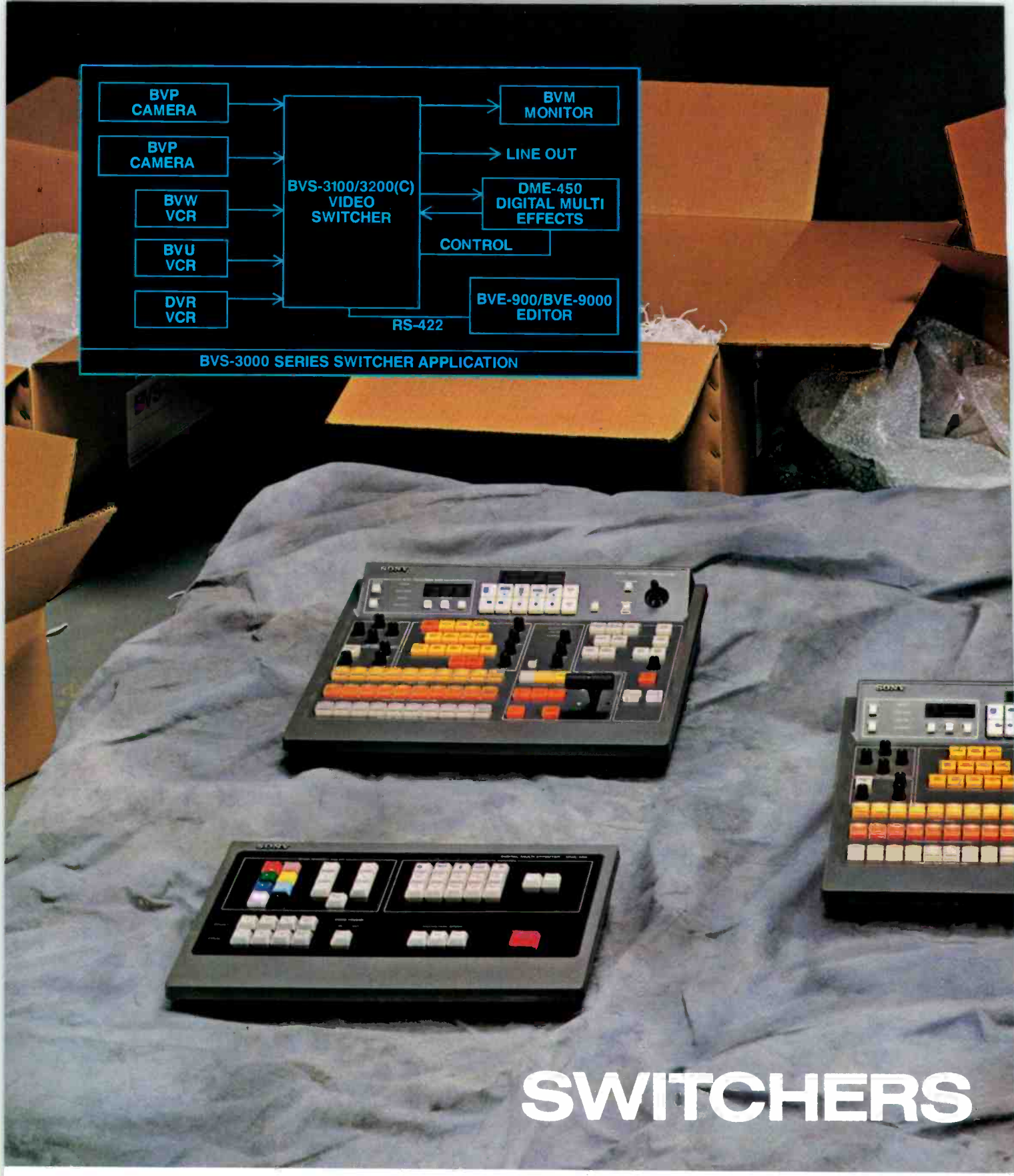


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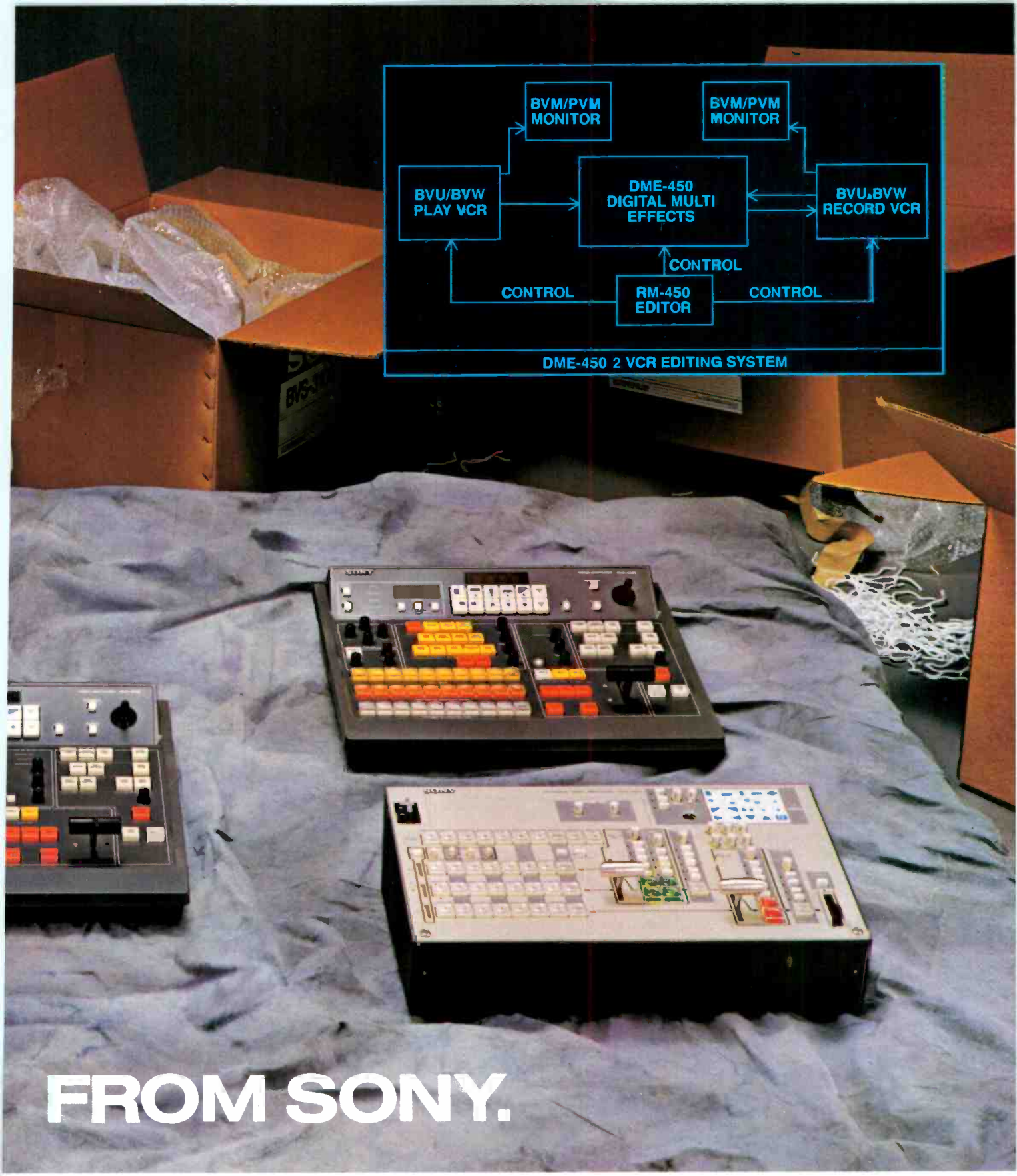


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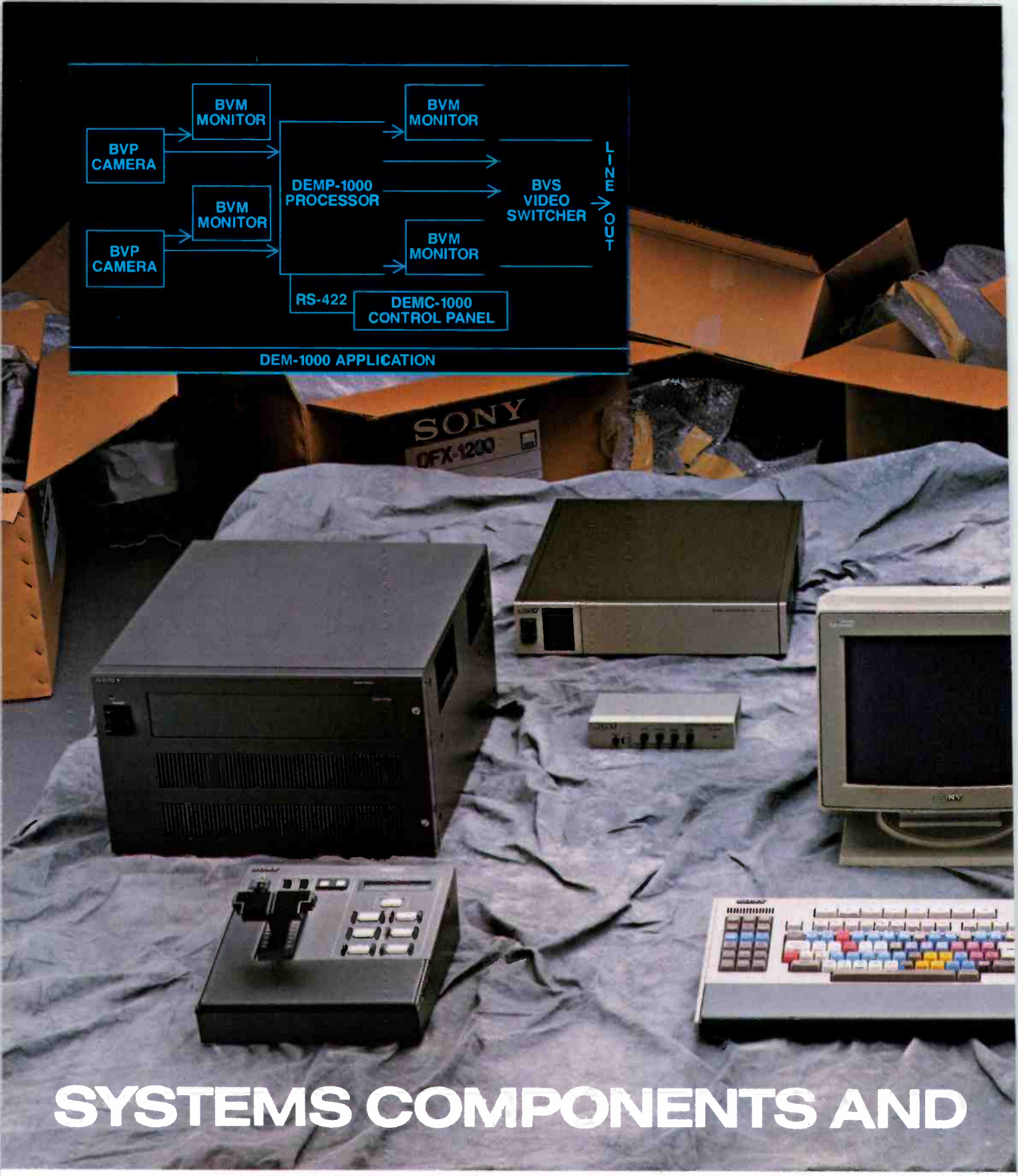


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*Continued from page 64*

matrix, while others can be several thousands of feet away.

Some systems provide serial port control, which can be performed from a dumb terminal or a personal computer. Other systems provide a keypad-type interface where commands are made from a Touch-Tone pad. Modem connections also are available. Some switchers even can be controlled by an automation system. Switches then take place according to the event log contained within the system.

### Types of control panels

The most common type of control panel is the single output controller. This panel usually is located at a signal destination point, where control is desired. Typical locations might include a VTR or a studio. One output of the switcher matrix is assigned to this location and operates under the direction of that particular control panel. This permits the desired signal to be accessed and routed to the proper location without any interaction with other signals.

A variation of this scheme is a control panel that provides access to a group of outputs. This might be useful in a production studio where several switcher outputs are connected to an audio mixing console. Such a control panel could access several sources as needed by the audio console operator.

Another important type of control panel is the X–Y controller. This panel directs only one output at a time, but it can switch any input to any output. In this way, every crosspoint in the matrix can be switched

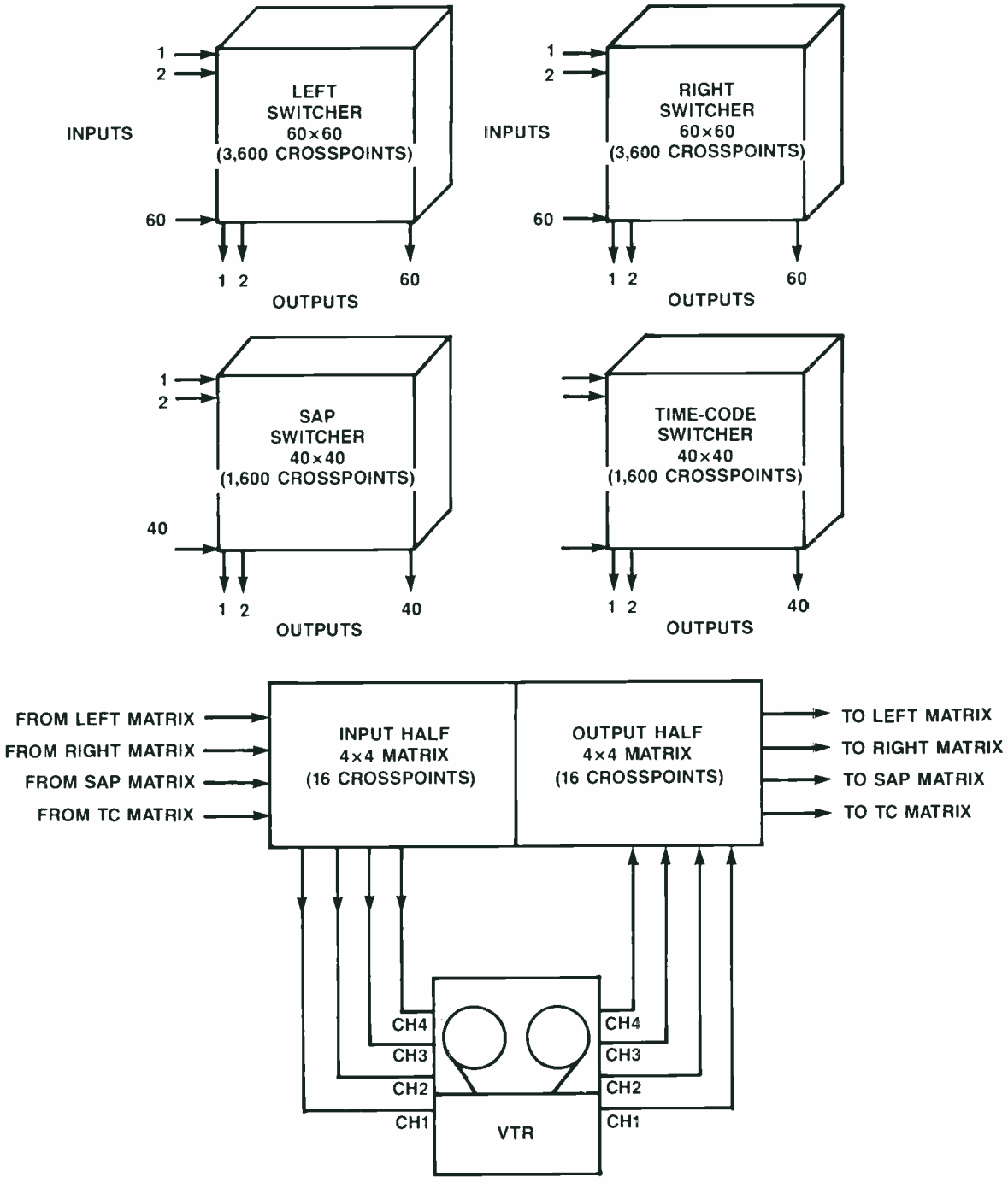


***Figure 4.*** *Switcher configuration using a small, 32-crosspoint switcher located at a tape machine. If a small switcher has mixing crosspoints, total stereo/mono signal interchange is possible.*

by this panel. This type of control panel commonly is used in an engineering area where maximum versatility is needed.

Variations on these panels abound. Some control panels provide memories so that commonly used switch combinations can be selected quickly. Others provide unique control features, such as the ability to switch the left and right audio channels separately.

### Control architecture and security

Switcher control architecture also varies in complexity, ease of reconfiguration and expandability. Some systems store mnemonic names in each control panel's EPROM memory. Other systems permit the user to download mnemonics and preset information for the control system. Some designs concentrate the intelligence in central data concentrators, rather than in the control panels.

If your station is growing or constantly changing, consider a system that's easy to reconfigure and expand. The best control systems will allow you to reconfigure your switcher as your needs change. They also may permit you to customize the control and human-interface architecture to best meet the needs of your operators.

Security provisions can be implemented in many ways, one of which is to limit access to inputs based on the control panel. For instance, the permitted inputs are stored in EPROM. Any input mnemonic not stored in the panel is inaccessible. Other systems allow an output to be locked or protected so that no other control panel in the control system can take away a switch already made.

Some newer systems allow the use of passwords to provide access to inputs and outputs. Careful consideration should be given to these features, especially if the switcher has outputs that feed critical devices such as your transmitter.

### Reliability and maintenance

Routing switchers also should be evaluated on their ability to handle power bumps and outages. Many systems permit battery-protected memory, which will retain the switcher status. When power returns, the switcher resumes the same configuration as before the interruption. Some stations may need to use uninterruptible power supplies to retain switching capability.

The reliability of today's switchers is typically excellent. Most systems provide redundant power supplies and control cards with automatic switchover. In addition, power supplies often can be spread around the switching network so no single power-supply failure can bring down the entire switcher.

With a large routing switcher, it's usually unacceptable to power down the entire system for maintenance. For this reason, many systems allow cards to be changed while the matrix is powered. Cooling fans, power supplies and control cards also may need to be changed if a failure occurs. Being able to replace matrix cards and control cards while the power is applied is a must for critical applications. This approach allows the card's switching configuration to be re-established immediately so that all interrupted crosspoints will be restored.

### Audio performance

In the design of an audio routing system, one important question is sometimes never asked. How does the system sound? There are sometimes audible differences among the types of audio components used in routing switchers. And the higher-quality components do not necessarily cost more than lower-quality components. Careful component selection by the manufacturer can make a great deal of dif-

*Continued on page 78*

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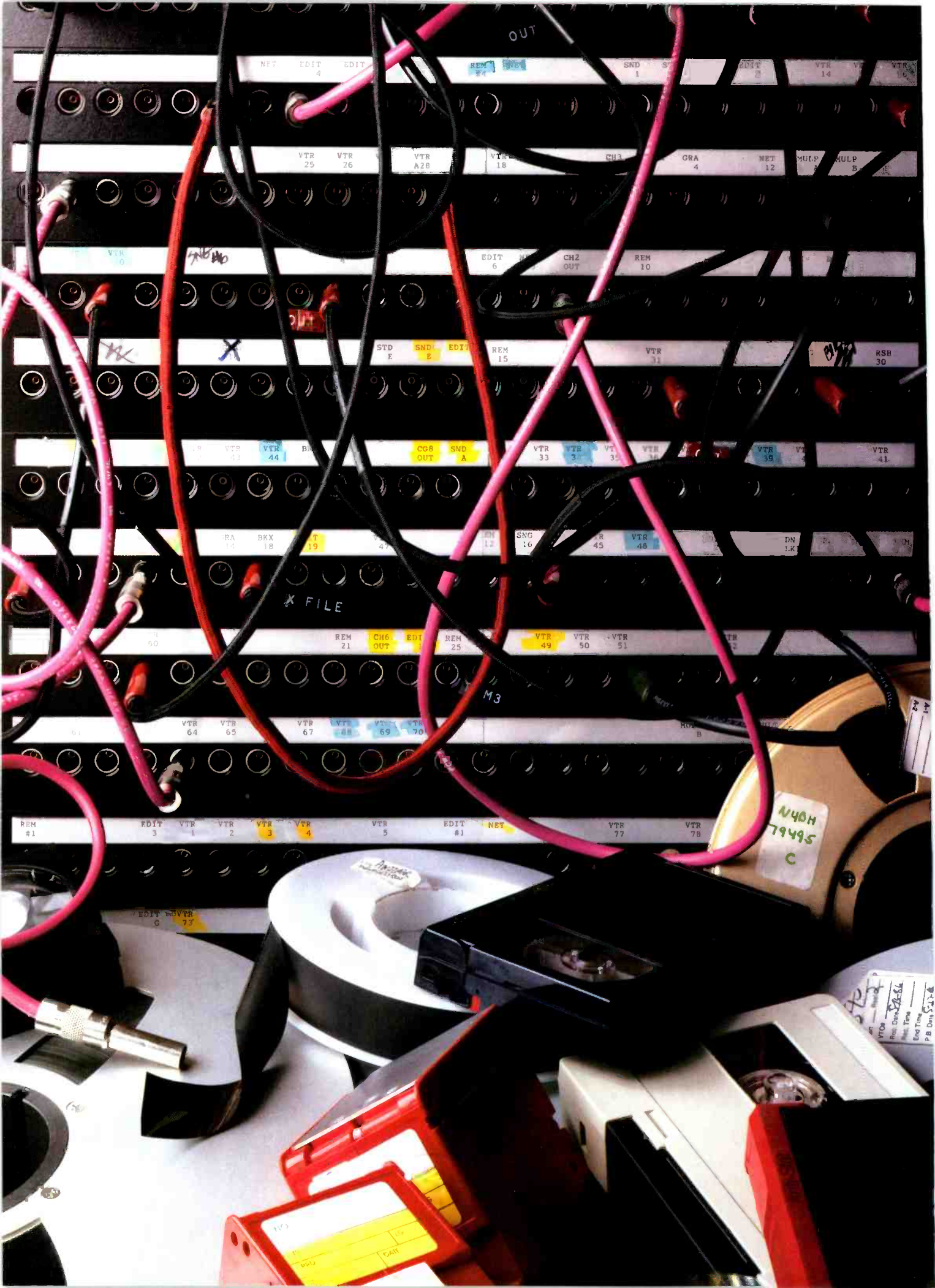
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*Continued from page 74*
ference in the overall quality of a routing switcher.

It's important to evaluate the router's audio performance. This requires a close look at the listed audio performance specifications. The most common audio performance measurement is total harmonic distortion (THD). Other measurements used to help quantify audio performance include intermodulation distortion (IM), transient intermodulation distortion (TIM), phase linearity and slew rate.

Intermodulation distortion probes for non-linearities that produce new frequencies as a result of the beating of the two test tones. These generated frequencies usually are not harmonically related to the original test tones. The human ear is more sensitive to this type of distortion than it is to THD.

One type of distortion is not necessarily masked by another. It also is possible that two devices with identical harmonic distortion readings still will sound different from each other. This is because the actual harmonics measured may be different for the two devices, yet continue to produce the same reading on test equipment.

In addition, other effects such as bandwidth limiting, non-linear frequency response, group delay and transient distortion may not be reflected in the tests conducted. Distortion performance using traditional methods provides limited insight into actual system performance.

### Study specifications carefully

When using specification sheets to aid in selecting a switcher, keep the following in mind. When comparing numbers, you must use the same units and measure-

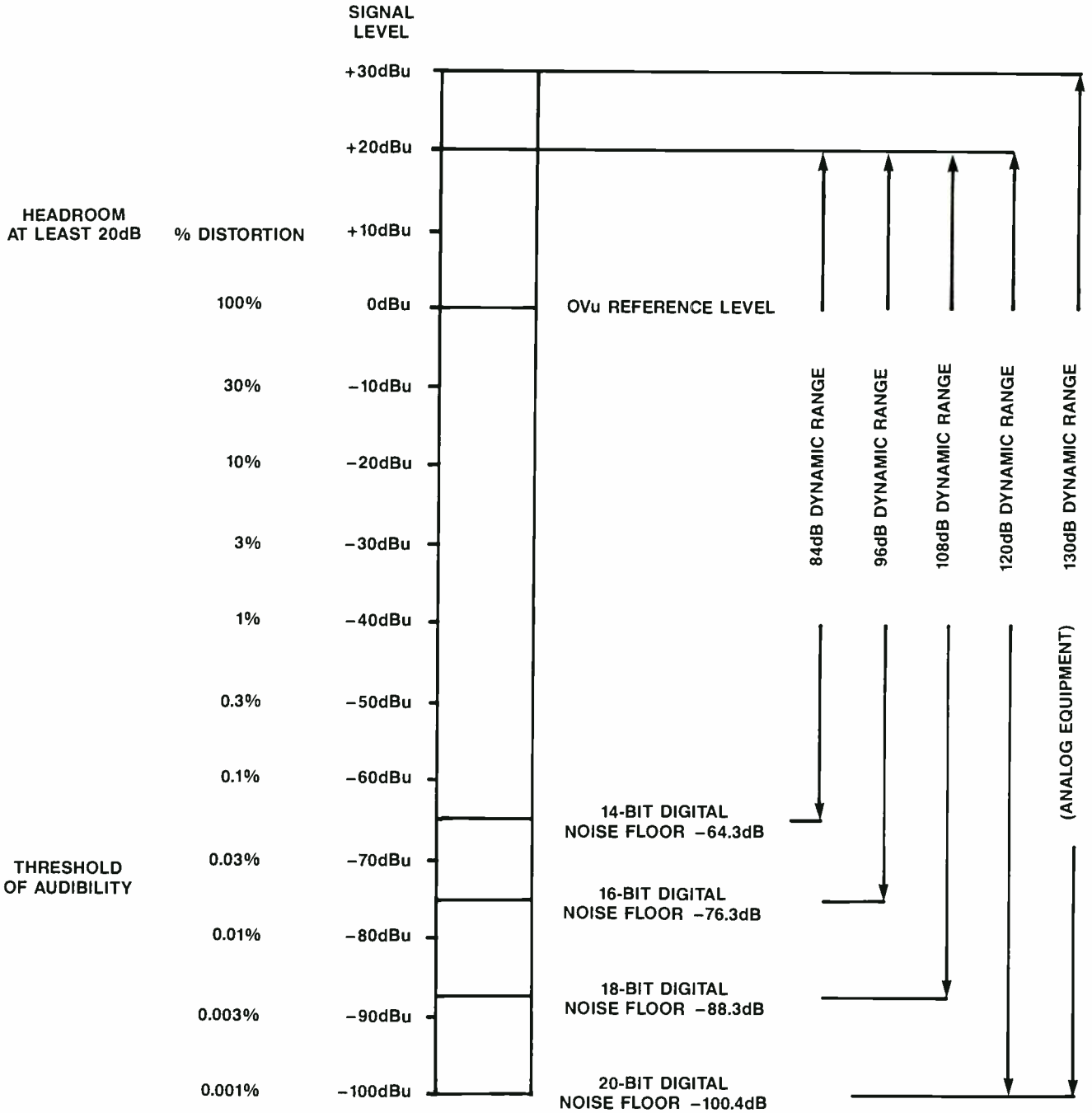


***Figure 5.*** *Graph showing dynamic range of digital and analog audio devices. Also shown are percentage levels of distortion and noise levels. Noise and distortion should be below −75dB to remain inaudible.*

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ments conditions. For the THD specification to be meaningful, it should be specified at a given frequency, load impedance, measurement bandwidth and signal level. If any of this information is missing, then an incomplete picture of the measured parameter is presented. Be careful when comparing specifications of systems when you have insufficient information.

The most linear systems have low distortion at all frequencies within the audio spectrum. The distortion usually remains low at all signal levels up to the maximum level the system can pass. High-quality audio systems usually have IM distortion at levels comparable to those of THD.

### Noise

It's important to look at the noise specification of the equipment you're considering. Noise exists in all electronic circuitry, and only the best designs control it well. The practical limit on noise within a circuit is determined by the laws of physics.

The best designs can reduce circuit noise to within a few decibels or a fraction of a decibel of the theoretical limit. This usually is specified as the *noise figure*. This states how many decibels of noise a device will add to a theoretical source impedance. Unfortunately, few manufacturers use this specification method.

In a system, if a signal is passed through two devices with the same noise levels, then the total noise will be 3dB greater than with either device alone. This is the case whether the noise is wideband white noise or of a non-coherent nature. However, if the noise is perfectly in phase and of the same amplitude, then the resulting noise will be 6dB greater. An example would be a case in which the primary noise is power-supply hum.

Different weighting curves have been developed to find a measurement that correlates with audible noise. Measurements made with different weighting curves are not directly comparable. When comparing noise specifications, note the bandwidth or weighting curve used, the reference level and the measurement units used. Without this kind of information, comparing noise specifications becomes an apples-to-oranges issue.

### Crosstalk

Crosstalk is defined as the leaking of one signal into another. In audio, it is usually heard during silent passages or pauses in the audio. The ear is particularly sensitive to it because crosstalk usually manifests itself as a signal that is unrelated to the desired signal.

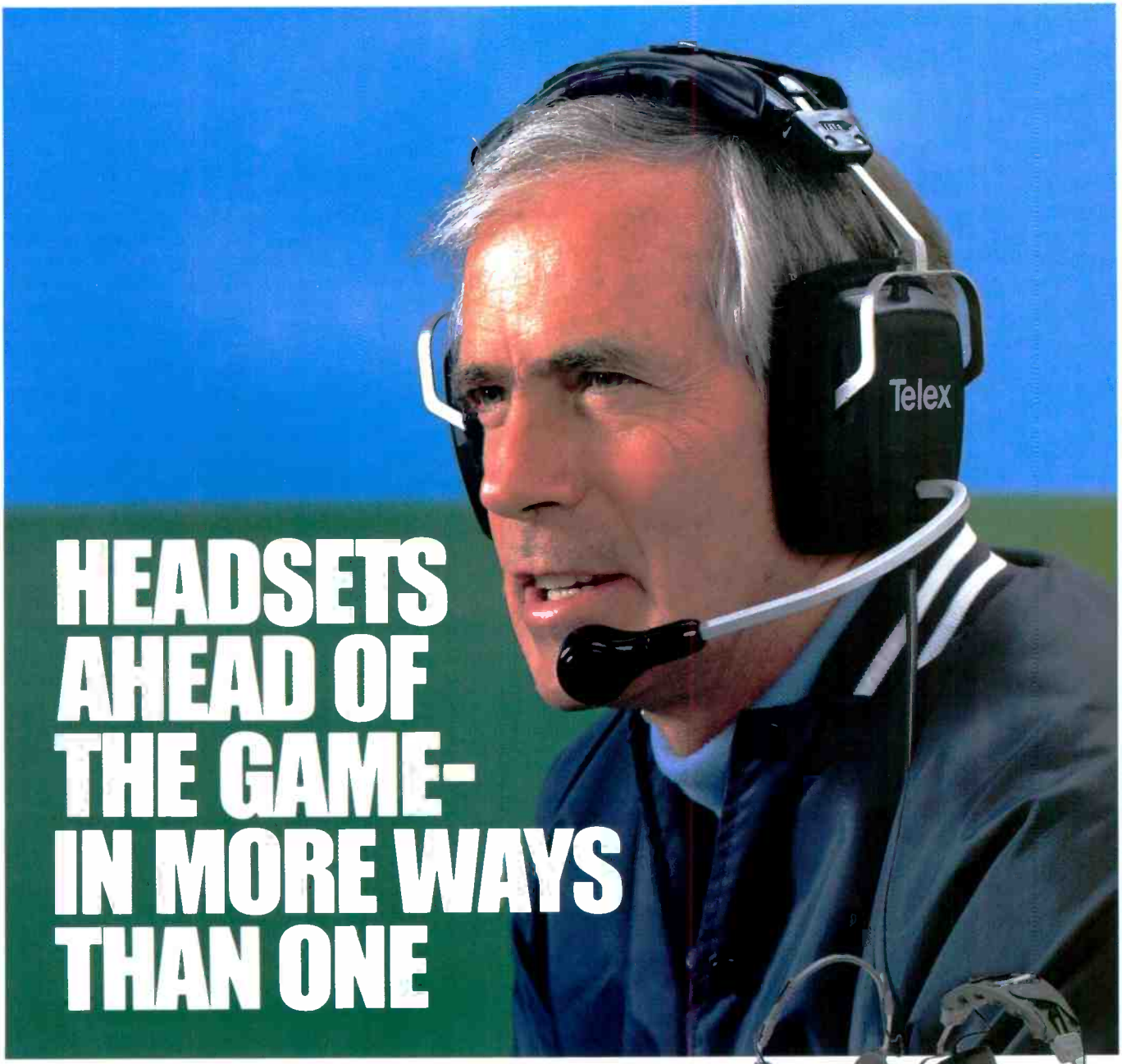
Videotape machines operating in high-speed rewind are common sources of crosstalk. Many tape machines do not mute the audio during rewind, which allows the audio to come through at exceptionally high signal levels. These signals can be extremely troublesome and cause crosstalk injection. All the energy is concentrated in the high-frequency end of the audio spectrum, and it is at a level much higher than normally encountered.

Crosstalk typically must be attenuated 80dB to remain inaudible. If the signal leaving the tape machine is +20dB, the switching system must be capable of 100dB isolation between audio channels. Otherwise, the high-level rewind signal will leak into adjacent audio channels.

### RF sensitivity

Radio frequency (RF) interference is another important performance parameter in routing systems. Well-designed routers can operate in strong RF fields, such as at transmitter sites, without picking up the transmitted signal.

Proper performance requires that the input stages and system grounding be designed to reject any RF before it gets into amplifier stages. If RF leaks into these stages, it may be rectified and cause in-

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terference. One solution is to limit the system's bandwidth enough to prohibit RF interference, but not enough to affect the audio. If audio circuits can pass signals in the RF range, the RF signals eventually will find an amplifier stage or system where they will be rectified and appear in the desired signal.

### Transformers

Another significant advancement in professional audio is the elimination of audio-coupling transformers. Transformerless equipment can be produced that has higher noise rejection, lower noise and distortion, less hum pickup and even better RF rejection than equipment using transformers. That's not to say that transformers aren't needed. Transformers still are needed where large common-mode voltages or large dc currents are flowing in loops (such as in telephone lines).

Entire facilities have been built without transformer-coupled equipment and provide excellent audio performance. Some early transformerless equipment was poorly designed and caused problems. However, today's transformerless equipment is more advanced and performs much better than earlier designs.

### Transparency

Audio engineers use the term transparency to describe the sound of an audio system. It is not something that can be measured by conventional test equipment. A device that is transparent allows the listener to hear into the sound, sort of a 3-D effect.

There are many sources of distortion that produce a veiling effect, like looking through cheesecloth. Coupling transformers, electrolytic capacitors in the signal path, intermodulation distortion, odd-order harmonic distortion and many other effects all can reduce transparency.

It is not enough to meet this goal for only one pass through the system. High-quality switching systems can pass signals many times through without serious degradation.

### Digital performance requirements

The use of digital audio sources places special requirements on a routing switcher. A good rule of thumb is that all audio distortion, noise and crosstalk should be 75dB to 80dB or more below the standard operating level. Signal levels between 70dB and 80dB below listening level represent the threshold of audibility for noise, crosstalk and distortion.

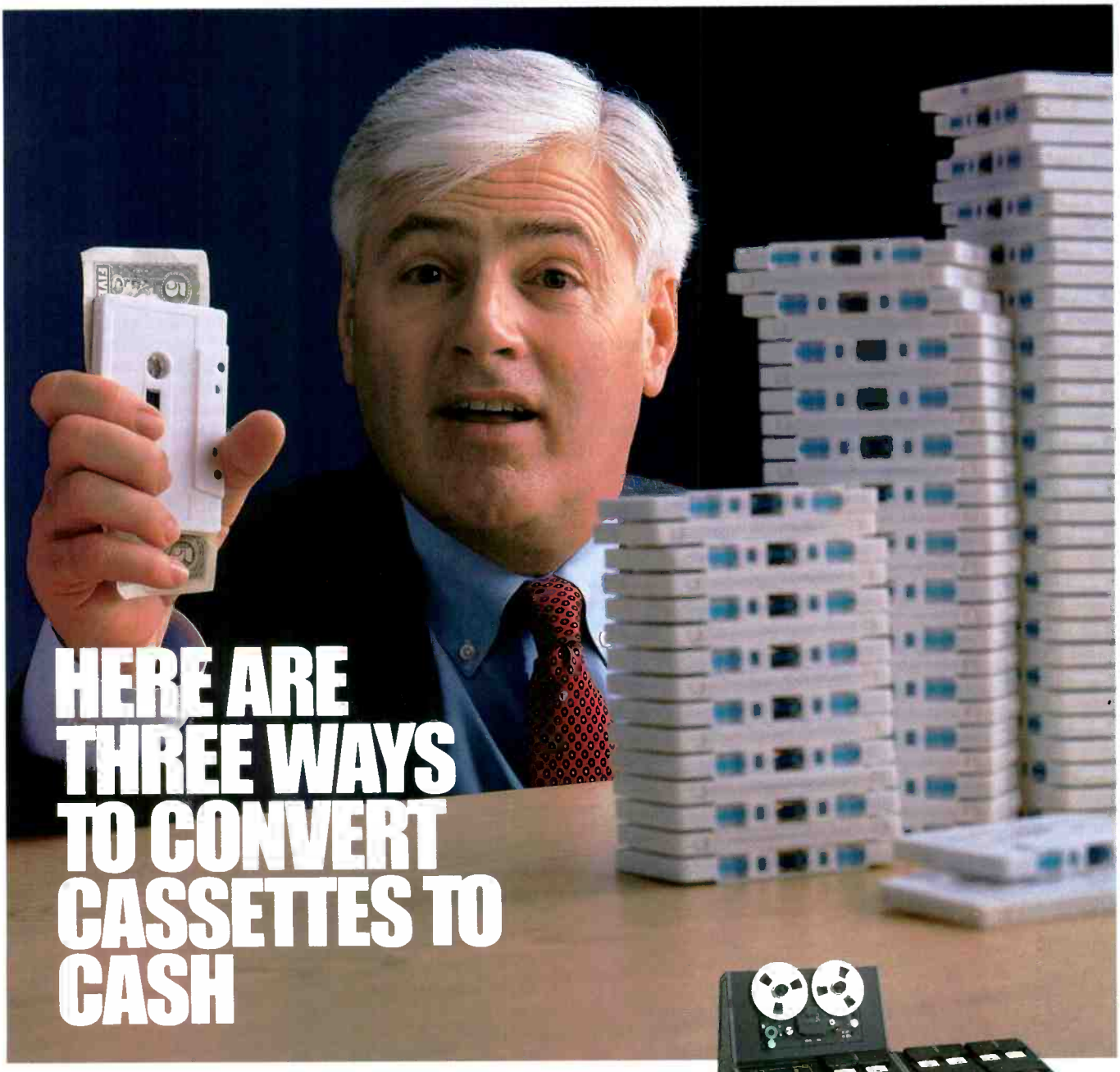
In addition to this low noise level, 20dB of linear, distortion-free headroom should be available. Combined, these two numbers project a total dynamic range of 95dB. Obtaining this level of performance requires at least 16-bit digital audio. To maintain this quality level, each component in the switching system must be much better because noise, distortion and crosstalk, as well as bandwidth limiting, add directly.

Figure 5 is a graphical representation of dynamic range, digital noise levels and distortion levels. For example, if a signal must pass through four audio components in the distribution system, each must have a noise floor of −81dB of non-coherent white noise to achieve a −75dB noise level. Any power supply or 60Hz hum present in the devices will cause the resulting noise level to be even worse.

In a typical station, a signal might pass through the audio-distribution system three or four times between origination and final delivery to the end-user. This is why the performance of the switching system is so important.

### Unbalanced circuits

It's common to find high-end consumer equipment in a broadcast station. This type of equipment, which usually has



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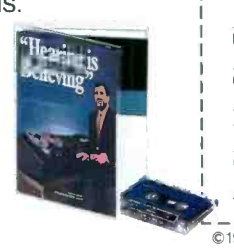




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unbalanced inputs and outputs, is sometimes difficult to interface with transformerless routers.

A more serious problem may occur when balanced and unbalanced audio devices are combined. It is always possible to feed a balanced input from an unbalanced output. If they are connected correctly, the common-mode rejection of the balanced input will be retained. It is not always possible, however, to connect unbalanced loads to balanced outputs.

The cause of this problem lies in the design of the output stage. Typically, two amplifiers are used to derive a balanced output driver. If an unbalanced load is connected to such an output stage, one side of this driver stage is connected directly to ground. This causes large currents to flow in the power supply and system grounds. The result is greatly increased crosstalk. In some cases, the output device may be destroyed.

If an unbalanced load must be connected to this type of balanced output driver, only the positive (plus) output terminal should be connected to the load. The load should be placed between the positive terminal and the ground terminal. In most systems this will reduce the level by 6dB. In many cases this drop in level actually helps the interface process because the consumer equipment usually has a reference level lower than that of gear used in professional applications.

Some transformerless equipment relies on a newer type of output stage, sometimes called a *floating output driver*. This unique circuit simulates the floating output characteristics of a transformer. Either side of the floating output can be grounded without causing loss of signal level or an increase in crosstalk. Cross-coupled feedback provides this unique automatic balancing action.

Sometimes this circuit requires a common-mode output trim to maintain balance. An added advantage is that if either side of the wiring is shorted to ground, the correct signal level still will be present.

### Level matching

A related point to consider is that of reference level matching. Most consumer-grade equipment uses a standard reference level of −10dBu. This corresponds to 0.0775Vac equaling 0VU. If the station reference level is +8dBu, then there is an 18dB difference between the two levels. This can cause serious compatibility problems. Playback levels will be too low in level, and inputs to recorders may be overdriven.

It is always desirable to provide for the required gain and loss at each consumer machine. This keeps all signals in the distribution system at the standard reference level. Level-matching devices are available from several manufacturers and should be used as necessary.

### System reference levels

At least 20dB of headroom should be available in any distribution system. Headroom is the difference between the standard system reference level and the maximum signal amplitude the system can pass. A minimum level of 20dB is required because of the dynamic nature of modern recording techniques and the advent of digital recording. Even the human voice can exhibit a peak to average ratio of up to 20dB.

Most digital systems set the standard reference level 20dB below the maximum level. If the plant reference level is +8dBu, then the maximum signal level is +28dBu (0dBu = 0.775V). Although many modern devices can reach this maximum level, it is not common.

If the equipment uses ±15Vdc supplies (common voltages for audio circuits), then


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the maximum level usually obtainable is about +26dBu. A lot of the audio gear can provide only a maximum of +24dB. The best reference level for such equipment, therefore, is +4dBu. If this reference level is chosen, the 20dB of headroom is maintained, as well as a good S/N ratio.

Reference levels other than +4dBu can be used, and some equipment can be changed easily to these levels. Some stations use 0dBu as the reference standard. Although this provides more than 20dB of headroom, it also sacrifices noise performance. The reference level is 4dB closer to the noise floor than that of a +4dBu system. It is recommended that systems be operated at the +4dBu level.

### Voltage matching

One of the most significant improvements to audio-distribution systems in recent years is the use of *voltage matching*. Simply defined, voltage matching operates the system at a constant voltage. This means that all inputs are high-impedance or bridging, and all outputs are low-impedance. The standard 600Ω terminations are not used. This differs from the techniques used in video-distribution systems, in which all source and load, as well as cable, must have the same impedance.

Recent research shows that the performance of voltage-matched systems can far surpass that provided by 600Ω impedance-matched systems. Most of the research shows that an optimum output or source impedance should be used throughout the system. The optimum impedance for a twisted-pair cable with foil shield is usually between 50Ω and 60Ω.

If a driving impedance lower than this is used, frequency peaking results. If the driving impedance is higher, then high-frequency rolloff can result. With longer cables, this effect becomes more pronounced. Voltage matching is effective for distances of 5,000 feet or more.

Voltage matching can be accomplished with transformer-coupled equipment. However, it is usually more successful with transformerless circuitry. This is because most transformers require precise source and load impedances to provide good frequency response. In a voltage-matched system, this can be accomplished if the correct terminations are placed on source output transformers and all the loads driven are high-impedance. Transformer-coupled bridging inputs can be built, but they require special high-input impedance transformers.

### Long lines

The requirement to drive long audio cables often is overlooked. All output stages have a limited amount of available current. Most output stages are designed to drive a 600Ω load. Although few devices actually have a 600Ω input impedance, the capability to drive this impedance is usually needed.

The load formed by the capacitance of the interconnecting cable easily can be 600Ω or less at high frequencies. Most 600Ω outputs can feed standard audio cables of lengths up to 500 feet. Longer cables have enough capacitance to cause current limiting in standard output stages.

For cables up to 5,000 feet, a driving current of up to 100mA may be needed, regardless of the load connected at the far end. Output stages capable of driving a 150Ω load to full output voltage can deliver this amount of current. If your station has some long lines, be sure your switching and distribution equipment can handle the task.

Choosing a routing switcher is not easy. The wide variety of switching and control options makes the decision even more difficult. The key is to first define carefully your particular needs, for both today and tomorrow. Next, identify systems that meet those needs while providing the level of audio quality you desire. Look for a system that meets those needs most cost-effectively.

**Bibliography**


Baskind, Dave. "Interface Induced Audio Anomalies." *Recording Engineer/Producer*, October 1980, pp. 98-105.

Buff, Paul C. "Perceiving Audio Noise and Distortion." *Recording Engineer/Producer*, June 1979, pp. 84-95.

Burdick, Allen H. "A Clean Audio Installation Guide." Benchmark Media Systems, North Syracuse, NY.

Bytheway, David L. " Wired for Stereo." **Broadcast Engineering**, September 1986, pp. 22-32.

_____. "Transformerless Audio Systems in the Broadcast Installation." Society of Motion Picture and Television Engineers Preprint No. 128-111. Presented at 128th SMPTE Technical Conference, Oct. 24-29, 1986.

Hess, Richard L. "Voltage Transmission for Audio Systems." Audio Engineering Society Preprint No. 1708 (1-3). Presented at the 67th AES convention, Oct. 31-Nov. 3, 1980.

Howard, Edgar Lee. "Wiring an Audio-Video Production Facility." **Broadcast Engineering**, September 1986, pp. 74-90.

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# Managing satellite operations

By Richard Maddox

**To effectively manage a satellite operation, you have to stay on your toes and keep everything at your fingertips.**

Rarely are today's audiences captivated by a news story read from the set. They expect to see live pictures from the scene. Many times a market exclusive can be obtained if a station can react more quickly and decisively to news events than its competition can. Being able to react fast requires coordination among several departments. The news department originates the request, engineering and technical services departments move satellite dishes and tune receivers, and the operations department loads up the machines and starts the tapes rolling.

To coordinate these various activities is the job of the satellite operations manager, also known in the business as the news feed coordinator, satellite traffic manager, satellite news coordinator, remote supervisor or EFP (electronic field production) supervisor. Regardless of the title, the duties remain the same — to manage what is coming into, and sometimes going out of, the station's satellite dishes.

### Job prerequisites

That satellite communications are important to today's broadcaster is demonstrated by the fact that 99% of all U.S. TV stations are able to receive C-band transmissions, and more than 70% have both C-band and Ku-band reception capabilities. The majority of programming from out-of-house, be it news, sports, syndicated, network or advertising, now is being delivered via satellite.

For this reason, satellite communications managers need to know satellites — how to book time on them, how to coordinate feeds on them, and how to get signals into and out of them through the equipment at the station and on the road. These managers must be well-connected. They should be able to thumb through their Rolodexes and find the right contact at almost any station or uplink across the country.

At this time, there is no formal course of study to become a satellite communications manager. The position is typically filled by a technically astute individual who has grown into the job by being a quick study and having a background in broadcast technology. Engineers often make good candidates.

### Who, what, where

With more than 100 video transponders operating at C-band and another 50 on Ku-band at any one time, it would seem to be an easy task to get time for a short insert for an evening news program. But the aspiring satellite communications manager quickly learns that a number of factors determine whether you can get a feed into your station at a desired time:

- *Time of day.* Because most news broadcasts run between 4 p.m. and 7 p.m., it follows that early afternoon is a hot time for feeds. Couple this with a big story, the regular business teleconferencing and syndicated programs, and you'll find that trying to get a 3:45 p.m. EST time slot is as easy as juggling transmitter tubes.

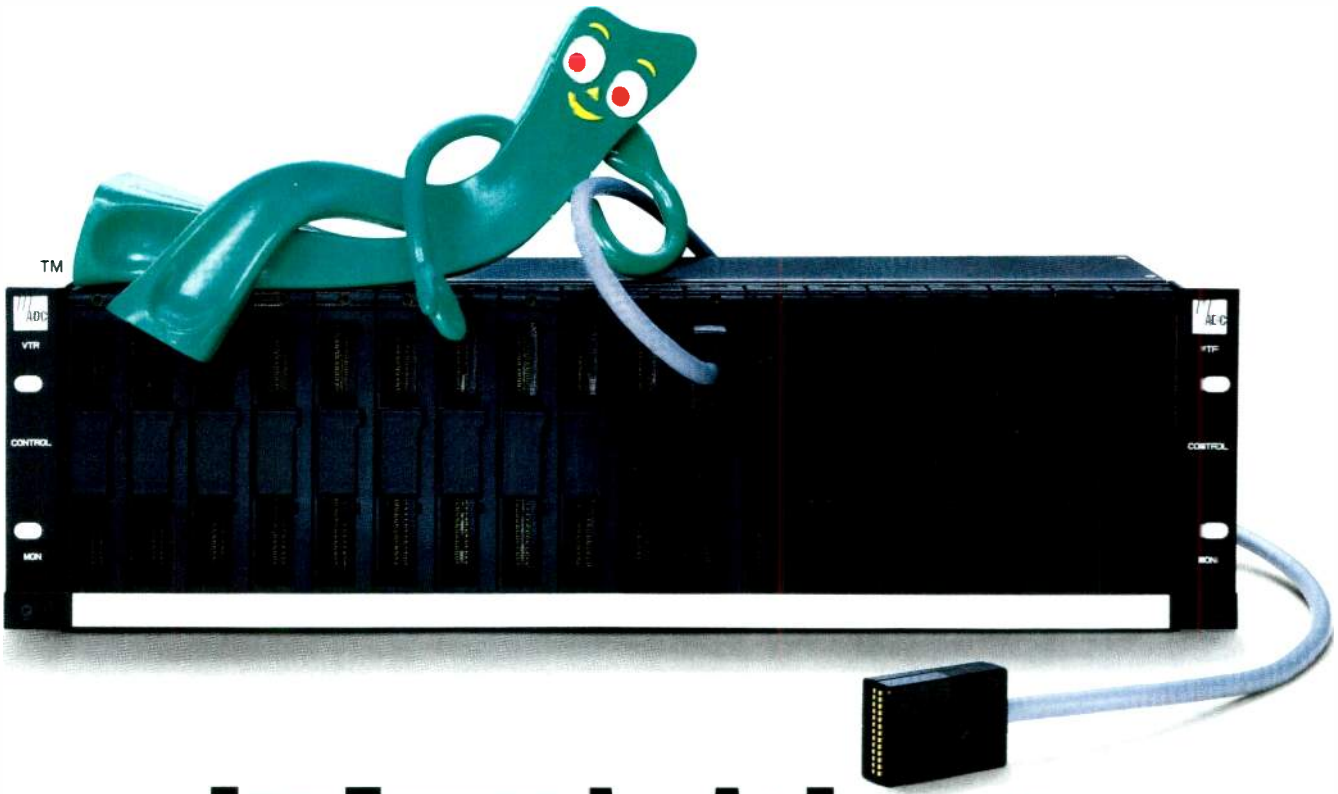
- *What the receive dish can see.* Some stations cannot move their receive dishes to hit every satellite. Some have only C-band available. A feed on a satellite you can't receive won't do you any good at all.

- *What satellites the uplink can hit.* Some uplinks are fixed on one bird, and you have no choice. On the other hand, asking the SNV (satellite news vehicle) to hit a satellite behind a building is not advisable.

- *Who you know.* Satellite brokers usually can get you time on any satellite, but to get you time in the next half hour is a different story. Most have direct booking on only a few satellites. The rest are cross-brokered, which means the broker has to call somebody else to arrange time for you. Again, it boils down to who's in your Rolodex.

For network affiliates, getting satellite time is pretty easy. If you're an NBC affiliate, you call up Skycom control and let them know when you want a feed and for

Maddox is chief engineer for Muzak, Seattle.

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how long. The satellite choice is predetermined, as is the price — $14 per minute — so it's a pretty cut-and-dried operation. For CBS (Newsnet) and ABC (ABSat) the process is similar, but the satellite (GStar II) and cost ($8 per minute) are different.

For non-affiliated stations, syndicators and teleconferencers, this procedure is not so cut and dried; dozens of options are available. For these type of operations a satellite broker is essential. (See the related article, "Call Your Broker.")

### How to get there

It's one thing to order up some time on a "bird," then issue memoranda directing underlings to receive and transmit it. It is quite another to arrange for a successful satellite feed. What separates the "stars" from the "saps" is a thorough knowledge of the microwave and fiber interconnects that will get a signal from its origination point to the satellite uplink and, at the receive side, from the downlink to the tape recorder. This is where a firm background in broadcast engineering can be helpful.

It is incredibly frustrating for satellite technical personnel whose managers haven't the slightest idea of what it takes to get the job done. For instance, many large cities are cursed with such a high amount of electrical and RF interference that satellite receive stations must be located in the surrounding countryside. Often the receive capability of the downlink outstrips the number of signal paths back to the station. This problem is readily understandable for engineers, but it can be baffling to non-technical people. Failure to master the links and paths inside a city may result in the writing of feed orders that technicians can't service.

### Satellite limitations

Satellites can't do everything. Being aware of the limitations of the satellite system can prevent a lot of problems.

It is important to know the footprint for every usable satellite. The footprint is a map of the amount of energy that hits the ground from a given satellite. Footprints vary among satellites across the country. Areas such as Alaska and Hawaii have limited satellite access because most satellites are aimed at the continental United States. Service to these areas is provided either on special satellites properly positioned for the purpose or on certain transponders that are aimed toward these areas. (See Figure 1.)

It also is important to know the causes and predicted times of sun outages. It is no good booking feeds that the station cannot receive. It also is inexcusable. Predicted sun outage periods for most satellites are available well in advance.

Weather is a factor, too. Raindrops are about the same size as one-fourth of a Ku-band wavelength, so they'll absorb the Ku-band signals. Looking at a Ku-band satellite near the horizon (K2, for instance, from the West Coast) means there is more rain to go through, hence more attenuation, possibly leading to noisy pictures. A thunderstorm near the satellite news-gathering truck also can cut power up to the satellite so much as to render the pictures unusable. If the feed drops, where do you go for backup? The satellite operations manager has to have the answers.

### Scheduling and budgeting

Satellite operations management, especially at stations with SNVs, entails much more than booking time and coordinating feeds. There's also scheduling of the truck and crews. It is important that drivers keep logs, and that their trip hours don't exceed the Department of Transportation's regulations. Truck engine maintenance also must be scheduled, as well as maintenance of the transmit and receive electronics.

Somewhere along the line, the costs for incoming and outgoing feeds surely will be scrutinized, so the operations manager must maintain adequate logs of which department ordered feeds and what the material was used for. The accounting department won't understand why you spent time sending another station a feed at no charge, unless you show that it was in exchange for a piece you used and weren't billed for. So be sure to log the freebies as well.

### Satellite time charges

Do not go gently into that "good night." It may cost you a lot of money. Among the other intricacies of satellite communications, there is the matter of protocol for billing purposes. When a feed is finished, it is important that someone tells the uplink, the leaseholder (loosely called the "owner") of the transponder used, and perhaps the operators of the paths used to get feeds to and from the uplink and downlinks. This sometimes can be accomplished with a phone call, sometimes with a "good night" super placed over color bars. The procedures vary by satellite and by uplink. The satellite communications manager should establish the drill and leave instructions for doing it. Otherwise you may one day find yourself the not-so-proud purchaser of eight hours of

*Continued on page 94*

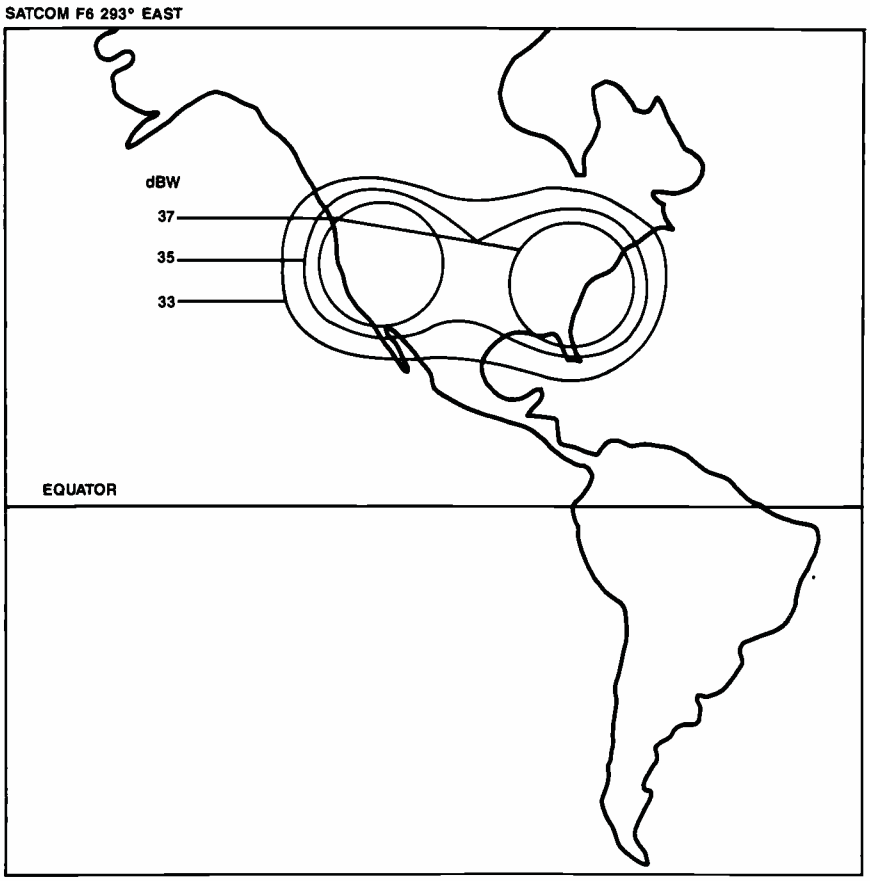


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***Figure 1.*** *EIRP "footprint" map of Satcom F6. Such a map shows that some satellites work better than others for certain locations. The footprint is determined by, among other things, spacecraft power and antenna orientation.*

# TRUTH...

# OR CONSEQUENCES.

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**TRUTH:** A lot of monitors "color" their sound. They don't deliver truly flat response. Their technology is full of compromises. Their components are from a variety of sources, and not designed to precisely integrate with each other.
**CONSEQUENCES:** Bad mixes. Re-mixes. Having to "trash" an entire session. Or worst of all, no mixes because clients simply don't come back.

**TRUTH:** JBL eliminates these consequences by achieving a new "truth" in sound: JBL's remarkable new 4400 Series. The design, size, and materials have been specifically tailored to each monitor's function. For example, the 2-way 4406 6" Monitor is ideally designed for console or close-in listening. While the 2-way 8" 4408 is ideal for broadcast applications. The 3-way 10" 4410 Monitor captures maximum spatial detail at greater listening distances. And the 3-way 12" 4412 Monitor is mounted with a tight-cluster arrangement for close-in monitoring.
**CONSEQUENCES:** "Universal" monitors, those not specifically designed for a precise application or environment, invariably compromise technology, with inferior sound the result.

**TRUTH:** JBL's 4400 Series Studio Monitors achieve a new "truth" in sound with an extended high frequency response that remains effortlessly smooth through the critical 3,000 to 20,000 Hz range. And even extends beyond audibility to 27 kHz, reducing phase shift within the audible band for a more open and natural sound. The 4400 Series' incomparable high end clarity is the result of JBL's use of pure titanium for its unique ribbed-dome tweeter and diamond surround, capable of withstanding forces surpassing a phenomenal 1000 G's.
**CONSEQUENCES:** When pushed hard, most tweeters simply fail. Transient detail blurs, and the material itself deforms and breaks down. Other materials can't take the stress, and crack under pressure.

**TRUTH:** The Frequency Dividing Network in each 4400 Series monitor allows optimum transitions between drivers in both amplitude and phase. The precisely calibrated reference controls let you adjust for personal preferences, room variations, and specific equalization.
**CONSEQUENCES:** When the interaction between drivers is not carefully orchestrated, the results can be edgy, indistinctive, or simply "false" sound.

**TRUTH:** All 4400 Studio Monitors feature JBL's exclusive Symmetrical Field Geometry magnetic structure, which dramatically reduces second harmonic distortion, and is key in producing the 4400's deep, powerful, clean bass.
**CONSEQUENCES:** Conventional magnetic structures utilize non-symmetrical magnetic fields, which add significantly to distortion due to a nonlinear pull on the voice coil.

**TRUTH:** 4400 Series monitors also feature special low diffraction grill frame designs, which reduce time delay distortion. Extra-large voice coils and ultra-rigid cast frames result in both mechanical and thermal stability under heavy professional use.
**CONSEQUENCES:** For reasons of economics, monitors will often use stamped rather than cast frames, resulting in both mechanical distortion and power compression

**TRUTH:** The JBL 4400 Studio Monitor Series captures the full dynamic range, extended high frequency, and precise character of your sound as no other monitors in the business. Experience the 4400 Series Studio Monitors at your JBL dealer's today.
**CONSEQUENCES:** You'll never know the "truth" until you do.

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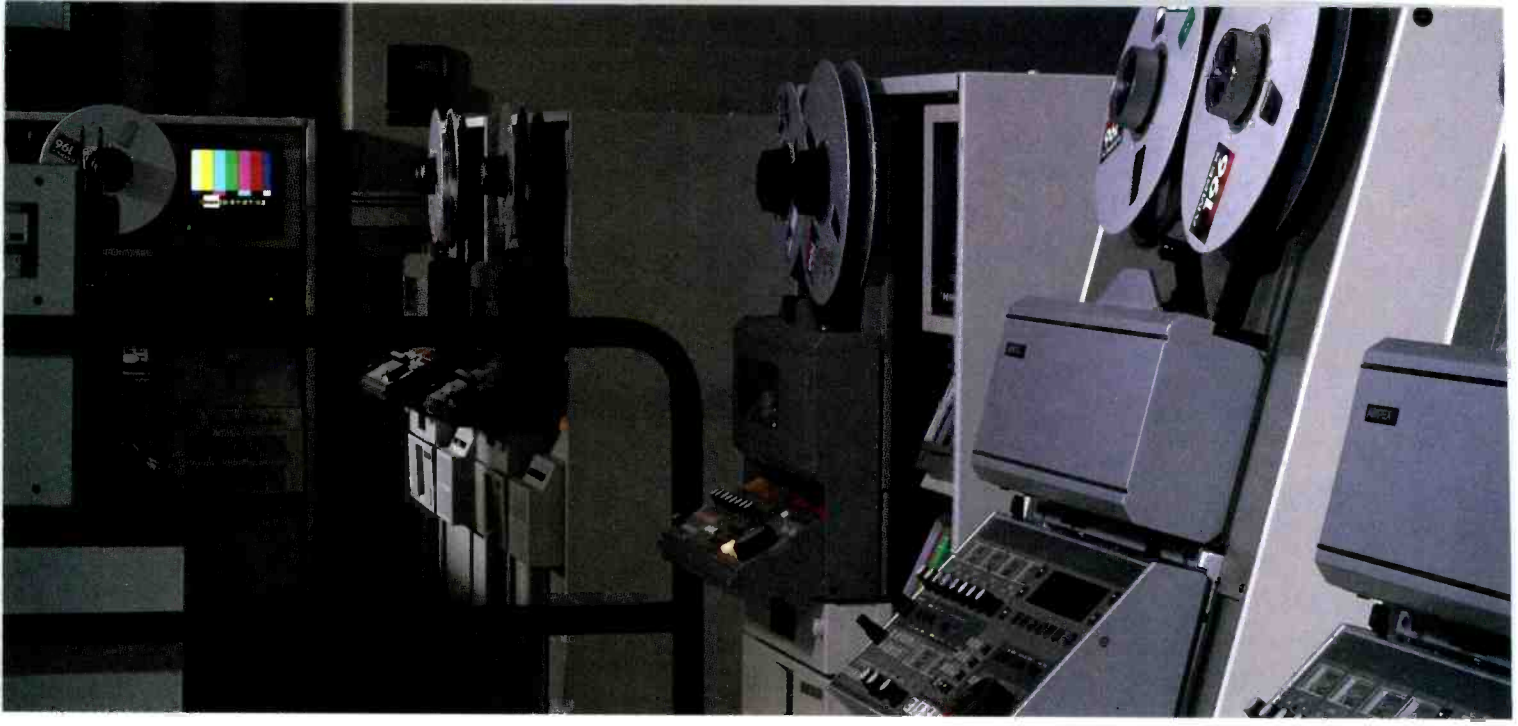

# A convincing argument for Type C from a company that invented D2.

We didn't spend five years pioneering the world's first D2 composite digital recorder just to win technology awards—selling D2 machines is one of our top priorities.

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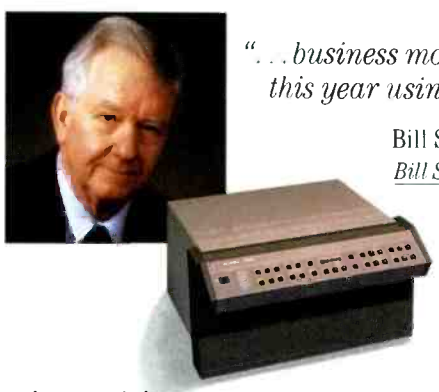


*"...business more than tripled this year using Type C..."*

Bill Stokes,
*Bill Stokes Associates*

*Ampex Zeus Advanced Video Processor*

for the straight story about that equipment and its applications.

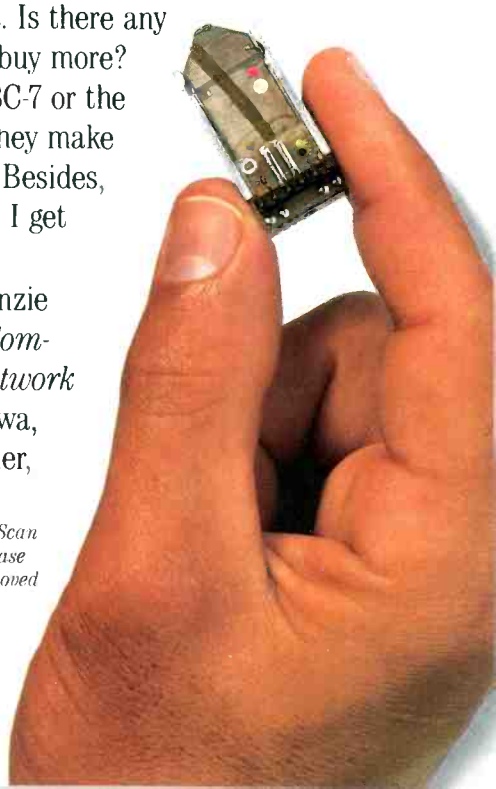
A case in point is the question we recently asked several of our customers who purchased Type C *after* we introduced D2.

*"With the introduction of D2, why did you purchase Type C?"*

We think the answers we got may interest you if you're considering the purchase of *any* video machine.

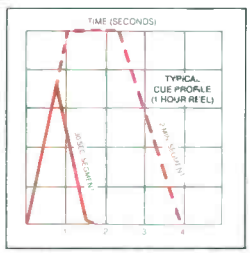
Bill Stokes (*Bill Stokes Associates* in Dallas), came right to the point. "My business has more than tripled this year, and I'm using Ampex Type C machines. Is there any better reason to buy more? With the new TBC-7 or the Zeus processor they make perfect pictures. Besides, I like the service I get from Ampex."

Jerry McKinzie with *Cycle-Sat Communications Network* in Forest City, Iowa, (a satellite courier,



*The VPR-80's Automatic Scan Tracking head and its erase head are both easily removed and replaced with only a screwdriver.*


production, and post-production business), thinks it's important to be able to update easily as his business changes. "The hardware and software upgrades Ampex makes in their equipment allow me to keep my facility current, and to always give my customers the newest look. I like that, and my customers demand it."




*The VPR-3's incomparable acceleration allows a 30 second segment to be re-cued and synchronously played in 2 seconds, using one hour reels.*

Darrell Anderson, whose company *Anderson Video* in Los Angeles, recently purchased several

*"...Type C business is readily available..."*

Darrell Anderson, *Anderson Video*

VPR-3s, pointed out that the Zeus port allows interface with D2. Darrell believes that, "Type C and D2 will co-exist successfully in a well-managed facility. Type C business is readily available." We were gratified to hear that he, "bought the best Type C machine he could find."

Consider your purchase decision carefully. When the excitement of a new equipment introduction passes, and you've put the pros and cons down on paper, Type C may be exactly the right machine for your application. After all, it's still the world's broadcast interchange and distribution standard.

*"...hardware and software upgrades keep my facility current..."*

Jerry McKinzie, *Cycle-Sat Communications Network*

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*Continued from page 90*
non-refundable feed time, after the fact.

And that time may not come cheap. The owners of Ku-band satellites have enjoyed the proliferation of SNVs over the past four years. It has meant that Ku-band time, which at one time could be had for a song, is now commanding top dollar on the spot market. Today you'll pay about 33% more for bulk Ku-band time (in 30-minute to 1-hour increments) than for the same time at C-band.

Most C-band satellite time is booked in 30-minute increments. If you go one minute past, you've just bought yourself another 30 minutes, or you've just gotten cut off. Using one of the Ku-band networks, such as Conus or Newsbeam, which book in 5-minute increments, can mean a 5-minute feed can be had for as little as $40, compared with $175 for a C-band feed of the same length.

Using less popular satellites when backhauling sports feeds can help keep expenses down. Through the use of such a satellite, a 3-hour sporting event's transmission costs can be kept under $4,000 today, which is down considerably from what it was only a few years ago.

### Satellite networks

Over the past 10 years or so, almost entirely because of satellites, an entirely new way of gathering news has developed. You no longer must be an NBC, CBS, ABC or PBS affiliate to gain access to taped footage of major and minor stories and human interest pieces.

Dozens of regional and national news-gathering networks have cropped up to feed the hundreds of non-affiliated stations with raw footage. Conus, Visnews, Satnet, ESPN, Hughes and CNN are but a few of these news networks. Each has regularly scheduled satellites and times that are used, and each usually bills by the story or by the minute of footage used.

Video news releases (VNR) and satellite media tours are areas that offer packaged footage via satellite. Most of the VNR times, satellites and transponders are listed in the Medialink newswire service, so coordination is pretty routine, unless several feeds are coming in at the same time. Often you can get a feed repeated — if you know who to talk to, that is.

### Communications

Perhaps the most critical aspect of satellite operations is communication with the crew in the field. To be effective in a live situation, the talent must be able to hear not only the anchors on the set, but also the instructions of the producer and director. This means the satellite communications manager must be thoroughly acquainted with the inner workings of mix-minus feeds and interruptible foldback (IFB).

Briefly, mix-minus is an audio feed that includes everything going into the program mix (the mix), except for the talent's voice (the minus). Hearing their own voices, especially with a second or so of satellite delay, is dreadfully confusing for newspeople. IFB, on the other hand, is an override signal that interrupts the mix-minus feed, replacing it with verbal instructions, typically from the director or producer.

Many technologies exist to accommodate these audio requirements. Learn them.

### Why we do the things we do

News is rarely cooperative. It never seems to break three or four hours before airtime; more often than not, it happens at the last minute. Being the first with the most requires managing your station's satellite resources for peak performance and a minimum of confusion.

Why should stations work so hard at news? The answers are many, and they often have to do with money. First, a

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strong news presence shows a station's involvement in the community. Mention a leading station's call letters, and someone is likely to respond with the names of the 6 and 10 o'clock anchors. A popular news team means more revenue from the station's news products, and that pays the light bill. Second, information is today's commodity. Today's audiences want to stay informed. Because station management often lives and dies by the ratings book, it's only natural they'd put their muscle where they can make a difference.

### At your fingertips

Managers of satellite communications, whatever their local titles require a thorough understanding of the plant's input and output capabilities, complete familiarity with the truck in use, a strong desire to keep accurate logs and records, and a broad knowledge of who's who in the industry.

## Call your broker

Satellite brokers do more than simply book time on satellites. Most also can provide uplinking and downlinking equipment and coordinate syndication of special events, among other functions. Some satellite brokers even own one or more transponders.

Prices charged for broker services vary. Like broadcasters, brokers have rate cards that list their standard fees. For most, however, bargaining is a way of life. You'll need something to bargain with, such as wanting a large block of time on a less popular satellite.

Time charges vary according to the time of day requested, the satellite that is desired and how much time will be booked. If you need a Ku-band transponder, expect the cost to rise significantly. Typical hourly rates are running at $525 per hour for Ku-band time vs. $350 per hour for C-band time on the spot time market.

Time for a "known event," such as a sporting event, can be scheduled only up to 90 days in advance. Beyond that point most satellite operators will not book time unless you want to buy a significant block of time, such as for coverage of the Olympics or national political conventions.

"Day of air" bookings, typically late-breaking news feeds and special events, can become coordination nightmares if the satellite operations manager doesn't know the station's capabilities inside and out. If it's a national or international story, hundreds of other satellite operations managers will be trying to get feeds in or out at the same time. Being flexible and tying in with other stations not only ensures you a feed but also can cut your costs.

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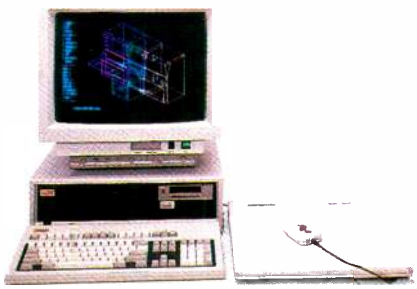

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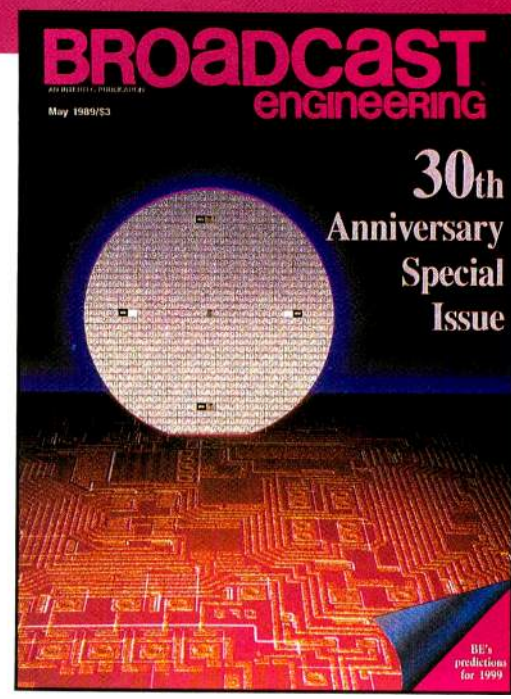
# Setting standards for the future




By Don McCroskey

## Standards: Are they friend or foe?

To most of us the term "standards" means the promotion of interchangeability of basic hardware. To others, it evokes thoughts of a slowdown of progress, of maintaining a status quo, perhaps for the benefit of a particular group. Each camp can cite examples to support its viewpoint, but no one can seriously contend that we would be better off without standards.

### What is a standard?

One dictionary lists seven meanings for standard, but only one of these — "anything authorized as a measurement of quantity and quality" — seems to relate to the idea of a standard in the industrial area. The original idea behind commercial standards was indeed to be bound legally on units of weights and measure for fairness in trade. The "standards" under discussion here are really recommendations for users and/or manufacturers to adhere to basic specifications that allow operational interchangeability in the use of equipment and supplies.

Anyone concerned with interchangeability of equipment or products should be concerned with standards. A user hesitates to purchase equipment that does not conform to recognized interface standards for connectors, input/output levels and test specifications. A manufacturer may not be able to sell products if they are not compatible with other equipment.

McCroskey is a **BE** consulting editor.

Ask yourself the following questions: How do standards affect my life? Do they stifle progress? Do they prevent products from appearing on the market in a timely manner? Do they discourage alternative technologies that might be beneficial in the long run?

Many would respond affirmatively to one or more of these questions. But consider the upside. Standards ensure that the needs of the user are considered, that equipment from different manufacturers can be interconnected.

### The standardization process

Standardization usually starts within a company as a way to reduce costs associated with parts inventory, design efforts and training of personnel. The next level might be a cooperative agreement, among firms that make similar equipment, to use standardized dimensions, parts and components. Competition, trade secrets and the NIH (not invented here) factor often generate an atmosphere that prevents such an understanding. Enter the professional engineering society, which promises a forum for discussion between users and engineers while downplaying the commercial and business aspects.

The professional society coordinates the documentation of existing and proposed systems with input from prospective users to effect a compromise between competing suppliers, and to ensure interconnectivity with the outside world. This recommendation might then be submitted to a body involving a larger circle of interested parties for further study and comment. (This second step is optional, depending on the scope of the project.)

The document then is forwarded to the national standards organization. Again, interested parties (who may not have participated previously) are invited to comment and appeal. Only when this group has determined that all parties affected by the standard have been represented fairly is the document approved.

A recent example is the 1125/60 high-definition production standard (SMPTE 240M), which was generated from the documentation activities of the Working Group for High-Definition Television and its various subgroups. After a number of drafts and a high degree of cooperation among the equipment manufacturers, a consensus was obtained. The document then was forwarded to the Advanced Television Systems Committee for review and consequent submission to the American National Standards Institute (ANSI). Following further *due process* procedures, the standard was declared.

### History of standards

In 1836, Congress authorized establishment of the Office of Weights and Measures (OWM) for the primary purpose of ensuring uniformity in customs house dealings. The treasury department was charged with its operation. As advancements in science and technology fueled the industrial revolution, it was ap-

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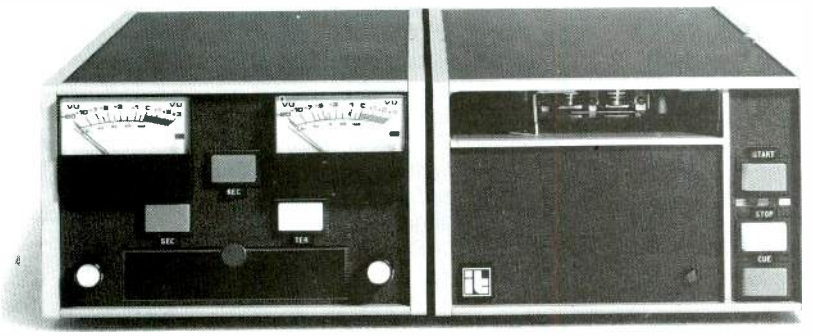

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parent that standardization of hardware and test methods was necessary to promote commercial development and to compete successfully in the world market.

The Industrial Revolution in the 1830s introduced the need for interchangeable parts and hardware. Wide use of steam railways and the cotton gin was possible only through mechanical standardization.

By the late 1800s, professional organizations of mechanical, electrical and chemical engineers were founded with this aim in mind. The American Institute of Electrical Engineers developed standards based on the practices of the major electrical manufacturers between 1890 and 1910. Such activities were not within the purview of the OWM, so there was no government involvement during this period. It took the pressures of war production in 1918 to cause the formation of the American Engineering Standards Committee (AESC) to coordinate the activities of various industry and engineering societies. This group became the American Standards Association (ASA) in 1928.

Parallel development occurred worldwide. The International Bureau of Weights and Measures was founded in 1875, the International Electrotechnical Commission (IEC) in 1904, and the International Federation of Standardizing Bodies (ISA) in 1926. Following World War II, this group was reorganized as the International Standards Organization (ISO). Today, approximately 54 countries participate on the ISO's 145 technical committees.

***Due process procedures ensure that participation is open to all persons who are affected materially by the (standard).....***

The International Telecommunications Union (ITU) was founded in 1865 for the purpose of coordinating and interfacing telegraphic communications worldwide. Today its 164 member countries develop regulations and voluntary recommendations relating to telecommunications systems. A subgroup, the International Radio Consultative Committee (CCIR), is concerned with the compatible use of the frequency spectrum — including geostationary satellite orbit assignments — and standardized transmission formats to allow interchange of communications over national boundaries. The Advanced Television System Committee (ATSC) and SMPTE channel recommendations to the CCIR via the U.S. State Department and the FCC.

The ANSI coordinates policies to promote procedures, guidelines and the consistency of standards development. Due process procedures ensure that participation is open to all persons who are affected materially by the activities, without domination by a particular group. Written procedures are available to ensure that consistent methods are used for standards development and appeals.

Introduction of new technologies or changes in the direction of industry or engineering societies may require a mediating group to assign responsibility for a developing standard to the proper organization. The Joint Committee for Intersociety Coordination (JCIC) operates under ANSI to fulfill this need.

Standards usually are changed only through natural obsolescence. Changes in basic quantities, such as units of length and volume, are extremely difficult for the general public to accept. In 1900 nearly all of the scientific, commercial and engineering community supported the change to the metric system. But the idea of changing ingrained benchmarks for weight and measure are as unpalatable as learning to speak a new language in another country.

**Society engineering committees**

The engineering groups that coordinate the work eventually presented to standardization bodies encourage participation from all concerned parties. Meetings often are scheduled in connection with major technical conferences to promote greater participation. Other necessary meetings usually are scheduled in areas where major research work is being done. No charges or dues are levied for membership or for attending meetings. An interest in these activities also can be served by reading reports carried in professional journals.

The wheels of standardization may seem to turn slowly at times, but the adoption of a standard that might have to endure for 50 years or more cannot be taken lightly. Many of the early standards relating to broadcasting were developed by equipment manufacturers, first under the banner of the Radio Manufacturers Association; then the Radio, Electronic and Television Manufacturers Association (RETMA); and now the Electronic Industries Association (EIA). The Institute of Radio Engineers (the forerunner of the IEEE) was responsible for measurement standards and techniques.

Who is responsible for what is a somewhat fluid situation, governed partly by tradition, but also by changes in business climates and the viability of engineering societies? The following will serve to outline the major players.

• *Institute of Electrical and Electronics Engineers*:

The IEEE, through its Broadcast Technology Society, traditionally has been involved with standards relating to transmission and recording systems. Presently available standards relate to definitions, measurement techniques and test methods. The Standards Coordinating Committees of IEEE publish books and documents covering definitions of electrical and electronics terms, graphic symbols and reference designations for engineering drawings and letter symbols for measurement units. These documents are available from IEEE or ANSI.

***The wheels of standardization may seem to turn slowly at times, but the adoption of a standard...cannot be taken lightly.***

• *Society of Motion Picture and Television Engineers*:

Organizations such as SMPTE, composed primarily of equipment users, are able to accomplish what is nearly impossible in the manufacturing community — to provide a forum where users and manufacturers can distill the best of current technology to promote basic interchangeability in hardware and software.

By about 1915 it became obvious that the rapidly expanding motion-picture industry needed to standardize the basic dimensions and tolerances of film stocks and transport mechanisms. After two unsuccessful attempts to form industry-based standardizing committees, the Society of Motion Picture Engineers (SMPE) was formed. The founding goals were to standardize the nomenclature, equipment and processes of the industry; to promote research and development; and to remain independent of, while cooperating with, its business partners. It is this independent quality of a professional society that enables it to mediate the strongly held opinions of business competitors.

By the late 1940s it was apparent that the future of motion pictures and television would involve sharing technologies and techniques. SMPE subsequently was expanded to SMPTE.

In comparatively recent times, SMPTE has been assigned more responsibility for TV standards. The recording and reproduction of TV signals has become the province of SMPTE standardization efforts. In the mid-'70s the society was successful

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*—Dana Geiken, DMB & B*

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*—Robert Strutzel, WGN-TV*

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*—Jim Martin, WOAY-TV*

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in coordinating an effort that resulted in a single standard for 1-inch helical scan videotape. Both the D-1 and D-2 digital videotape standards were developed in a remarkably short period of time for such a new and complex technology. During the past four years a working group of the society has documented the 240M (1125/60) high-definition TV production standard.

***Both the D-1 and D-2 digital videotape standards were developed in a remarkably short period of time...***

The "SMPTE Journal" publishes (yearly, in its December issue) an index of the work of its engineering committees in several forms:

1. *Engineering guidelines.* These are guidelines to be followed for the implementation of test materials and equipment operation.
2. *Recommended practices.* These include specifications for test materials, generic equipment setup and operating techniques, electrical recording/reproduction characteristics and mechanical dimensions involving operational parameters.
3. *ANSI/SMPTE standards.* These are mechanical specifications for film, tape, cassettes and transport mechanisms, and electrical recording and reproduction characteristics.

- *Audio Engineering Society:*

The AES was organized in 1948 primarily to serve the needs of the professional audio recording and reproduction community. The society maintains a standards committee (AESSC) that supervises the efforts of subcommittees and working groups. Drafts of proposed standards are published in the "Journal of the Audio Engineering Society" (JAES) for review and comment by all interested parties. Any substantive comments (as opposed to editorial comments) then are considered by the committee before the final document for a vote is issued.

Current AES standards address measurement methods, commercial loudspeaker specifications and audio transmission. The AES was assigned the task of developing standards documents to effect the transfer of digital audio information for recording and transmission.

- *Acoustical Society of America:*

The ASA covers the areas of basic

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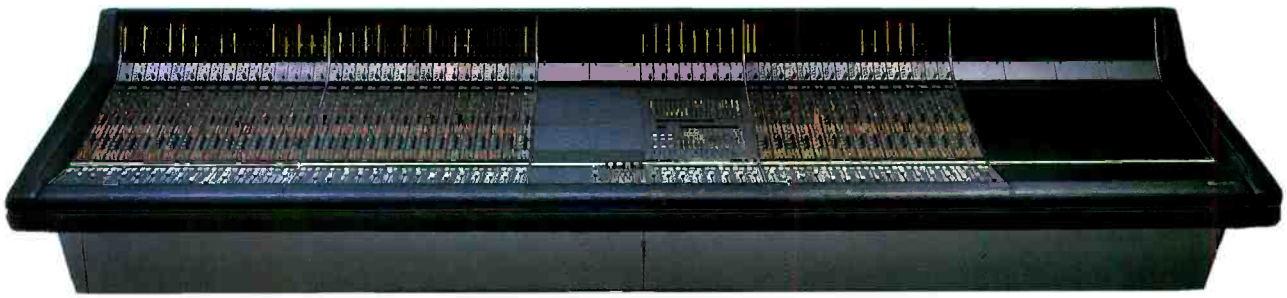

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The TV-4 console utilizes sophisticated Harrison electronics in a broadcast production console designed specifically for stereo television. Created to minimize operational hassles, the TV-4 is available in a variety of mainframe sizes and module complements. The console can be configured to the operator's specifications with optional accessories including: video switcher/editor interface, machine control panels, *several* different mixdown automation systems, clock/timer display, and other built-in options and accessories unavailable from other console manufacturers.

The PRO-790 is a second generation production console designed from the feedback of the owners and users of its predecessor, the PRO-7. It has become the most popular Harrison product ever. This highly successful, versatile console is available in configurations with serial link to video editors as well as configurations for OB Vans (remote broadcast) or station level production studios.

The AIR-790 is in the control rooms of the top radio stations in America and private stations in Europe. Its standard features far outdistance those offered by other companies as options: dual stereo and dual mono program, clean feed for mix-minus, auxiliary send, clock, up/down timer, test oscillator with pink noise generator, and muting of monitor feeds with tally. Its unique on-off-audition pushbutton system reduces talent/operator errors. The AIR-790—the undeniable leader in high quality on-air consoles.

The AP-100 reflects the first application of Harrison's digitally-controlled attenuator in a small broadcast console. The AP-100's logic control system allows the operator to program the console to accommodate the remote control of virtually any playback device, as well as to set any input for use as either a microphone or line level input. These features are only a few of the revolutionary features of the new AP-100—yet the AP-100 is available at a very affordable price.

The TV-3 (not pictured) is one of the most comprehensive stereo teleproduction consoles in the world. Designed for world class facilities, the TV-3 has full 24-track routing and monitoring and eight stereo audio subgroups. A flexible stereo and mono program output matrix allows the TV-3 to tackle the most complex tasks with "push of a button" ease.

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acoustics, electro-acoustics, shock and vibration and noise. Many of these standards are available through ANSI.

• *National Association of Broadcasters*:
The NAB traditionally has been involved with standards involving audio equipment used principally by broadcasters. A disc recording pre-emphasis specification was developed circa 1940 to bring order to the chaos then existing in electrical transcriptions used for music libraries and program syndication. Again, in the 1950s, NAB was instrumental in the adoption of standard audiotape recording/playback pre-emphasis curves. Tape cartridge specifications are another example of the work done by the NAB standards group.

• *International Standards Organization*:
ISO standards are concerned with audio quantities, units and symbols; cinematography; terminology; acoustics and information-processing systems.

**Case study: NTSC**

An example of standards development will illustrate how the process is conducted and what can result from industry cooperation. Standardization efforts for the black-and-white TV system used in the United States, and the compatible color system that followed, were well-documented.

• *NTSC I*:
In 1936, the Radio Manufacturers Association (RMA), the forerunner of today's EIA, set up a committee to recommend standards for a commercial TV broadcasting service. In December 1937 the committee advised the FCC to adopt the RCA 343-line/30-frame system that had been undergoing intensive development since 1931. The RCA system was the only one tested under both laboratory and field conditions.

A majority of the RMA members objected to the RCA system because of the belief that rapidly advancing technology would soon render this marginal system obsolete and, perhaps more important, would place them at a competitive disadvantage. (RCA was prepared to immediately start manufacturing TV equipment and sets.) Commercial development of television was put on hold.

At an FCC hearing in January 1940, a majority of the RMA was willing to embrace the RCA system, now improved to 441 lines. However, a strong dissenting minority (Zenith, Philco and DuMont) still was able to block any action.

The result was that the National Television Systems Committee functioned essentially as a forum to investigate various options. DuMont proposed a 625-line/15-frame/4-field interlaced system. Philco advocated a 605-line/24-frame system. Zenith took the stance that it was still premature to adopt a national standard. Not until June 1941 did the FCC accept the consensus of a 525-line/30-frame (60Hz) black-and-white system, which still exists today with minor modifications.

• *NTSC II*:
During early development of commercial TV systems, even as early as the 1920s, it was assumed that color would be demanded by the public. Primitive field-sequential systems were demonstrated in 1929. Peter Goldmark of CBS showed a field-sequential (color filter wheel) system in the early 1940s and promoted it vigorously during the postwar years. Despite the fact that it was incompatible with existing receivers, had limited picture-size possibilities and was mechanically noisy, the CBS system was adopted by the FCC as the national color TV standard in October 1950.

The engineering community felt

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betrayed (CBS excepted). Monochrome television, little more than three years old, had a base of 10 to 15 million receivers; broadcasters and the public were faced with having much of their new, expensive equipment become obsolete. The general wisdom was that color must be an adjunct to the 525/30 monochrome system so that existing terminal equipment and receivers could accept color transmissions.

Was the decision to accept the CBS color wheel approach a political one? Not entirely, because it was based on engineering tests presented to the FCC in early 1950. Contenders were the RCA dot-sequential, the CTI (Color Television Incorporated) line-sequential and the CBS field-sequential systems. The all-electronic compatible approach was in its infancy, and there were no suitable display devices. Thus, for a decision made in 1950 based on the available test data, the commission's move to embrace the color wheel system was reasonable.

CBS, however, had no support from other broadcasters or manufacturers; indeed, the company had to purchase Hytron-Air King to produce color TV sets (which also would receive black-and-white NTSC). Two hundred sets were manufactured for public sale.

Programming commenced on a 5-station East Coast network on June 21, 1951. Color receivers went on sale in September, but only 100 were sold. The last broadcast was on Oct. 21, 1951. The final curtain fell in November when the National Production Authority (an agency created during the Korean War) imposed a prohibition on the manufacture of color sets for public use. Some cynics interpreted this action as a design to get CBS off the hook because the production of monochrome sets was not restricted.

Meanwhile, the proponents of compatible, all-electronic color systems were making significant advances. RCA had demonstrated a tricolor delta-delta kinescope. Hazeltine demonstrated the constant luminance principle, as well as the "shunted monochrome" idea. GE introduced the frequency interlaced color system. Philco showed a color signal composed of wideband luminance and two color-difference signals encoded by a quadrature-modulated subcarrier. These and other manufacturers met in June 1951 to reorganize the NTSC for the purpose of pooling their resources in the development of a compatible system. By November a system employing the basic concepts of today's NTSC color system was demonstrated.

Field tests showed certain defects, such as sound interference caused by the choice of color subcarrier. This was corrected easily by the choice of a slightly different frequency, but at the expense of lowering the frame rate to 29.97Hz. RCA demonstrated the efficacy of unequal *I* and *Q* color-difference bandwidths. After further field tests, the proposal was forwarded to the FCC on July 22, 1953.

A major problem remained: the color kinescope. It was expensive and could be built to yield only a 9"×12" picture. Without the promise of an affordable large-screen display, the future of color television was uncertain. Then came the development of a method of directly applying the phosphor dots on the faceplate together with a curved shadow mask mounted directly on the faceplate. This breakthrough came from the CBS-Hytron company! The commission adopted the color standard on Dec. 17, 1953. It is interesting to note that the *phase alternation line* (PAL) principle was tried, but practical hardware to implement the scheme would not be available until 10 years later.

Those who suspect conspiracy behind every happening may still be heard suggesting that the field-sequential system was the best and that RCA forced an in-

ferior system on the public. The facts show that many of the prime features of the NTSC system were advanced by other research organizations. After 35 years, NTSC still has a remarkable aptitude for improvement and manipulation. But even with the advantage of compatibility for monochrome viewers, it took 10 years of equipment development and programming support from RCA and NBC before the general public starting buying color receivers in significant numbers.

### Are standards fair?

In a recent investigation by the Federal Trade Commission, only a small number of the almost 20,000 standards documents developed in the United States were found to arouse concern regarding equitable or fair trade practices. The voluntary development/voluntary compliance process does work. Standards are not developed by a self-serving group of people in secret.

Can the standards process be abused? Of course, in the same way that any rulemaking organization can be swayed by a determined group of people, be it a social organization, a city council meeting or the U.S. Senate. The safeguards are the encouraged participation of a diverse group and due process procedures. In a widely publicized incident in the early 1980s, a committee in the mechanical engineering field generated a standard that was alleged to favor a particular group of manufacturers. Engineering committees must be vigilant to prevent such a possibility.

## *The best standards are evolutionary.*

### Food for thought

The best standards are evolutionary. Our basic TV standards came out of an industry-based committee in 1941. Color information was added to the system in 1953, but programs still could be received on existing black-and-white TV sets. Further additional features and minor specification changes continued to be appended to meet the needs of new recording and transmission systems, but never at the expense of rendering existing equipment obsolete. And yet we all know that there will be a juncture when an orderly changeover to a new technology must begin. This point in time is not likely to be universally identified. The numbers of players and observers are such that many conflicting agendas will work against a general consensus.

The standards process will, however, continue to be an important element in equipment design and use. Not because the industry likes standards, but because it needs them.


**Bibliography**

Alden, Alex. "International Standardization," *SMPTE Journal*, October 1985.

Brown, George H. "And Part of Which I Was: Recollections of a Research Engineer." Angus Cupar Publishers, 1982.

Kirby, Richard C. "Broadcasting and International Standards." *SMPTE Journal*, September 1988.

Reitan, Edwin Howard Jr. "The Collection of Television Technology and Design." *IEEE Transactions on Consumer Electronics*, May 1984.

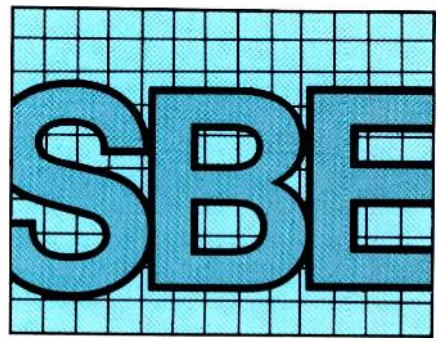
Streeter, Richard G. "What is a Standard?" *SMPTE Journal*, January 1988.

Zavada, Roland J. "SMPTE's Evolving Role in Standardization." *SMPTE Journal*, May 1982.


**Editor's note:** For additional information, contact the following organizations:

- Acoustical Society of America, 335 E. 45th St., New York, NY 10017-3483.
- Audio Engineering Society, 60 E. 42nd St., New York, NY 10165-0075.
- Institute of Electrical and Electronics Engineers, The Standards Office, 345 E. 47th St., New York, NY 10017-2394.
- National Association of Broadcasters, Office of Science and Technology, 1771 N Street, N.W., Washington, DC 20036.
- Society of Motion Picture and Television Engineers, 595 W. Hartsdale Ave., White Plains, NY 10607.

# SBE Update




## Board adopts licensing policy

By Bob Van Buhler

At its meeting during the NAB convention in Las Vegas, the SBE board of directors adopted a formal policy on the professional licensing of broadcast engineers. After reviewing each section of the policy carefully, the board edited and assembled the society's consensus on the issue.

Investigations by the board discounted the perceived crisis atmosphere, finding few accounts of enforcement. Where such actions do occur, the board policy instructs the national SBE to pursue modification of the statutes involved.

### Board position

The society sees no rationale for state regulation of technical responsibilities of either employees or contractors at communications facilities. The board stresses that deregulation by the FCC is not analogous to surrender of authority.

The official policy recognizes the expertise of professional engineers. In addition, it discourages those who do not hold a state-regulated professional license from claiming expertise in the professional engineer's domain by virtue of their involvement as broadcast engineers.

The policy affirms the validity of the titles of engineer, chief engineer and broadcast engineer, and recognizes the professional engineer's right to protection of that title. It also discourages non-PEs from calling themselves consulting engineers.

The legitimacy of the broadcast contract engineer's duties is recognized by the policy. It lists many of the contract engineer's rightful duties and services.

The policy statement declares SBE certification titles as valid, but such titles are in no way intended to imply competence in other disciplines. It is forbidden to use those titles to represent holders as being state-licensed professional engineers.

A copy of the policy statement was distributed to each attendee at the convention's session on professional licensing. Additional copies are available from the national office in Indianapolis. Call 317-842-0836 to request yours.

Van Buhler is manager of engineering at KNIX-AM/FM, Tempe, AZ.

### Scholarships announced

Two students will receive grants totaling $2,250 from the Ennes Scholarship Fund and another $1,000 from the Ennes Foundation.

The largest award, $1,500, will go to Mark L. Nielsen of Lincoln, NE. Nielsen, a sophomore at the University of Nebraska-Omaha, is studying electrical engineering.

Nielsen works part-time in TV engineering to finance his education, and he has been employed as an operations supervisor at KUID-TV. He also works as an operating engineer for Multi-Media Production Group in Omaha.

Nielsen is SBE-certified as a TV broadcast engineer and has an FCC general-class license. He chairs the Eastern Nebraska and Western Iowa chapter.

A second award, of $750, will be made to Beverly L. Collette of Newport News, VA. Collette has worked in master control and tape operations at several satellite uplink facilities. She was most recently employed by WHRO-TV, Norfolk, VA.

Collette, a student at Thomas Nelson Community College, will transfer next semester to Norfolk State University to pursue a bachelor's degree.

The Ennes Foundation's $1,000 scholarship award will go to James A. Nelson of Madison, WI. A student at the Wisconsin School of Electronics, Nelson is a master control operator at WMSN-TV and is responsible for transmitter and satellite operation.

Scholarship applications are investigated and reviewed by past president Ron Arendall, Detroit.

### "SBE Signal" editor to be hired

By formal resolution, the board of directors instructed the executive committee to select a paid editor for the "SBE Signal." Two issues are to be published before the SBE national convention. The editor will be paid a fee for each issue produced, plus reasonable expenses for postage and telephone service.

### Special Ennes workshops

Special engineering workshops will be provided by major equipment manufacturers on Wednesday, Oct. 4, the day before the opening of the national convention in Kansas City, MO. The workshops will be conducted free of charge by the following companies: Ampex, Broadcast Electronics, Grass Valley (Dubner), Harris Broadcast and Sony.

In addition, Mitchell Vo-Technical School will conduct an all-day seminar on satellite and uplink communications and operation. Consulting engineer Don Markley will coordinate a daylong session on AM and FM antenna systems. Under the auspices of the Cupka Corporation, WHIO-TV director of engineering Sim Kolliner and **BE** technical editor Brad Dick will coordinate the workshop on engineering management.

Each of the manufacturer-directed sessions will be taught by factory instructors. These will be hands-on technical presentations, not sales demonstrations.

Seating at each of the sessions is limited to 50 and will be reserved on a first-come, first-served basis. Attendance is limited to those registering for the **BE** technical seminars, which run from Thursday through Sunday (Oct. 5-8) at the convention. Plan on attending these important sessions.

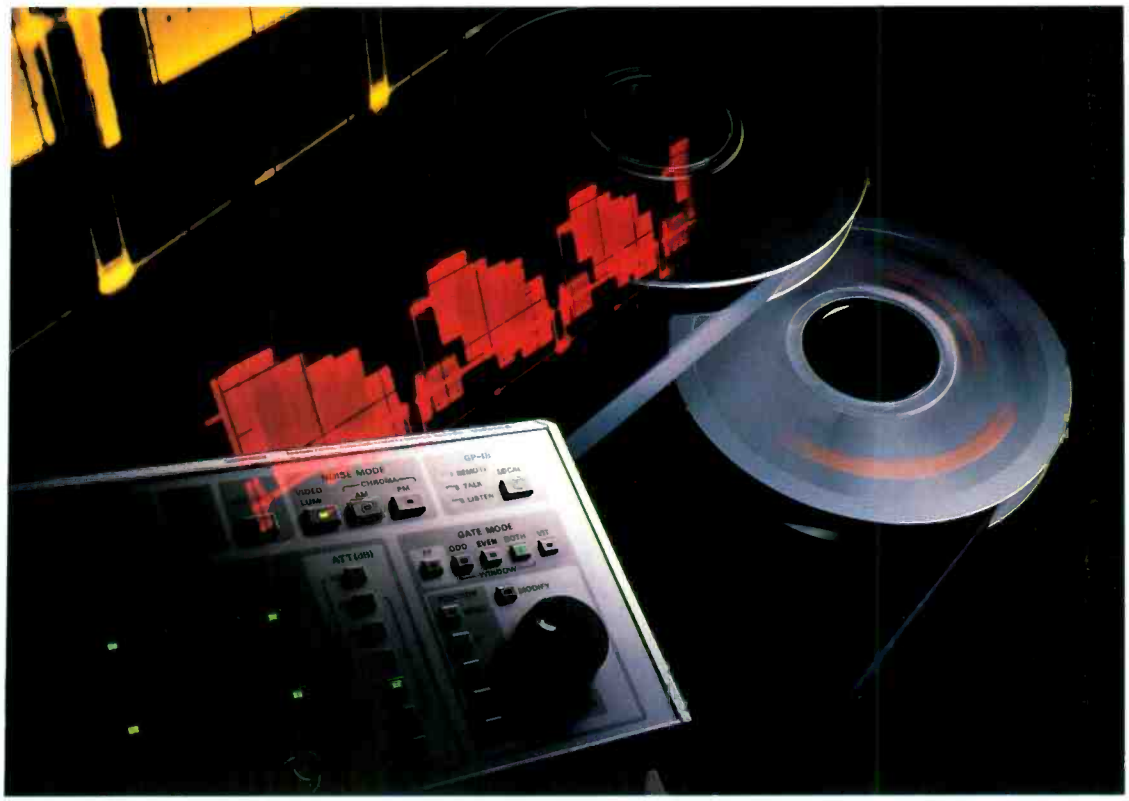
Continuing education units (CEUs) will be awarded to attendees at both the Ennes workshops and the **BE** conference sessions by Ferris State College. Remember, CEUs apply toward recertification points.

### Convention update

This year's national convention, which will be a celebration of the SBE's 25th anniversary, will combine plenty of learning opportunities with plenty of ways to have fun.

Attendees can take advantage of a special SBE cab fare. Usually, the cab ride from Kansas City's airport to the convention hotels is approximately $30. However, SBE has made special arrangements with the Yellow Cab company for reduced rates of only $7.25 per person. You must reserve your transportation in advance to take advantage of this discount fare. See the attendee mailing for additional information and toll-free telephone numbers.

**Editor's note:** For additional information about SBE activities, !GO BPFORUM on CompuServe. |:-)))|



# What should you expect from the company that designed the first color video noise meter?

# Clearly, everything.

*Fifteen years ago, when we introduced the first color video noise meter there was a lot to make noise about. Today, with the advent of super tapes, super formats and CCD technology, measuring noise accurately has become an exacting science. Shibasoku's VN30A Series Color Video Noise Meters rise to the occasion with some improvements of significant note.*

**Little Windows.**

New user defined measurement windows, easily constructed from the front panel, can be located anywhere on the screen. Create a spot window as small as a 4μs line segment and infinitely expand it up to full field. You can even place it in the vertical blanking interval.

**Free Buss Rides.**

Whether you've already automated testing, or plan to in the future, you get a GP-IB as standard equipment. That's right, standard. Not an expensive add-on afterthought.

**And All The Extras.**

The new VN30A Series gives you all the little extras like automatic sag compensation, auto level control and automatic memory for noise mode measurement. This means you can initiate a test quickly, in fact, at the touch of a single button. To help you isolate noise more precisely, the VN30A Series will let you measure even field, odd field or full field. And, the VN31AX will automatically select between NTSC and PAL.

*To find out why, for price and performance, the VN30A Series is clearly the leading color video noise meter, contact us today.*

ASACA

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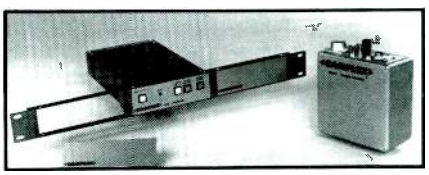
# New products

### Camera control system

*Concept W Systems* has introduced the CAMPLEX CP-201, which extends remote-control capability of video cameras to 5,000 feet on one coaxial cable. Signals transported on the cable include a blackburst signal to the camera, camera video, 2-way intercom, call/tally functions to the camera, mic/line audio, IFB/audio return and remote power. The camera adapter clips to a camera operator's belt, and connects to the camera with a 14-pin VCR cable or BNC connection. Remote power to the adapter must be within 1,000 feet. The control unit, in a ⅓-width rack-mount or tabletop package, processes and produces necessary signals at the video control location.



**Circle (350) on Reply Card**

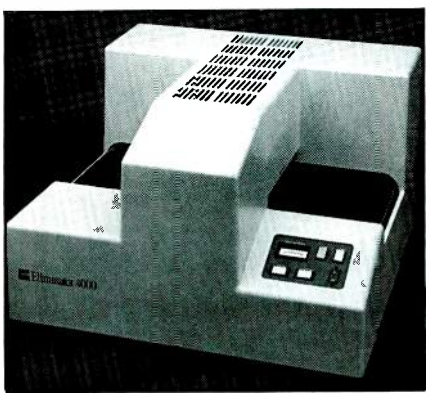
### Ku-band microwave system

*E & M Development* has introduced the PV104 series of bidirectional microwave systems for simplex video and audio transmission between a remote site and the station. A duplex order channel between the remote and fixed station is standard. A third audio channel can be added for stereo or reverse video, including S-VHS. The preassembled systems operate at 12.2-13.25GHz and include a 2-foot parabolic antenna, which will allow communications at distances to 20 miles line-of-sight. An automatic alignment system assists in link setup.

**Circle (351) on Reply Card**

### High-coercivity degausser

*Garner Industries* has introduced the Eliminator 4000 conveyor-type degausser that services the needs of video production centers using high-coercivity metal tape to 1,500Oe. Generating a 4,000Oe degaussing force, erasure depth of metal particle tape is typically −75dB on audio tracks, well into the noise level. A belt speed of 2.7ips provides an erasure time of 18s nominal.



**Circle (352) on Reply Card**

### Guy protection

*Hughey & Phillips* has introduced the Guyline Guardian, a device that bolts around guyline preforms with self-locking fasteners. As a cover over the preform, the device prevents vandals from unwinding preforms. The shape of the device breaks ice sliding down the guy to avoid ice damage. The bolts can be used as a point for grounding.

**Circle (353) on Reply Card**

### Broadcast monitoring

*Standard Broadcast Service* has introduced the National Supervisory Network (NSN). NSN uses very small aperture terminals (VSAT) to link information regarding conditions and operation of the stations' transmitters, automation systems, EBS and other equipment by satellite to the network center in Avon, CO. Equipment readings are logged at ½-hour intervals; alarms, EBS tests and other events are logged upon occurrence. Restarting a transmitter that has timed out during a power failure can often be restarted without local station staff intervention. Weekly tests of backup equipment, power changes and many other functions are handled from the remote.

**Circle (354) on Reply Card**

### Eight-track cassette

*TASCAM* has introduced the model 238 eight-track cassette recorder. The frequency response of 30Hz-16kHz at the standard cassette tape speed of 3.75ips is equivalent to that of a ¼-inch eight-track transport running at 7.5ips. With dbx noise reduction activated, the S/N measures 90dB, while crosstalk is 70dB.

**Circle (355) on Reply Card**

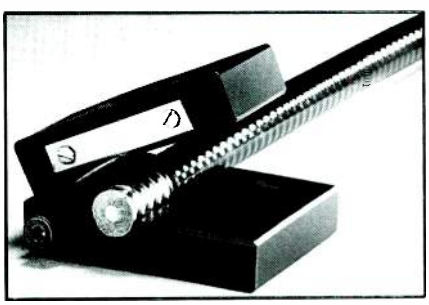
### Audio D/A converter

*UltraAnalog* has introduced the DAC D20200 dual 20-bit audio D/A converter. No external components are required for its use. Two independent channels, each with 20-bit resolution, operate at a 200kHz conversion rate, turning digital data back to analog audio signals. A dynamic range to 112dB is accommodated with this universal serial interface. When data of less than 20 bits is received, the device automatically inserts logical 0s as the least significant bit.

**Circle (356) on Reply Card**

### Cable prep tools

*Andrew* has introduced EASIAX, cable preparation tools for use on ¼-inch and ½-inch HELIAX coaxial cable. The pocket-sized devices include reversible, off-center cutting blades, which provide easy access to a spare cutting edge. A 3-step process readies the cable ends for connector attachment.



**Circle (357) on Reply Card**

### Calibration equipment

*Bird Electronic* has introduced the model 4029, a power sensor calibrator to be used in conjunction with the 4420 series RF power meters. The unit allows in-the-field calibration of the meters to ±3% of a known RF standard. The calibrator is used in conjunction with a CRT terminal or PC with serial port. The company also has announced the model 4024, an additional directional power sensor to the 4020 series Thruline RF sensors. The unit covers a frequency range of 1.5-32MHz at powers to 10kW.

**Circle (358) on Reply Card**

← Circle (69) on Reply Card

### Audio recorder interface

*Audio Kinetics* has introduced an additional ES 1.11 synchronizer interface. The addition serves the Otari MTR100 24-track audio recorder, which demonstrates a "tach rate" determined by the time-code standard in use. An MTR100 with the ES1.11 and an ES Eclipse controller provides full rehearse facilities with normal remote transport control and autolocate functions.

**Circle (359) on Reply Card**

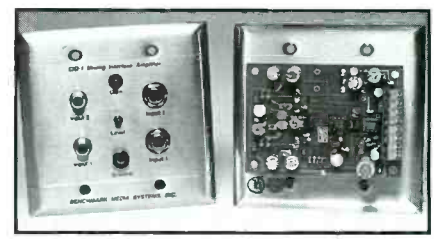
### Battery maintenance system

*BatteryPro Centres* has introduced the RAM recharging/analyzing maintenance system. Operating under a 16-bit microprocessor controller, charger cards, each with individual microprocessor, manage the charging operation with as many as 260 batteries in a fully expanded system. Five different programs are accessible from the front-panel keypad including instant charge, fast charge, exercise, recondition and standby. Data on each battery charged can be downloaded to a PC or printer.

**Circle (360) on Reply Card**

### Audio mixing interface

*Benchmark Media Systems* has released the CID-1 2-input mixing interface. The device is mounted on a 2-gang wallplate and provides two inputs with paralleled RCA and ¼-inch TRS phone jacks. The interface requires 24Vdc to 36Vdc for operation, and accepts two audio inputs (a stereo pair or two monaural signals), and produces a monaural output for recording or for driving a monaural sound system.



**Circle (361) on Reply Card**

### Ready-to-assemble furniture

*Bretford Manufacturing* has introduced the No. 60979 entertainment center, which includes an audio compartment enclosed by tempered glass doors with a wireform storage tray for 39 audiocassettes or 78 compact discs. The upper video compartment provides space for monitors to 27-inch widths, and a VCR shelf with storage tray for 30 VHS cassettes. Slots in the back panels of the cabinet simplify cable management.

**Circle (362) on Reply Card**

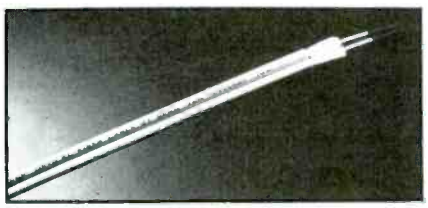
### Audiocassettes

*BASF Information Systems* has introduced the Ferro Maxima I audiocassette. A microcoating technology and proprietary megadium iron oxide allows a maximum output level approximately 4dB greater than the previous Ferro Extra I formulation. Cassettes are available in C60 and C90 lengths.

**Circle (363) on Reply Card**

### Plenum FO cable

*Berk-Tek* has introduced an improved plenum duplex fiber-optic cable. PT-DP provides two optical paths with increased flexibility, significant weight reduction, reduced attenuation and operation over a wider temperature range. The product uses flame-retardant materials in a zipcord design.



**Circle (364) on Reply Card**

### LPTV multichannel antennas

*Bogner Broadcast Equipment* has introduced a series of multiple channel antennas for LPTV operators, which allow from two to five operators to use the same transmitting antenna. These antennas use a patented slot array design capable of an 84MHz useful bandwidth with several VSWR options. Omni, directional and custom pattern designs include null fill, beam tilt and integrated redundancy.

**Circle (365) on Reply Card**

### Contact cleaner, lubricant

*Caig Laboratories* has announced an updated Cramolin aerosol product based on ozone-safe propellants, which deoxidizes, cleans, preserves and lubricates metal surfaces. The solution forms a protective, molecularly bonded layer to prevent contamination without reducing electrical conductivity.

**Circle (366) on Reply Card**

### Ethernet transceiver

*CaSat Technology* has introduced the LANCAST ENT-4303, an ethernet transceiver, which includes a patented collision avoidance circuit. The unit complies to the IEEE 802.3 specification for medium attachment units and comes with a choice of three cable taps to serve a variety of network schemes. The metal packaging meets FCC Class A requirements.

**Circle (367) on Reply Card**

### Switcher effects memory

*Central Dynamics* has introduced the SFX-MEM, a switcher memory system. Two Mbytes of memory store 120,000 panel commands compiled to discrete events. Events can be linked into sequences with sequences combined into routines. Auto Step allows a sequence to be "stepped through", allowing the operator to perform special functions. Wait commands control the delays before starting an event or sequence. The system is designed for the Strata-10 production switcher.

**Circle (368) on Reply Card**

### VTR automation and edit control interface

*Connolly Systems* has introduced the following products:

- The VTS-100 is an enhanced videotape sequencer system. With all hardware and software necessary to operate eight VTRs and an AFV switcher, the system supports on-air automation with titling and still-store functions. In conjunction with the PSS-100 PC-based program library and schedule system, direct access to a tape library including all transmission details allows advance generation of VTS-100 schedules and playlists for a Betacart system.
- The MEI-10 edit control interface has full edit control of Ampex VPR-2/2B VTRs from a Sony BVE series editor. Primarily for PAL standard operation, the interface provides time code, user bits and tape timer information on an 8-character, 7-segment display.

**Circle (369) on Reply Card**

### Portable R-DAT

*Digital Audio Technologies* has introduced the STELLAVOX STELLADAT, a portable R-DAT recorder. Extended battery life is one of the varied powering capabilities of the system. Multiple standard and optional input and output plugs provide versatility, while the shock-resistant and waterproof construction can withstand almost any climatic extreme.

**Circle (370) on Reply Card**

### Visualization system

*Cubicomp* has introduced CADView, a computer graphics system for creating presentation material and animated graphics, which draws upon drawings developed with a CADKEY 3-D modeling system. After a 3-D model is imported into CADView, various surface attributes, such as color, texture, transparency and reflectivity, may be assigned. A CS/24 24-bit frame buffer generates broadcast-quality images, which may be ported to a video printer for slides.

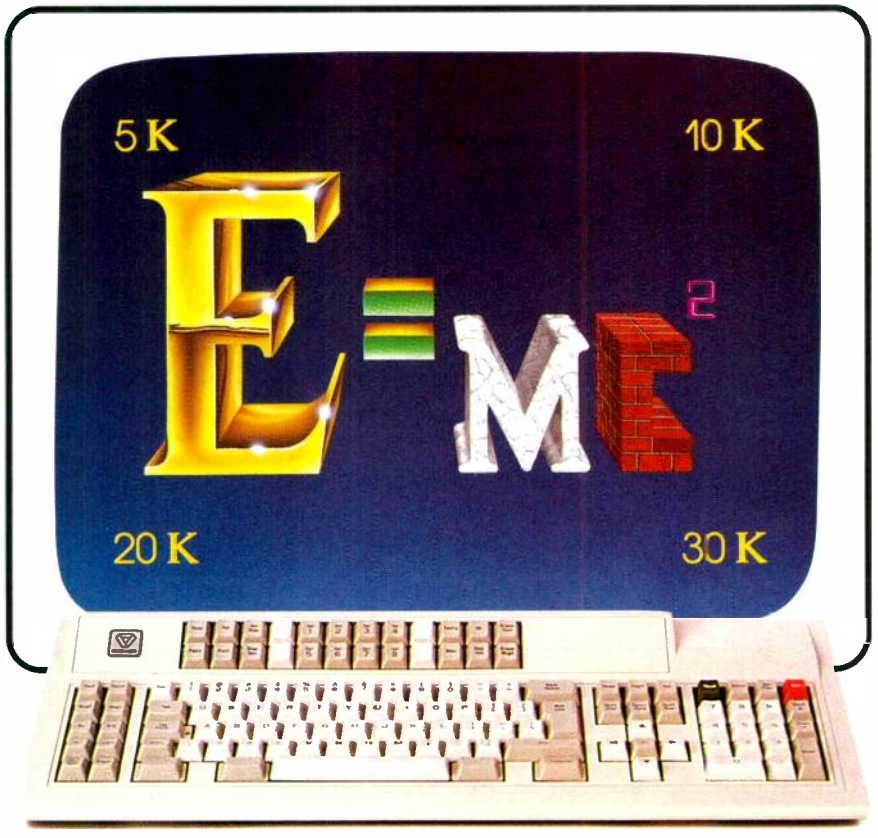
**Circle (371) on Reply Card**

### Time code and sync generators

*Horita* has introduced the FP-50 time-code system and BSG-50 sync generator. The FP-50 Field Pak is a portable time-code generator with "jam" mode and a window dub unit. When used for window dubbing, the device reads and inserts time code surrounded by a black mask into the video signal being recorded. The BSG-50 generator produces blackburst, composite sync and an audio test tone. Set for three blackburst and three composite sync outputs, internal jumpers allow the outputs to be reconfigured for H/V drives, composite blanking and subcarrier outputs.

**Circle (372) on Reply Card**

# SMART CHARACTERS

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### Editing system enhancements

*Editing Machines Corporation* has announced two enhancements to the Emc² editing system. Discrete Cosine Transform (DCT) compression improves image fidelity as well as quadrupling disk storage capacity to four hours of raw video per drive. In addition, original material storage now uses erasable, removable magneto-optical disk drives from Sony.

**Circle (373) on Reply Card**

### Autogram enhancement modules


*Henry Engineering* has introduced several enhancement modules. U.S.D.A. is a utility summing and distribution amplifier for combining and splitting audio signals for distribution. TELECART II operates with a cart machine to answer a phone line and play a recorded message, or as a line monitor to answer a phone line and feed audio to the caller. Update modules for Autogram consoles are improved versions of the MA-10 differential mic pre-amp, LA-10 line-input buffer, SA-10 servo-summing amplifier and OA-10 output program and meter amplifier.

**Circle (374) on Reply Card**

### Video DA

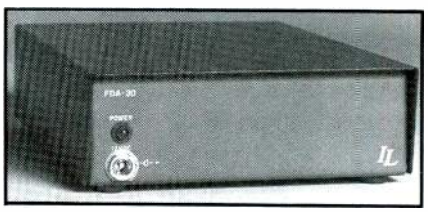


*Image Labs* has introduced the FDA-30 video DA. Three separate amplifiers, each with looping inputs and two outputs, are housed within a single chassis. For distribution of RGB signals or three separate video signals, the unit operates from a 12V battery or 10.5-17Vdc, drawing 100mA.

**Circle (375) on Reply Card**

### Engineering software

*EDX Engineering* has announced four engineering software packages. AMSW performs skywave propagation calculations for medium-wave frequencies. AMGW combines map conductivity, distances to groundwave contours and plotting of AM groundwave contours. TVSR performs a TV channel study for a new or changed full-power station. FMSR performs channel studies for new or changed FM stations.

**Circle (376) on Reply Card**

### Headset with boom mic

*Heil Sound* has introduced the BMA series of boomsets. The microphone, using wideband or noise-canceling cartridge, is detachable from the headset. Model BMA-5 is a single-element headphone, while BMA-10 is a double-muff type. The units terminate in a ¼-inch stereo phone plug.

**Circle (377) on Reply Card**

## Video titling system

*G2 Systems* has introduced ManuScript, an anti-aliased caption generator and video titling system. With an integral encoder and linear keyer, the system includes instant character resizing from a library of more than 2,000 type faces. Anti-aliasing produces an effective resolution of 10ns. Available for NTSC, PAL and CCIR-601 4:2:2, the system provides outputs in composite, RGB, component YUV and YC/S-VHS formats.

Circle (378) on Reply Card

## Videographics system

*Getris Images* has introduced VENICE, which offers paint tools with four superimposed images and linear keying, interactive 2-D animation of up to 11 anti-aliased actors, advanced 3-D animation and modeling with DGS2.1 software from Digital Arts, and mixing of computer graphics from different digital video sources. Based on 32-bit architecture, the system offers 4,096×4,096 pixel resolution with CCIR-601 inputs and outputs.

Circle (379) on Reply Card

## PA speaker systems

*Galaxy Audio* has introduced the Pro Spot 2 speaker systems for indoor or outdoor sound reinforcement. The system handles 200W 8Ω continuous input with a frequency response of 4Hz to 18kHz. The lightweight, wedge-shaped design is suitable for ceiling-mount or portable use. A speaker component of a 15-inch woofer and 1.5-inch dome tweeter is driven with a 1.3kHz crossover frequency.

Circle (380) on Reply Card

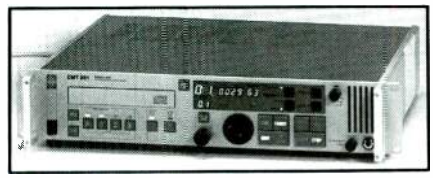
## Fader automation system

*GML* has announced Version 6 hardware and software for the series 2000 console automation environment. The version adds intelligent master machine control as well as Ethernet networking, extended editing and optional graphics display capability. Both 3.5-inch floppy and 40Mbyte hard disks are included in the system, while an external 8-inch drive is available to convert SSL and Necam mix data in the GML system.

Circle (381) on Reply Card

## Pro CD player

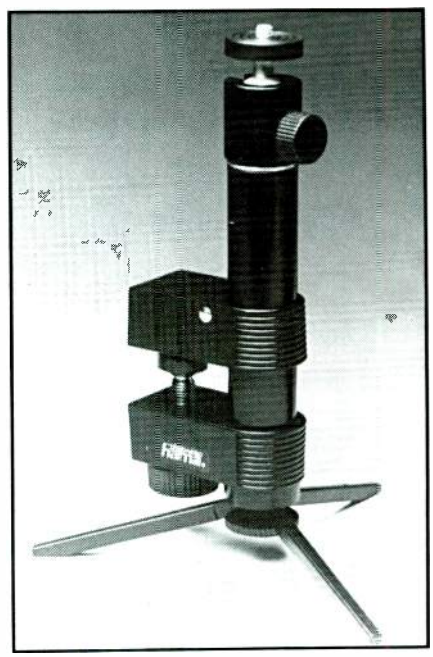
The EMT-981 professional CD player by Barco-EMT is available through *Gotham Audio*. The control and monitoring capabilities are suitable for broadcast or automated programming systems. All operating functions are accessed from large illuminated push-buttons or rotary controls with LED indicators. An EDIT mode serves setup, while ONLINE is the on-air mode, CUE provides precise cuing with repeatable segments. A ±10% varispeed range, AUTOCUE and AUTO STOP functions are standard features.



Circle (382) on Reply Card

## Camera support system

*Hamaphot* has introduced a dual-purpose camera support system for lightweight cameras or camcorder equipment. Acting as a C-clamp, the device opens to 2 ¾ inches to attach equipment to fences, tabletops, railings or other non-horizontal surfaces. Legs are stored in the accessory shaft, which allow the device to be used as a tabletop tripod. A ball-and-socket head provides for camera-angle adjustments.



Circle (383) on Reply Card

## Servo mic pre-amp

*Jensen Transformers* has announced the Twin Servo 990 microphone pre-amplifier. Packaged in a rack-mount chassis for two or four channels, the unit includes multiple LED monitoring with selectable peak or VU modes. Lighted switches select polarity, phantom power, feedback gain control and source impedance settings.

Circle (384) on Reply Card

## Frequency counter, color pattern generator and digital storage scope

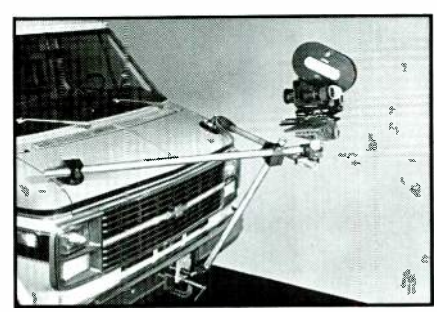
*John Fluke Manufacturing Company* has announced the following products:

- The PM 9608B is a high-frequency input option for use with the Philips PM 6660 frequency counter series. Although the standard counter units have a range of 0.1Hz to 120MHz, the option extends the range to 1.3GHz. Digit blanking also is available for the counters to remove irrelevant display digits for improved reading accuracy.
- The Philips PM 5518 TXI pattern generator features operation from the front panel or through a GPIB/IEEE-488 interface. More than 70 test patterns and carrier frequencies can be generated in NTSC, PAL/-N/-M and SECAM transmission standards.
- The Philips PM 3308 digital storage oscilloscope is a portable package with a 100MHz bandwidth that features an electroluminescent screen, extensive arithmetic and analysis functions. It also features a 180kbyte RAMdisk for storage of 100 waveforms or setup menus and is non-volatile with battery backup. It weighs 14.5 pounds, and the DSO displays four traces simultaneously, including Channels A and B with two mathematically calculated traces.

Circle (385) on Reply Card

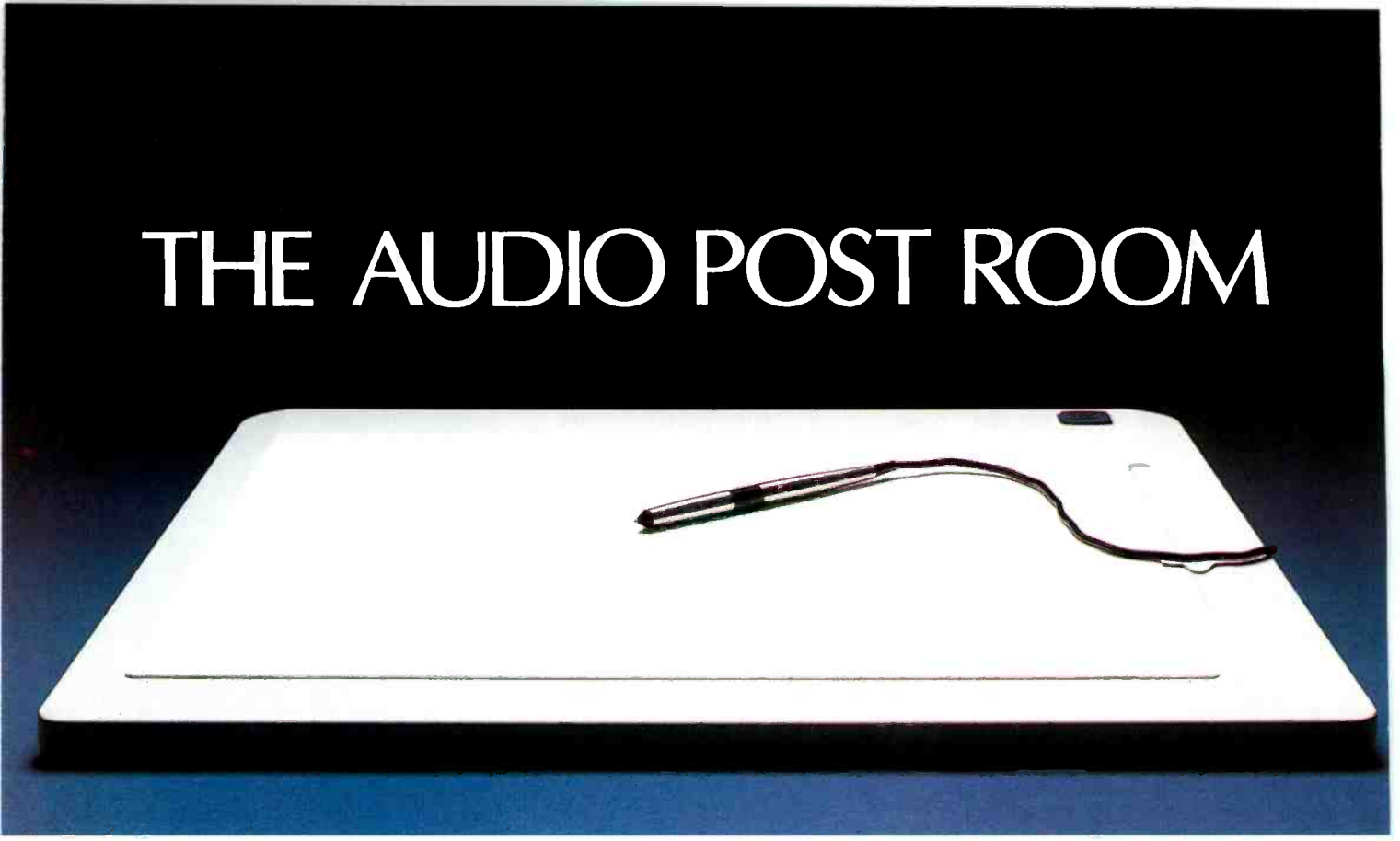
## Equipment-mounting system

*Kinetic Support Systems* has introduced the VCM F189 vehicular equipment support. Flexibility in mounting is possible through the combination of multipurpose couplings and articulated assemblies with several lengths of pipe, which allow a camera or other equipment to be mounted in nearly any orientation inside or outside the vehicle.



Circle (386) on Reply Card

# THE AUDIO POST ROOM



## DIGITAL AUDIO FOR VIDEO AND FILM

A state of the art audio-for-vision editing suite usually requires considerable investment in equipment, but above all, the patience and dexterity of skilled engineers to manipulate several tape sources to VT and film. Miracles can be performed, but the editor is often constrained from creative experimentation by the limitations of both time and his facilities.

Solid State Logic conceived ScreenSound to put more creative power and time into the hands of the editor by eliminating logistical problems. Instead, we provide an entire editing suite in one integrated unit, with a simple pen and tablet control surface, enabling rapid editing, laying up and track-slipping, all with the digital sound integrity necessary to meet today's broadcast standards.

ScreenSound provides the first working environment built around the editor, not the equipment, leaving him free to use his creative skills on the final soundtrack.

**ScreenSound**

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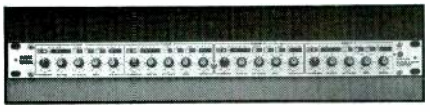
**Circle (94) on Reply Card**

### Audio delays and compressor

*Klark-Teknik* has introduced two stereo delay units and a multicompressor system. The DN726 stereo delay supports two inputs and provides stereo, in-phase outputs over a frequency response of 20Hz-20kHz. The delay range of 0-1.3s is adjustable in 20μs increments. The DN775 stereo mastering preview delay response covers 20Hz-25kHz with a delay range of 0-5.55s, adjustable in 16μs increments. Both use 16-bit linear processing. The DN504 quad compressor-limiter includes switchable hard- and soft-knee compression for four channels in a single rack-unit package. Separate threshold, ratio, attach, release and output controls as well as separate LED gain reduction metering are provided for each channel.



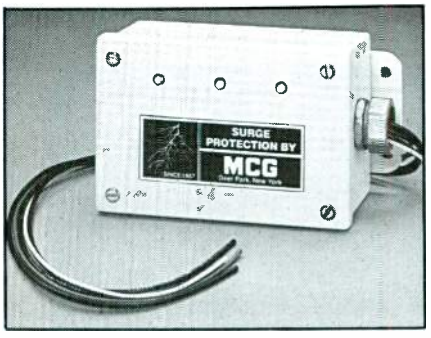
Circle (387) on Reply Card

### Lightning protection

*Lightning Master* has introduced the TT-3S series lightning dissipation array that reduces and controls the static charge buildup that initiates a lightning strike. On tall towers, both top and mid-point dissipation bleed the charge slowly, making the structures less visible to lightning.

Circle (388) on Reply Card

### Transient protection




*MCG Electronics* has introduced the SPA series of transient protectors for sensitive electronic equipment. The units install on the load side of a local service panel, connecting in parallel to the AC lines to be protected. Parallel MOVs on each phase provide energy-handling capabilities to 1,680 joules/phase with models from 120Vac to 480Vac in single phase, wye and delta configurations.

Circle (389) on Reply Card

### Fiber-optic links

*Ortel* has announced the following products:

- The 5515A and the 5515B fiber-optic links operate at 10GHz and 12GHz, respectively. The links consist of a 3515A/B laser transmitter using a 1515A/B laser module and 4515A/B receiver incorporating the 2515A/B photodiode. For analog transmissions, both systems operate beyond X-band frequencies.
- The 5601A broadband link is capable of transmitting 20 analog video channels on a single optical fiber to distances greater than 10km without repeat units. Fabry-Perot laser diodes without isolators and PIN photodiode receivers perform with low noise and distortion. Applications include CCTV, CATV or other broadband requirements.

Circle (349) on Reply Card

### Animation software

*Mindware International* has introduced PageSync, a software package interfacing the Commodore Amiga PC graphics with sound equipment including MIDI. The animation software synchronizes sound and video in animation. The program introduces interactive operation between the computer and MIDI equipment with either unit capable of controlling the other for effective animation production.

**Circle (390) on Reply Card**

### Video isolation transformer

*North Hills Electronics* has introduced the 1116UA and 1117UA 3-channel video isolation transformers. The multiple-channel configuration eliminates hum from video signals in RGB or composite installations. The 10Hz-5MHz bandwidth of 1117UA is compatible with NTSC, while a 20Hz-25MHz bandwidth of 1116UA is suitable for high-resolution video applications.

**Circle (391) on Reply Card**

### Mobile UPS system

*Nova Electric* has introduced Galaxy, a 1kVA rack-mountable UPS system. The 108-pound unit requires five inches of space in a 19-inch rack. Operating from shore power or field generators over an input frequency range of 45Hz to 65Hz, the output of the unit maintains regulation of ±1% from no load to full load, with a ±0.5% regulation of frequency.


**Circle (392) on Reply Card**

### Program timer, controller

*Monroe Electronics* has introduced the softkey control panel of the series 3000 program timer. It includes a 2-line, 40-character LCD display that is self-prompting. Sixteen open-collector outputs control program source equipment including satellite receivers, video recorders, IF switching systems or A/V relays. Optional modules for expansion with this 250-event minimum capacity controller are available.

**Circle (393) on Reply Card**

### Phono cartridges

*Ortofon* has introduced products in two phono cartridge series. The OM Super series features a cut-away stylus assembly for improved viewing of the stylus during cuing. A split pole pin technology reduces eddy currents in the pole pins for an extended high-frequency response. The X-Turbo series of high-output moving coil cartridges incorporate a finer grade of wire and a refined magnetic system for an output of 4mV.

**Circle (394) on Reply Card**

### Modular equipment cabinets

*Precision Fabrication* has introduced the medium-sized Mod-U-Desk rack cabinets. Technologies range from 12-to-22 inches high and 17-to-23 inches deep, while all accommodate standard 19-inch equipment chasses. The standard finish is royal blue. All the cabinets include adjustable mounting rails and permit panel modification with a knockdown construction design.

**Circle (395) on Reply Card**

# Business

### Video Services acquires Martin Audio Video

Martin Audio Video has signed a letter of agreement to be acquired by *Video Services* (VSC), Northvale, NJ. VSC is the parent of nine communications-related companies. Martin Audio will become part of VSC's A.F. Associate's unit. Martin, who founded his company in 1962, will continue to serve as its chief operating officer.

### Varian acquires W-J product line

*Varian Associates*, Palo Alto, CA, and Watkins-Johnson Company have reached an agreement in principle for Varian to acquire W-J's space communications product line. The product lines include high-reliability traveling-wave-tube amplifiers and power supplies for use in satellite-based space communications systems. The line will be assigned to Varian's Microwave Equipment Division in Santa Clara, CA.

### BTS announces sales agreement with Barco

*BTS Broadcast Television Systems GmbH*, Darmstadt, Federal Republic of Germany, will cooperate with Barco n.v. (Kortrijk) in the area of broadcast monitors. The BTS product range has been expanded to include the master control color monitors CTVM 4 (with 14- and 20-inch diagonal screens), the CVS series control color monitors (14- and 20-inch) and the CVM series color monitors (14- and 20-inch), as well as monitors from the HD series for HDTV. In accordance with market demand, the product range will continue to include complementary BTS monitors.

### Brabury Porta-Pattern relocates

*Brabury Porta-Pattern* has relocated its entire operations to the Kansas City area. The new location is 15755 South Highway 169, Olathe, KS 66062; telephone 913-780-4822; fax 913-780-5144.

### Carillon Technology sells dbx Pro Products to AKG

*Carillon Technology*, Sunnyvale, CA, has received a formal letter of intent for the purchase of the dbx Professional Products Division from AKG Acoustics, Stamford, CT, and it has been accepted.

### Former COMSAT unit to be sold to IDB

*IDB Communications*, Culver City, CA, has executed an agreement for the sale of CICI, the international services division of Contel ASC, to IDB. CICI, formerly a subsidiary of COMSAT, is a provider of international transmission services for the data/voice and TV marketplace.

The acquisition will improve the use of resources in facilities, manpower and operating leverage. Because the joint traffic of both companies will consolidate onto fewer facilities, IDB will be able to access new routes/countries for expanded international video and data services using the IDB and CICI facilities made available as a result of the consolidation.

### Neve links with Mitsubishi Electric

*Neve*, Bethel, CT, has been named the exclusive distributor of Mitsubishi Electric professional digital audio products in North America. Under the terms of the agreement, Neve will

be the exclusive North American distributor of the entire line of Mitsubishi Prodigi-format digital reel-to-reel tape recorders and ancillary equipment throughout the United States, Canada and Mexico.

Sonotechnique, Neve's exclusive Canadian distributor, has been appointed the distributor for Mitsubishi pro audio products in Canada.

### SISCOM and NBC announce joint development project

*Satellite Information Systems Company* (SISCOM), Boulder, CO, and NBC News will jointly develop advanced news production control systems that use NBC's graphics display software.

Under the terms of the agreement, news automation products that result from the joint development effort will be marketed internationally by SISCOM as part of its existing NewsPro computer software. The agreement provides NBC with an option to acquire up to 5% of SISCOM's common stock.

SISCOM and NBC News will work together to modify and expand automation software that has been developed by NBC over the past four years.

SISCOM and Digital Equipment Corporation also have announced the signing of a System Cooperative Marketing agreement covering SISCOM's NewsPro electronic newsroom software.

The agreement, part of Digital's Cooperative Marketing Program, enables SISCOM and Digital to work jointly on providing broadcasters with cost-effective, technical solutions for their newsgathering, editorial and production needs.

### Solid State Logic announces the formation of Audio Processing Technology

*Solid State Logic (SSL)*, Oxford, England, has announced the formation of a subsidiary to develop and market a new digital audio compression system. Audio Processing Technology (APT), will have its sales, marketing and manufacturing operations based at SSL's headquarters near Oxford. Development and subassembly functions are located in Belfast, Northern Ireland.

APT will exploit digital audio compression techniques pioneered by Dr. Stephen Smyth of Queen's University, Belfast, and use SSL's development and manufacturing resources to produce hardware. Smyth and the university remain partners in the new company. apt-X is the first product of the subsidiary.

SSL also has formed Solid State Logic Japan K.K. The subsidiary company is headquartered in Tokyo and will coordinate all SSL's Far Eastern sales and service operations, with the exception of Hong Kong and the People's Republic of China.

### Sony inaugurates Advanced Video Technology Center

*Sony*, Teaneck, NJ, has inaugurated the Advanced Video Technology Center at San Jose, CA. The recently consolidated Technology and Engineering Operation incorporates the Advanced Video Technology Center, which will serve as the focal point for development of advanced video technologies, with emphasis on R&D for high-definition TV program production and post-production equipment.

HDTV-related products recently developed by the center include a digital HDTV framestore system for storing high-quality images from an HDTV source and an off-line edit system.

The Sony Professional Audio Training Group in Fort Lauderdale, FL, has announced its 1989 schedule of technical service training courses and engineering seminars. The program is designed to educate the professional audio industry about changing technology and new products, and is aimed at sys-

tems designers and studio engineers, technical service personnel, dealers and users and engineering instructor and students.

The programs are held at Sony Professional Products Company, 1400 West Commercial Blvd, Fort Lauderdale, FL 33309. Courses can be conducted on-site at recording studios, video post-production facilities, dealerships or colleges. The Professional Audio Training Group also can give custom-tailored courses to fit specific requirements.

For more information, please contact Raymond Callahan or James Gayoso at 305-491-0825, ext. 186.

### VTA purchases Steadi-Film

*Video Tape Associates* (VTA), Atlanta, GA, has acquired an interest in Steadi-Film, Nashville, TN, which specializes in the research, development, production and marketing of equipment for the video post-production industry.

Steadi-Film's founder, Wayne Smith, will remain as president of the new corporation, which is called VTA Steadifilm.

# People

**John H. Babbel** has been named director of engineering at Alamar Electronics, Campbell, CA.

**Eric Heiberg** has joined Alpha Audio, Richmond, VA. He is one of the company's hardware and software designers. He already has completed his first project, a retrofit time-code reader module for ¾-inch video machines.

**Rupert Neve** has joined Amek Systems and Controls, United Kingdom. He will develop an advanced range of equipment and make some circuit enhancements in the existing Amek range. The company will provide Neve with its full range of facilities, including an in-depth manufacturing capability and production design team.

**Dan Lavry** has joined Apogee Electronics, Santa Monica, CA. He will head up the design of high-performance A/D and D/A conversion systems.

**Charlie Day** has been appointed product manager of the apt-X 100 digital audio compression system for Audio Processing Technology (APT), Oxford, England. He is responsible for worldwide sales and marketing of APT products. He is based at the Begbroke offices of the parent company, Solid State Logic.

**John R. Hickey** has been named manager of the newly created international division of Best Power Technology, Neceda, WI.

**James L. DeStefano, Raymond C. Kiesel** and **Stuart M. Kravitz** have been appointed to positions with Comark Communications, Colmar, PA. DeStefano has been appointed to full-time position of vice president of international sales. He is responsible for all international sales of the company's products, working directly with foreign, governmental and other buying entities. Kiesel has been promoted to vice president of advanced development. He is responsible for the engineering and development of the air- and liquid-cooled Klystrode-equipped transmitter product line. Kravitz has been promoted to vice president of domestic sales. He is responsible for total sales for the comprehensive line of UHF TV transmitters in the United States, as well as its line of RF systems and components.

**Chris Fichera** has joined Klark-Teknik, Farmingdale, NY, as DDA product sales representative. He is headquartered in Los Angeles and is responsible for DDA studio consoles. Fichera concentrates on selling consoles to studios and post-production facilities.

**Hugh R. Heinsohn** and **William V. Trowbridge** have joined Gentner Electronics, Salt Lake City. Heinsohn is director of corporate development. He is responsible for researching acquisition and joint venture candidates, procuring patent rights and supervising management information systems. Trowbridge, chief operating officer, assumes product management responsibilities from the director of marketing development. He oversees this area in addition to his current managerial responsibilities.

**Chips Davis,** formerly of Chips Davis, LEDE Designs, is now a principal at Paoletti/Lewitz/Associates, Acoustical and Audiovisual Consultants, San Francisco, CA.

# Professional services

# Professional services



# Classified

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## SERVICES



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## TRAINING

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**FCC GENERAL RADIOTELEPHONE** operators license through cassette recorded lessons at home plus one week seminar in Boston, Washington, Detroit or Philadelphia. Our twentieth year teaching FCC license courses. Bob Johnson Radio License Preparation, 1201 Ninth, Manhattan Beach, Calif. 90266. Telephone (213) 379-4461. 8-81-tfn

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**FOR SALE:** Rank Cintel ADS-1 Line Array Scanner/telecine, 3 years old and well maintained includes; 1 transport, scratch corrector, auto color corrector, VAC, 16mm and 35mm. One Cinescan 16mm film viewer and 2 VP-5000's all low hours, contact Andy Murphy 608-833-0047. 7-89-1t

**FOR SALE:** Bogner Antenna B16UA, 10KW, very good condition, $19,500. Diplexer, GE type PY-45-A, rated at 110KW, tunable from Ch 14-57, very good condition, $10,500. Call 419-684-5311. 7-89-1t

**FOR SALE:** One MAUST 106 AM Transmitter, Channel 68 LPTV and one Scala Slot Antenna SCA-SL-3-1 Channel 68, 1KW rating. Excellent condition. Best offer accepted. Contact: Teresa Dahlberg, 1400 One Summit Square, Fort Wayne, Indiana 46802, (219) 423-9411. 7-89-1t

**CROSSPOINT LATCH 6139-BK VIDEO SWITCHER WITH 7239** automated controller. Excellent condition, including all cables and manuals. $17,000, or best offer. Contact Ed Martin (615) 970-2192. 7-89-1t

**FOR SALE:** 3 RCA TK-46 studio cameras with pedestals, prompter monitors and studio cable. Retubed in December 1988. Dave Layne, KCNC-TV, 303-830-6426. 7-89-2t

## HELP WANTED

**MAINTENANCE ENGINEER:** Career opportunity for motivated individual with hands-on experience in a post production environment. Successful, growing company needs responsible engineer for technical support of 1" and interformat edit suites. Afternoon shift. Comprehensive benefit package, salary commensurate with experience. Advancement opportunity. Send resume in confidence to: Allied Film & Video, 7375 Woodward Ave., Detroit, MI 48202. Attn: Gary Woodworth. 7-89-1t

**BROADCAST ENGINEER,** 5 years experience, for corporate oriented production/post production facility. Miami. Resumes to: Bob Kahn & Co., 2730 S.W. 3rd Ave., Suite 100, Miami, FL 33129. 7-89-1t

**CBN—700 CLUB, MAINTENANCE ENGINEER.** THE CHRISTIAN BROADCASTING NETWORK (CBN) has an immediate opening for a TELEVISION MAINTENANCE ENGINEER. Applicants must be able to repair and install television cameras, audio and video magnetic recorders, sound and lighting equipment, synchronizing and test signal generators used in television broadcasting. The position requires three to five years experience in broadcast electronics in a major market or network, and education or technical training in electronic theory. Candidates must hold a valid FCC general radio telephone license or an SBE certification with TV endorsement. If you would like to serve in this Christian Ministry send your resume to: Employment Department, CBN Inc., Box E-4, CBN Center, Virginia Beach, VA 23463. 7-89-1t

**HELP WANTED TECHNICAL:** Major broadcast group seeks engineers and technicians for an immediate opening in Wisconsin and future openings in the Southeast. Applicants should be familiar with all phases of studio, transmitter, and tower construction. Strong maintenance and people skills a must! Prefer SBE certification and/or FCC General Class license. Competitive salaries and benefits. Send resume, references, and salary history to: Jerry Brown, VP/Engineering, Joyner Communications, P.O. Box 1125, Cary, NC 27512. EOE. NO PHONE CALLS. 7-89-1t

**MAINTENANCE ENGINEER:** Responsibility for repair and maintenance of all equipment for 2 cable TV/ITV facilities in Memphis area. Experience required in servicing ¾" equipment, ENG systems, and digital units. Provide total engineering support for new systems installation, upgrades, and purchasing. Prior experience in TV, studio maintenance required. S.B.E. certification, desirable. Send resume to: Heritage Cablevision, Attn: Frank Bluestein, P.O. Box 381316, Memphis, TN 38163-1316. 7-89-2t

**CHIEF ENGINEER:** KBDI-TV growing alternative public television station seeks chief engineer to oversee VHF xmtr, air ops, microwave links, equipment maintenance, staff & budget. Management skills desired. Salary range $27,000-30,000 plus benefits. Send resume to General Manager, KBDI-TV, 1531 Stout St., Denver, CO 80202. AA/EOE. 7-89-1t

## HELP WANTED

# Classified

**TV MAINTENANCE ENGINEER:** KUVN-23 Dallas, TX is seeking a maintenance engineer. Prefer 3-5 years experience, first phone, SBE Certified, knowledge of UHF transmitter, VTRs, switchers, cameras, ENG. Good benefits, fast growing UNIVISION station. Send resume to Richard Craig, 3720 Marquis, Garland, TX 75042. EOE. 7-89-1t

**LIBERTY UNIVERSITY ELECTRONICS DEPARTMENT** needs a qualified audio visual technician with experience in ½" and ¾" VCR and radio broadcast systems repair to component level. Technician must be able to maintain ITFS and closed circuit TV systems and be familiar with design and operation of digital control systems. Candidate must hold FCC General Class license or SBE Certification. Send resume to: Personnel Department, Liberty University—North Campus, P.O. Box 20000, Lynchburg, VA 24506, EOE. 7-89-1t

**TELEVISION SALES PROFESSIONALS** needed immediately for Tektronix' Television Division. Openings in Dallas, Denver, Syracuse, and Long Island. Competitive compensation, company car, opportunities to grow are part of "total package." Requires engineering background in television measurement, previous sales experience and desire to join one of the most successful Fortune 500 companies, contact John Kelley, Region Sales Manager, Tektronix Inc., 393 Inverness Dr. South, Englewood, CO 80112, (303) 799-1000. Tektronix is an equal opportunity employer. 7-89-2t

**REPRESENTATIVES.** A leading manufacturer of Telecom/Broadcast products and components seeks reps. in all areas excluding New York, Conn., Calif. and the Northwest. Respond by resume only to: TRIMM INC., 400 West Lake St., Libertyville, Illinois 60048. 7-89-1t

**50KW NON-PROFIT CHRISTIAN FM** seeking Chief Engineer willing to do some on-air work and light maintenance. Resume and tape to Joe Emert, WAKW, P.O. Box 24-G, Cincinnati, OH 45224. 7-89-1t

**CHIEF ENGINEER:** Fast growing CBS affiliate seeks leader with mobile KU/satellite truck experience. Proven supervisory, personnel and hands-on skills a must. Send resumes to Frank Imes, General Manager, WCBI-TV, Columbus, MS 39703. No calls. EOE. 7-89-1t

**ENGINEERS NEEDED: Maintenance Supervisor**—5 years experience component level, 2 years supervisory, trade school or college technical degree preferred. SBE, NARTE, or FCC General or First Class License. Experience with Ampes, Harris, Grass Valley and Ikegami required. **Assistant Director of Engineering**—5-8 years in TV broadcast engineering, excellent interpersonal skills, thorough understanding of broadcast systems a must. 2-3 years experience in management, familiarity with capital and operational budget process preferred. SBE, NARTE or FCC General or First Class License required. College degree or technical school also preferred. APPLY TO: Director of Finance, WYES-TV, P.O. Box 24026, New Orleans, LA 70184-4026. No Telephone Calls! WYES-TV is an Equal Opportunity Employer. 7-89-1t



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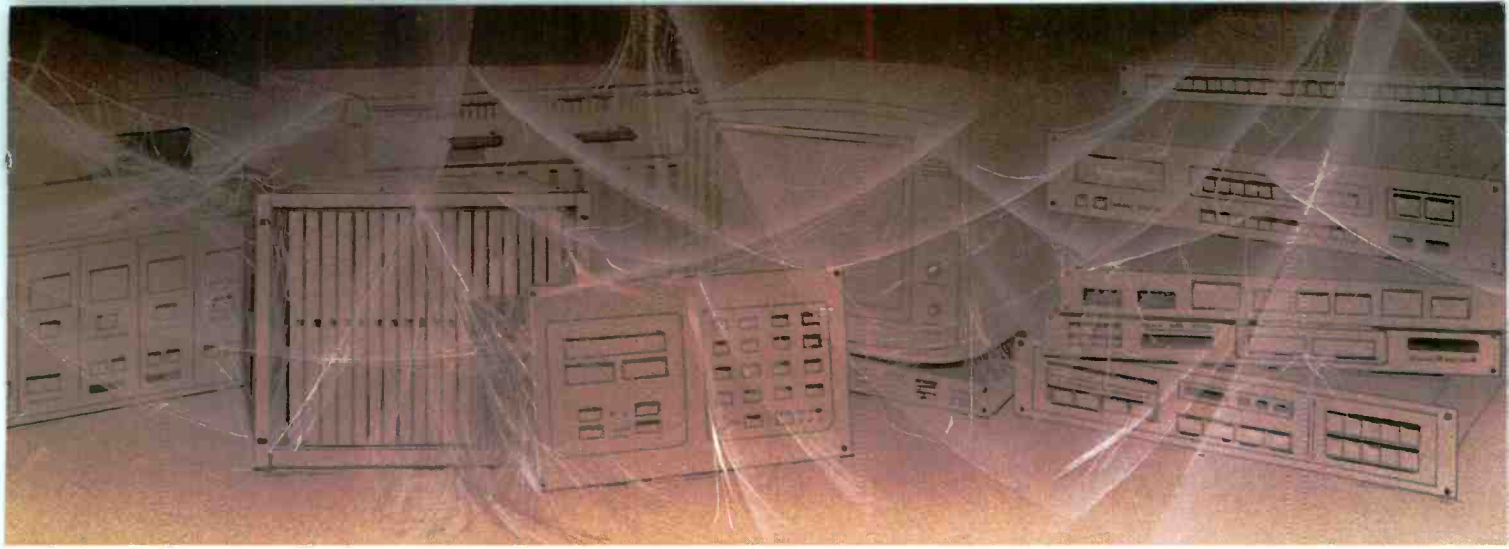
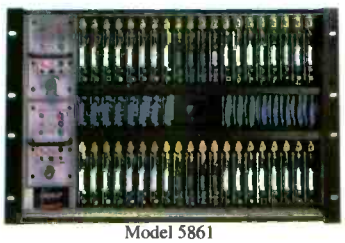
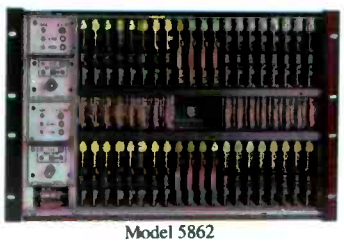


# DI-TECH'S VIRTUAL MATRIX MAKES OTHER ROUTERS VIRTUALLY PASSÉ



Model 5861
64 × 32 Video Switcher



Model 5862
64 × 32 Audio Switcher

Routing switchers are simple and efficient when all you need is a full AFV matrix. If you try reserving a few video only or audio only crosspoints, however, they can quickly become very clumsy and awkward. Now, you could play games moving switch cards around, tie up "spare" inputs with terminators, or rewire your router frames. But there is a better way.

Di-Tech's *virtual matrix* control system, Model 9002, maintains a software map of your router's hardware connections. This makes it easy to define single level crosspoints *anywhere* in a matrix, as well as preset breakaway switches. Special purpose routing – such as time code, RS422 or RGB – can be smoothly integrated into an 8 level master grid at any time.

Prepare for tomorrow with the company that can do it all today...Di-Tech.

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Circle (2) on Reply Card

# More versatility!
# More important functions!

## The D8212 Distribution Amplifier System just keeps on growing!

All of Ward-Beck's substantial investment in R&D is directed towards one single objective ... to bring you the very best professional audio systems.

That's why other manufacturers, who try to satisfy a wider range of audio and video applications, simply cannot match the performance and quality of Ward-Beck audio products such as the proven D8212 DA System.

Now Ward-Beck is proud to announce the addition of new modules for the D8212 System. These include the M8200 transformerless, remote sensitivity microphone pre-amplifier, a stereo DA and a test oscillator.

We invite you to ask for details on these and other high-performance products in the expanding D8212 family.

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