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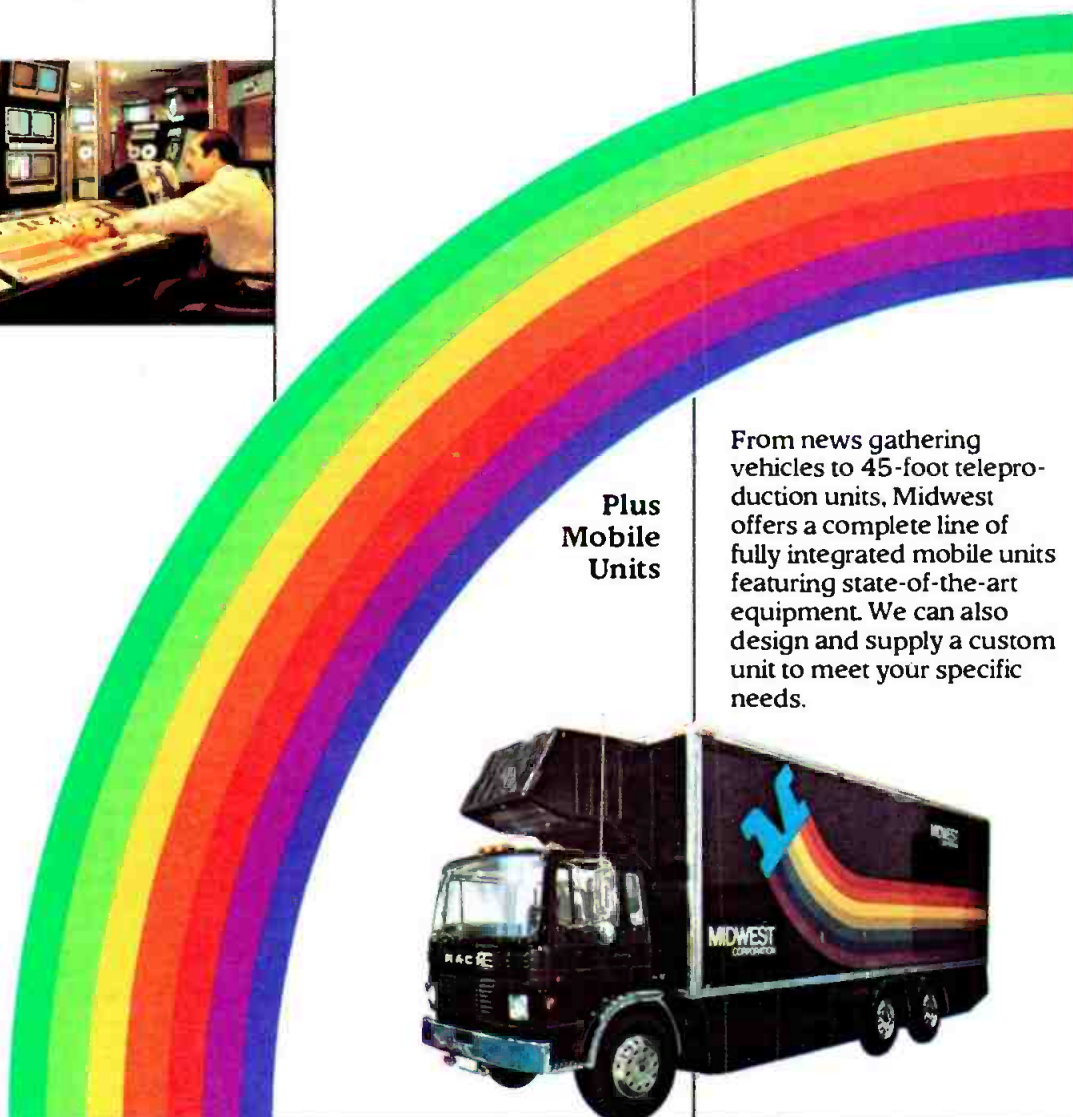
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BROADCAST engineering

The journal of broadcast technology

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BROADCAST engineering

March 1984/83



THE COVER this month shows one of the ABC News crews on assignment as part of ABC's worldwide coverage. The photo, which shows that the new ENG technology works well with a backdrop of some of man's age-old efforts, is courtesy of ABC, New York. An article, "Technology Behind ABC News," begins on page 22.

Coming events

March 27-28

LPTV West, Anaheim, CA

March 27-30

Audio Engineering Society (AES), Paris, France

April 8-12

NPR Annual Conference, Arlington, VA

April 29-May 2

NAB 62nd Annual Convention, Las Vegas, NV

May 3-6

ITVA, Las Vegas, NV

May 12-15

Audio Engineering Society (AES), Anaheim, CA

May 20-23

Broadcast Financial Management Association (BFMA) 24th Annual Conference, New York, NY

May 30-June 2

American Women in Radio and Television 33rd Annual Convention, Chicago, IL

NEXT MONTH BE will focus on the NAB-'84/Las Vegas Convention. Our pre-show issue will include a run-down of technical sessions (scheduled for Saturday and Tuesday nights); a detailed product/exhibitor listing; a floor map pinpointing booth locations, with exhibitors specified; and highlights of special events announced for this year's show.

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Broadcasters help fight crime

Criminals may have a tougher time breaking the law and getting away with it in 1984, because a 12-year-old organization, WE TIP, now reaches 15 million viewers across the nation. WE TIP enables people to give information regarding criminal activities via a national toll-free hot line.

WE TIP's partnership with television began in 1981 with Eyewitness News on KABC-TV, Los Angeles. Broadcasts of public service announcements, editorials and documentaries by KABC-TV to date are touted as being responsible for 2408 criminal arrests, 316 convictions and the seizure of \$11.5 million in illegal drugs. Another outstanding set of statistics involves WLS-TV, Chicago, which joined the organization in March 1983. The figures state 102 arrests, \$191,600 in recovered stolen property and \$45.8 million in illegal drugs and narcotics.

Other TV stations in the WE TIP program include WATE-TV, Knoxville, TN; WIXT-TV, Syracuse, NY; WPVI-TV, Philadelphia; WXYZ-TV, Detroit; WISN-TV, Milwaukee; and KGO-TV, San Francisco, as of Feb. 1, 1984.

Criminal activities handled by the WE TIP program are not limited to stolen property and drug traffic, however. WXYZ-TV's involvement in the program led to the arrest of a murder suspect. WATE-TV tells of a different type of situation, though, when a bystander attacked a plainclothes officer who, working with the TV production staff, was re-enacting a purse-snatching incident for later broadcast on WATE-TV's crime-stopper segment.

Stations interested in joining the WE TIP program may

contact: WE TIP National Crimefighting Network, P.O. Box 740, Ontario, CA 91761; 714-987-5005.

Individuals interested in reporting information to the network may call 800-73CRIME nationwide or 800-78CRIME in California.

Group cooperates to organize satellite distribution

A group of Canadian broadcasters and cablecasters are trying to organize satellite distribution and other services needed by the electronic media. The plan will see the launching within a year of Canadian Satellite Distribution System (CSDS), a service owned and operated by its users. The service will exploit Canadian technology and expertise.

Bob Lockhart of Saint John, New Brunswick, is chairman of the organizing committee. Lockhart was the last broadcaster president of Broadcast News Ltd., a wholly owned subsidiary of the Canadian Press. He said that seven broadcasters who, until Nov. 10, served on the BN board of directors, form a nucleus of the planning committee. Other industry representatives have been added in all regions and each medium has a voice in the work.

"Groups that to now have competed rather than cooperated in trying to meet broadcast/cable television needs, now will be working together," he said. "The support we've received has been overwhelming. It's an historic undertaking and the industry understands that point."

Canadians will benefit from the many new services CSDS will help to create and distribute. [:-:~))]]

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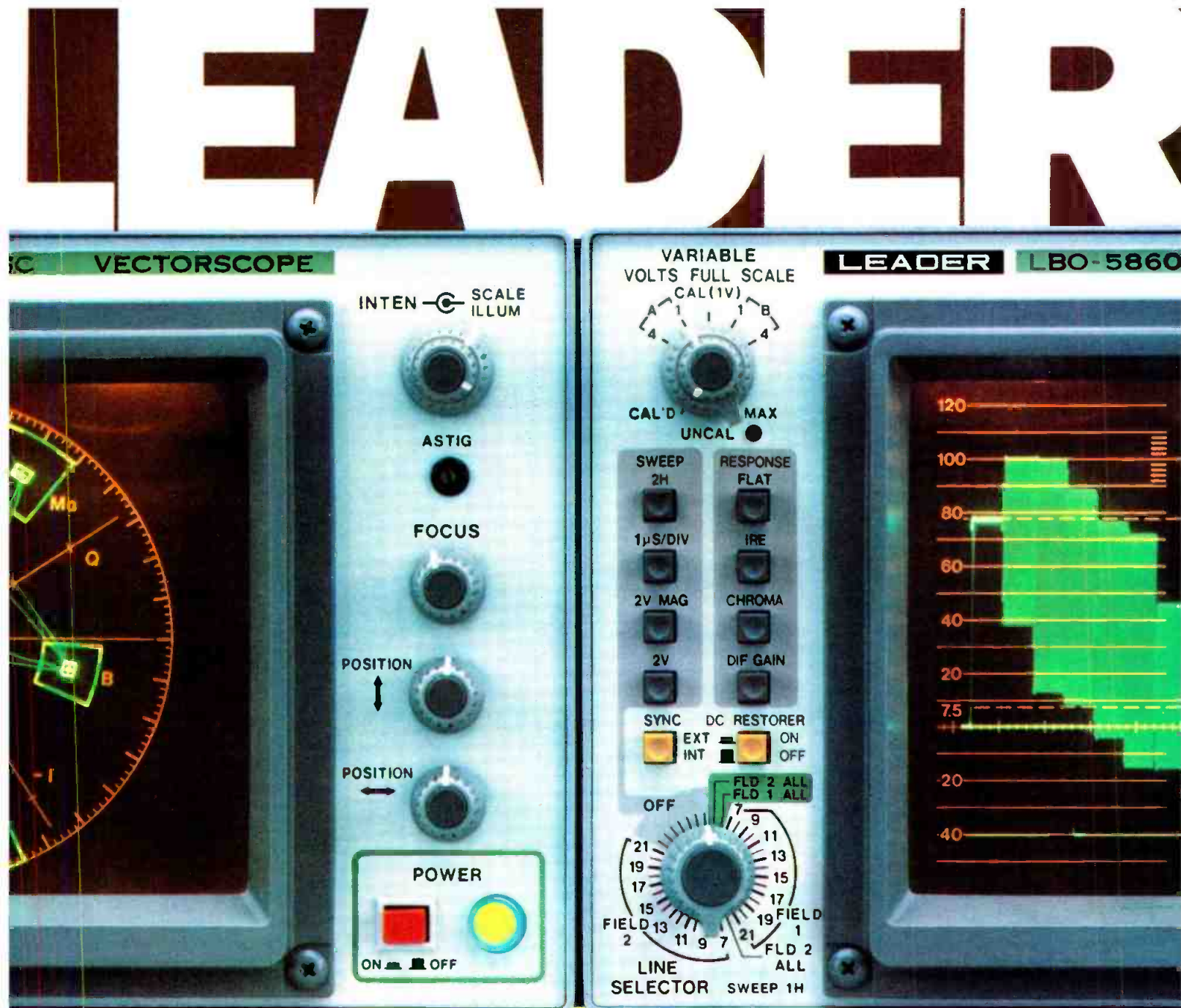
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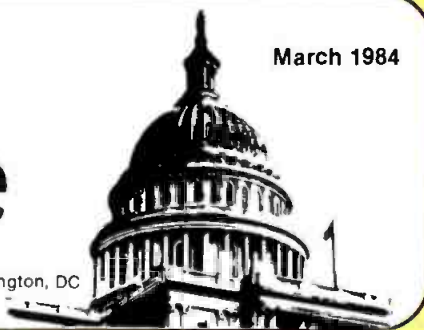
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FCC update

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



LPTV special:

Processing, status and outlook

The FCC began processing LPTV applications in 1983, but relatively few applications had been granted by the end of the year, with more than 11,000 still pending. This number would have been higher, except for the "purge" of more than 3000 technically defective proposals during the period from October-December 1983.

The commission held three lotteries last year, which resulted in the selection of 53 tentative LPTV permittees. The agency expects to conduct lotteries at least once a month during 1984 and hopes to include more groups of applications in each drawing session. As of Jan. 1, there were 227 licensed LPTV stations in the United States and 150 additional granted, but unbuilt, LPTV facilities.

Tier processing/freeze

For processing purposes, LPTV applications are grouped into categories, or Tiers, based on location. Applicants proposing to locate their stations more than 55.5 miles from the center of any of the 212 top TV markets are placed in Tier I. Tier II includes applicants proposing to locate their stations within 55.5 miles of markets 101-212. Tier III includes applicants proposing to locate within 55.5 miles of markets 1-100.

From June 17, 1982 (when the new LPTV rules became effective), through Sept. 15, 1983, the FCC froze the filing of applications for locations falling within Tier II and Tier III. As of Sept. 15, 1983, the commission extended the freeze to Tier I locations.

Current filings

Under the FCC's freeze, the only applications acceptable—in any tier—are those filed in response to cutoff lists. Through the end of 1983, the commission published such lists on a monthly basis, each including about 100 applications. All applications listed were for communities located in Tier I areas. The commission estimates that for each application that appeared on these cutoff lists, it received four competing proposals. Thus, through January 1984, the commission con-

tinued to receive approximately 400 new LPTV applications each month, despite the freeze.

Omnibus cutoff list

On Feb. 7, 1984, the Mass Media Bureau issued one omnibus cutoff list that included all of the approximately 3400 applications, in all tiers, that met the FCC's technical criteria and had not previously been cut off.

The cutoff date for filing applications in conflict with these proposals was set for March 8, 1984. The FCC expected to receive 10,000-20,000 new applications in response to the omnibus list. Depending on the number actually received, it may be a year or more before all pertinent data on the new proposals can be entered into the FCC's computer so that the proposals can be processed.

Lottery groupings

In the meantime, the FCC will continue to process applications already cut off by grouping them for lotteries. This grouping is done by computer. The computer identifies applications that are mutually exclusive with each other by applying the interference criteria contained in the LPTV rules. The computer calculates the pertinent interference contours of existing and proposed LPTV, TV translator and full-power TV stations and determines prohibited overlaps. An applicant whose proposal would exceed maximum permissible signal strength in relation to an existing construction permit (CP) or station, or a previously cut off application, is dismissed and no appeal is permitted unless the FCC's calculations were incorrect.

Applications that survive this threshold test, and are linked together by their mutual exclusivity, are placed in a lottery grouping. All applicants in a particular lottery grouping then are asked to file a statement declaring their minority status and the extent of their other broadcast interests. These two factors are used in assigning lottery preference points. A minority applicant with no other broadcast interests is assigned the highest probability-of-success factor in relation to competing applicants.

Many applications are linked together in daisy chains of mutually exclusive (MX'd) proposals. (In other words, if A is MX'd with B and B is MX'd with C, then A is considered MX'd with C.) The commission has one daisy chain consisting of 1000 interlocking mutually exclusive applications. In such cases, the FCC holds an initial lottery to break the chain followed by as many lotteries among the resulting subgroups as are necessary to dispose of the rest of the original 1000.

Post-lottery procedures

After winning a lottery, an applicant is subject to petitions to deny. About a dozen such petitions were filed regarding the 53 lottery winners in 1983. Applications against which no petitions are filed are reviewed for compliance with non-technical requirements and granted if they pass. In cases in which a petition to deny raises a substantial and material question of fact, the lottery winner must go through hearings before receiving a CP. If an applicant fails to survive the hearing process, a new lottery for the facility is conducted.

Construction period

Once a construction permit is granted, the permittee has one year to place its station in operation. Only applicants demonstrating that forces beyond their control caused delays in construction are eligible for extensions of this 1-year period. Also, the commission will not permit any change in an authorized facility that would improve its coverage in any direction. Thus, a permittee whose site becomes unavailable, for whatever reason, may not apply to relocate unless it can show that no area outside its original coverage area will receive a stronger signal.

Proposals for change

The commission may change its processing criteria in 1984. In a Notice of Proposed Rulemaking adopted in December 1983, the agency announced plans to scrap its cutoff procedures and substitute a system that would provide for a window, or specified date, for filing applications within a particular tier, geographic location or market, or for a particular channel. Under this procedure, applicants would have a limited period after public notice within which to file complete and sufficient applications to be considered with other mutually exclusive applications filed during the same window period. The commission is considering this change in its processing procedures to reduce the filing of mutually exclusive applica-

Continued on page 112

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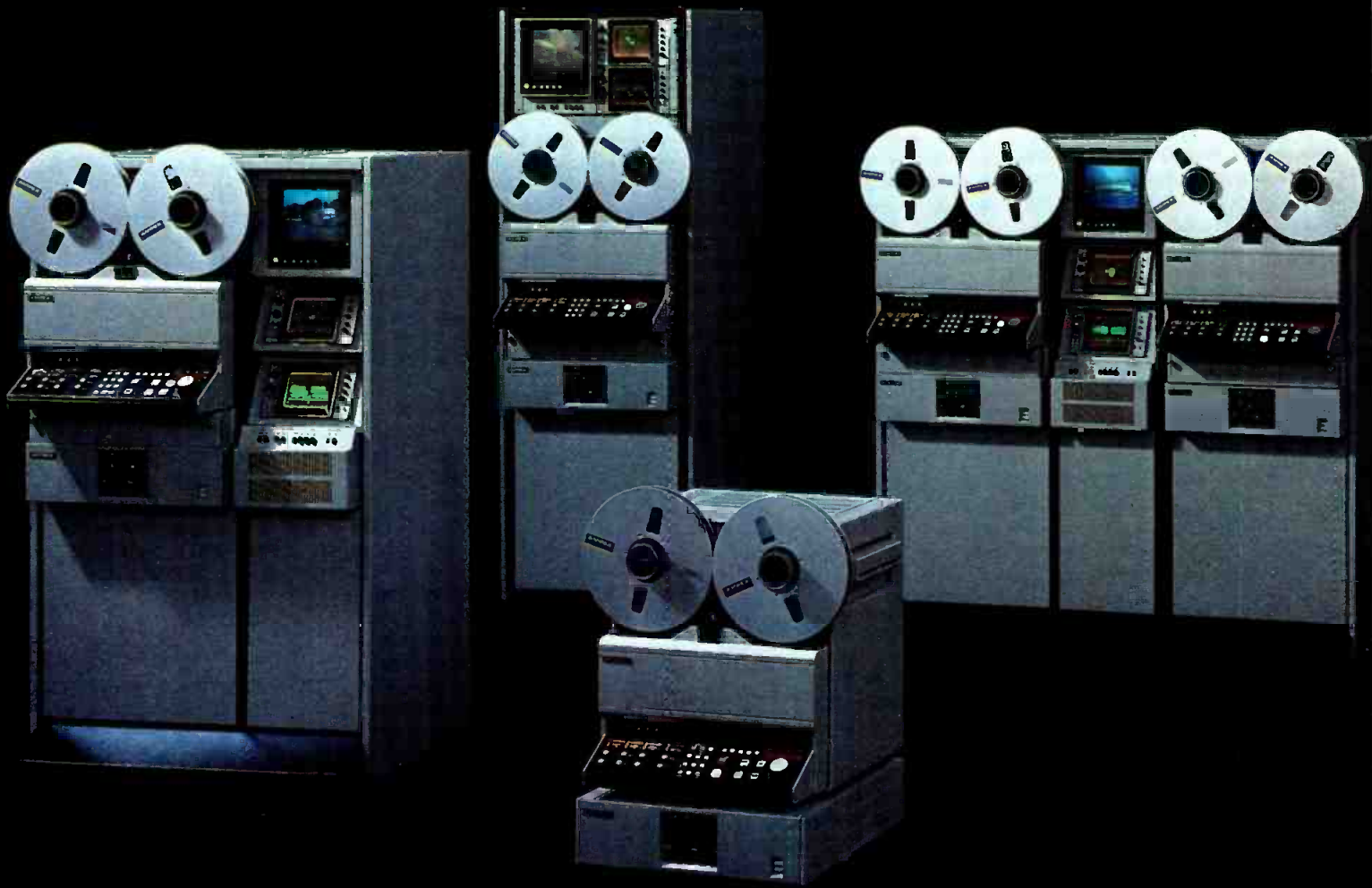
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March 1984 **Broadcast Engineering** 7

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Stereo TV for Christmas 1984

With the number of shopping days until Christmas rapidly dwindling, anyone interested in purchasing the latest in TV technology may wish to start looking for a timely gift. Thanks to the Broadcast Television Sound Committee (BTSC) of the Electronic Industries Association (EIA), there is a good possibility that stereo television, or multichannel TV sound, could be a reality by the end of this year.

Our congratulations go to the EIA and the many people involved in the recent decision on a single standard for the newest concept in US television. The hours spent examining various systems with laboratory test instruments and in subjective listening tests have determined that a new TV transmission system, proposed by Zenith, coupled with special audio processing, offered by dbx, should be implemented in the United States. The EIA/BTSC decision on the Zenith/dbx system comes after almost four years of working with three basic systems, including one presented by the Electronic Industries Association of Japan (EIAJ) and one proposed by Telesonics of Chicago. Also, audio processing proposals for the new transmission mode included other suggested companding systems from Dolby Laboratories, the CBS Technology Center and, initially, Straight Wire Audio. The EIA/BTSC recommendation awaits FCC approval before stereo transmissions on the TV aural carrier can begin.

What happens now? The final decision has been placed in the hands of the FCC. Will the commission send the choice selection to the marketplace, as was done with AM stereo? If so, the final choice may be years down the road. However, the EIA thinks that the selected system reflects the desires of the marketplace. Nearly every manufacturer of consumer and broadcast electronics equipment is associated with the EIA in some way.

It seems that the FCC has few choices. We think that denying the recommendation entirely would indicate that the commission has little faith in the EIA's capabilities, so total rejection of the EIA/BTSC proposal is unlikely. The worst possibility, then, is that the FCC would suggest a compromise. If a compromise is required, it is possible that the industry consensus tacitly indicated by the EIA-recommended system would lead to a number of varying, but essentially compatible, TV stereo audio systems.

If, on the other hand, the FCC gives approval, the United States could be enjoying multichannel TV sound by the end of 1984. Receiver manufacturers are ready to provide various configurations for the consumer. Possibilities include high end receivers with integral dual speakers, medium-priced units with left/right jacks for patching audio to the set owner's audio system, and adapter devices that could be attached to a TV set and interconnected to the stereo system.

Concern has been expressed about the cost of converting TV facilities for stereo transmission. The extent to which facilities wish to go stereo will govern the expense, according to NAB's Tom Keller, chairman of the BTSC. New exciters will be required for the stations, but, in many cases, exciter upgrade may be a good move anyway. For stations that are not co-located, the additional aural subcarrier on the microwave STL link will be an added expense. Some type of master control switching undoubtedly will be needed to properly route the second signal for stereo, as well as the second audio program (SAP) channel for multilingual programming and/or the utility channel proposed for TV remote crew cueing or data services.

Additional cabling may be required in some production facilities, but few stations currently use audio systems that could not handle at least a stereo feed. All recent-design helical-scan VTRs have 2-channel audio capability, and a stereo head stack is available for some 2-inch quad machines. In fact, many programs produced during the last five years have been recorded with multichannel sound, including the Johnny Carson show and music/concert-oriented materials. One network included four channels of digital audio distribution in a recently constructed West Coast facility. Several stations that we contacted said

Continued on page 125



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"18-18" instead of "7-7" recommended

In comments filed with the FCC in Docket 83-1009, the NRBA recommended replacement of the "7-7" limitation on radio station ownership with an "18-18" rule.

NRBA cited the dramatic increase in the number of AM and FM stations in the 30-year period since the 7-station Rule was put into effect.

"Concerns about undue concentrations of economic power and the possible loss of diversity in sources of information which served as the justification for the adoption of the 7-station Rule in 1953 have lost much of their validity," NRBA said.

However, NRBA also said that it did not believe that the FCC should eliminate all limits on the number of stations in which a party may have an interest.

In suggesting the "18-18" formula, NRBA said that the only logic for originally selecting the number seven for the FCC rule was the fact that, in 1953, the commission already had permitted a 7-station ownership. When the rule was adopted, ownership of seven stations amounted to 0.44% of the total number of stations licensed at that time. The same 0.44% applied to today's total number of stations accounts for 36 stations, which NRBA recommends as the maximum number of stations allowable for ownership by one party.

Based on growing totals of commercial FM stations, whose numbers are approaching those of AM stations, NRBA said that the total number of 36 stations should be divided equally between AM and FM services; hence, NRBA's recommendation to modify the rule to include a limit of 18 AM stations and 18 FM stations.

Proposed joint efforts announced

The NRBA and the NAB have announced a cooperative effort to work together on legislative matters, including deregulation. Both organizations agreed to present to their respective boards of directors the combining of NRBA's convention and the NAB Radio Programming Conference in 1984. The meeting, to be titled *The Radio Convention*, is scheduled for Sept. 16-19 at the Bonaventure Hotel in Los Angeles.



**National Association
of Broadcasters**

1771 N Street, NW
Washington, DC 20036
202-293-3570

FCC asked to adopt single MTS system

The NAB has asked the FCC to adopt technical standards for a single multichannel TV sound (MTS) system and not to rely on the marketplace to develop the expected new services. It said that a single system would result in swift introduction of high quality, low cost stereophonic sound and separate audio program services.

**A partial 1983 list
of broadcast
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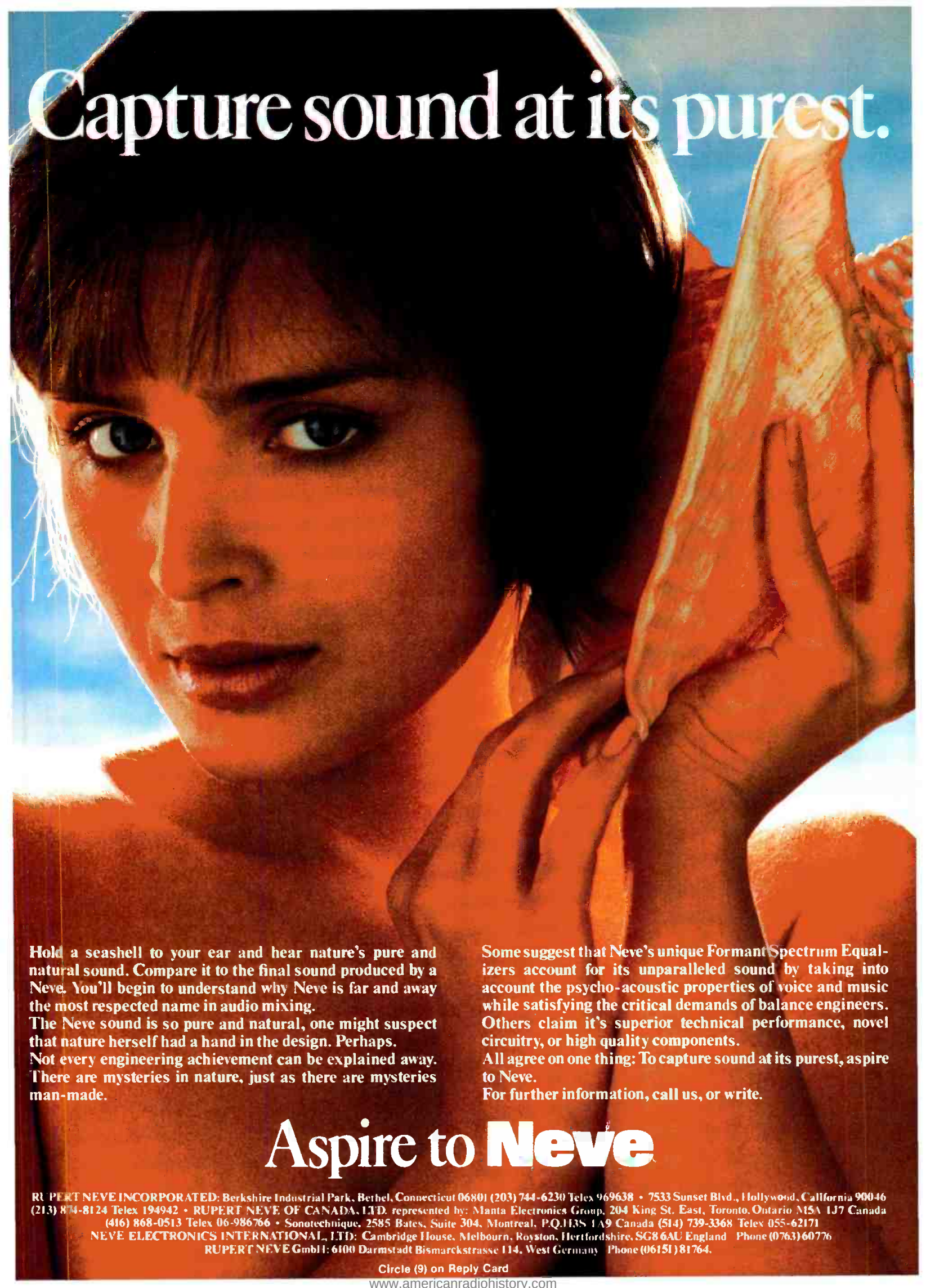
—Joe Commare, Director of Remote Engineering, ESPN, Connecticut

"When our clients walk in and see that we have a Neve, they are very happy."

—Bob Alexander, VP Engineering, Reeves Teletape, New York City

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A close-up photograph of a woman with dark hair and bangs, looking directly at the camera. She is holding a large, light-colored seashell to her right ear. The background is a bright, hazy blue sky. The overall color palette is warm, with a lot of orange and yellow tones from the lighting and the seashell.

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384



Circle (10) on Reply Card

In its filing, NAB contrasted the enormous growth of the FM broadcast service as a result of the commission's setting stereo standards with the lack of widespread acceptance of AM stereo because no one technical system was chosen.

NAB noted that after years of deliberation and testing, the Electronic Industries Association's Multichannel Television Sound Committee has endorsed the Zenith system. The findings were to be submitted to the FCC, providing a solid basis on which the commission could review, select and adopt the recommended system.

NAB asked the commission to preclude cable systems from stripping broadcast MTS and, to promote the maximum possible development of subcarrier use, not to impose common carrier status and regulation on any form of subcarrier service. It also asked the agency to pre-empt any state common carrier regulations.

Proposal on ownership rule supported

The NAB has said that it supports the FCC's proposal to liberalize or delete the 7-station limitations (7-station Rule) for radio and TV broadcasting. The rule limits ownership to seven AM, seven FM and seven TV (no more than five of which may be VHF) stations.

In its filing, NAB agreed with the FCC's view that over the years conditions have changed dramatically and that levels of concentration of ownership of radio and television now are insufficient to support retention of the current limits.

According to NAB, the association supports and will provide additional data for change in the current rule, but takes no position as to whether the rule should be eliminated or merely relaxed.

The association said that the antitrust laws and the functioning of the marketplace would be adequate substitutes for the current narrow restrictions in correcting any abuses on a case-by-case basis. It said that no technology that competes with broadcasting has ownership restrictions analogous to the 7-station Rule, and that it is neither necessary nor equitable to continue to apply the limitations to broadcasters alone.

NAB said, "There is no reason to establish separate or different limitations for radio and television, or for network ownership of broadcast properties."



Society of Broadcast Engineers
P.O. Box 50844
Indianapolis, IN 46250
317-842-0836

Exam dates announced

The SBE's certification exams will be given from June 15-23. The deadline date for applying is April 16.

SBE also is accepting applications for broadcast technologist certification from engineers who hold a valid FCC First Class Operator license (or who held a First that has been renewed as a General license) and meet the service requirement. These engineers do not have to take an exam and may apply at any time. For a copy of the application and Program of Certification booklet, contact the certification secretary at SBE. (1:1:1111)

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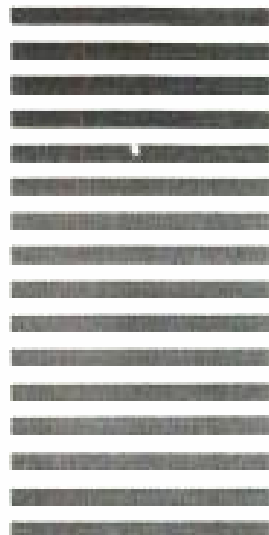
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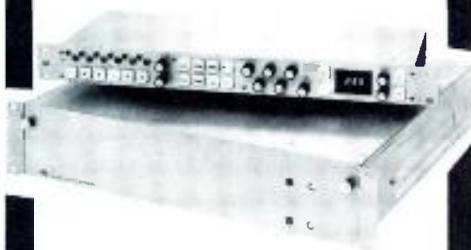
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Delta receives type acceptance

Delta Electronics has received FCC type acceptance for its C-QUAM AM stereo exciter. Designated the ASE-1, the unit allows new and existing monaural AM transmitters to be upgraded to stereo capability using the Motorola AM stereo system.



The Delta Electronics stereo generator (top) and modulation monitor.

Delta also has introduced a new AM stereo modulation monitor for use with the exciter. The exciter and monitor are manufactured under license from Motorola, developer of the C-QUAM transmission system. More than 70 stations now are using the Motorola AM stereo system in the United States.

McIntosh goes with Motorola

McIntosh Laboratories has announced that it will build AM stereo receivers designed to decode the Motorola signal. McIntosh is known for its line of consumer component systems.

Hazeltine working on new chip

The Hazeltine Corporation is working on the design of a single integrated circuit chip capable of decoding any of the AM stereo signals currently on the air. The project is an ambitious one, because of the complexity of such a universal decoder device. Hazeltine hopes the chip will be available to market to radio receiver manufac-

turers by the end of this year.

The company discussed its multimode chip plans with representatives from a number of receiver manufacturers at the recent Consumer Electronics Show in Las Vegas, NV. The planned introduction has generated much interest, because it would greatly simplify the construction of AM stereo radios. Equally important, it also should result in lower stereo radio prices for consumers.

Single-chip multimode decoders currently are manufactured by two Japanese receiver manufacturers, Sony and Sansui.

KJQN broadcasts basketball in stereo

A radio station in Ogden, UT, has broadcast what it believes to be the world's first play-by-play coverage of a basketball game in stereo. KJQN-AM carried a Weber State College home game against Southern Utah State College on Nov. 16, 1983, using two additional microphones, one near each basket.

Sportscaster John Peterson said the effect was unbelievable. "Not only can you hear the baskets dropping, but you can close your eyes and follow the action of the ball as it is dribbled across the court," he said.

Peterson said that the station planned to broadcast other basketball games in stereo, whenever equipment arrangements permit. KJQN uses the Kahn AM stereo exciter system.

NAB-'84 to cover AM stereo

AM stereo will be the topic of discussion at several sessions during the upcoming NAB Convention to be held April 30-May 2 in Las Vegas, NV. An engineering session devoted to recent developments in the AM stereo field has been scheduled, and several topics relating to radio broadcast technology in general are planned. (See "NAB-'84 Las Vegas: You've Got What It Takes" on page 80.) In addition to the technical sessions, a management-oriented discussion of AM stereo also will be held.

!:-:-:-:-:-)



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Technology behind

By Alan J. Zauzmer, Ztronic Enterprises Ltd., New York, NY

Twenty-four hours a day, 365 days a year, hundreds of people at ABC News work to squeeze each day's most crucial news events into 22 minutes of coverage. This race against time is accomplished with the help of advanced, sophisticated and innovative technology.

The longtime technological leadership behind ABC's worldwide news operation is embodied in one man: Julius Barnathan, president, ABC Broadcast Operations and Engineering (BO&E). Barnathan's innovations in broadcast technology are legendary, rebounding throughout the complex technical organization that drives ABC News engineering.

ABC News features a system of standardization in which all engineering personnel are trained to carry out production and engineering tasks with a precision and uniformity established by Barnathan.

According to Barnathan, "In times of peak loads and special news events, ABC can call upon the vast resources of its engineering support personnel in the Sports and Entertainment Divisions. The uniformity of the ABC engineering system has been successful in the support of its news operation."

The standardization is reflected in the equipment used by ABC. For example, when an emergency arises that calls for more powerful broadcast equipment for the News Division, various components can be shuttled readily to that division from the Sports and Entertainment Divisions. Because of standardization, all equipment interfaces with minimal engineering effort.

Barnathan's philosophy—that technology must be used as a creative production tool—is praised by one of his clients, Robert Frye, executive producer, *World News Tonight* (ABC's nightly newscast). Frye said, "Under Julie Barnathan, BO&E has given news tremendous support, not only in

providing technical tools and people for daily operations, but also in jointly developing advanced equipment and graphic systems specifically for the News Division. The willingness of BO&E not to go with (technological) fads, but rather to take the time to develop the technology, is a major factor in the technical success of ABC News."

The technical structure

All network news operations are not created equal. Several technical differences give the ABC News organization and broadcast a different look from that of CBS and NBC. At ABC, with the newsgathering organization located at its Broadcast Center in New York, news executives, producers and directors are the decision makers for the overall structure of the News Division.

Feeding into the structure are nine domestic and 11 international news bureaus. Domestic bureaus are located in New York, Los Angeles, San Francisco, Chicago, Boston, Miami, Dallas, Atlanta and Washington. International bureaus are situated in London; Paris; Rome; Hong Kong; Tokyo; Moscow; Tel Aviv, Israel; Beirut, Lebanon; Warsaw, Poland; and Bonn and Frankfurt, both in West Germany.

According to its location, each bureau performs a different mission and, therefore, each employs different types of equipment. Common to all bureaus, however, is an ENG news crew consisting of a camera operator and video/audio engineer. These crews are similarly outfitted with specific equipment packages. (See the sidebar, page 28). The major bureaus—located in New York, Los Angeles, Washington, London and Tokyo—play a key role in transmitting and producing news stories for the network. Therefore, their equipment inventories are larger than those of the other bureaus.



ABC News

From the frantic pace of a political convention to the more orderly inaugural ceremony in front of the Capitol, ABC keeps the nation and world up-to-date.





Domestic bureaus

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Los Angeles
San Francisco
Chicago
Boston
Miami
Dallas
Atlanta
Washington

International bureaus

London
Paris
Rome
Hong Kong
Tokyo
Moscow
Tel Aviv, Israel
Beirut, Lebanon
Warsaw, Poland
Bonn, West Germany
Frankfurt, West Germany



For example, look at edit systems. Each bureau has one organized system with the following components: Sony BVU-800 or BVU-200 VTRs, Yamaha or Sony audio mixers, a Tektronix waveform monitor and vectorscope, a Sony BVT-800 time base corrector, a Convergence ECS-103/104 edit controller and a frame synchronizer. In addition, the New York and Washington bureaus have two microwave trucks nicknamed "The Blue Goose" and the "Snow Goose," respectively. These

The control room for Studio 1 in New York shows how complex a production could be.

units are equipped with videotape machines, production switchers, transmission and distribution equipment, and an internal communication system.

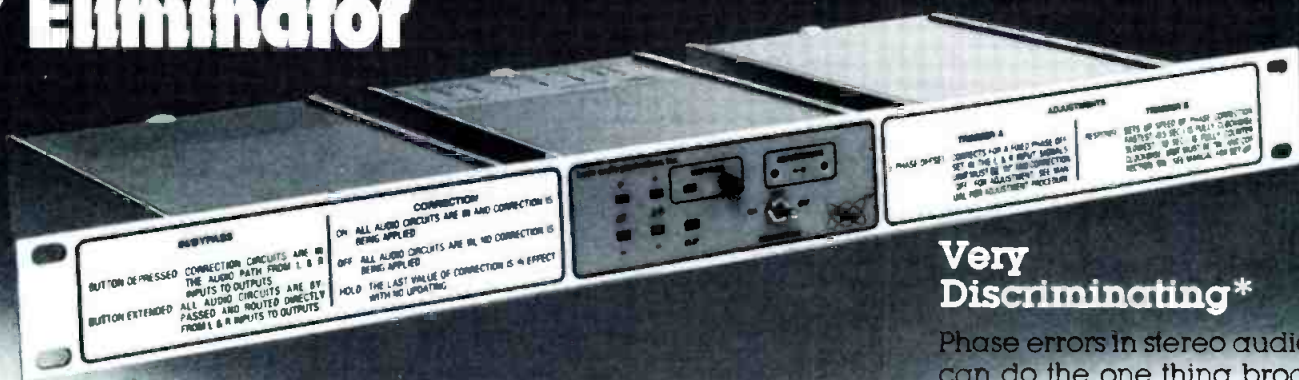
Rounding out ABC News' equipment inventory is peak load equipment. The equipment, located in the New York, Washington and London bureaus, is used to supplement exist-

Continued on page 28



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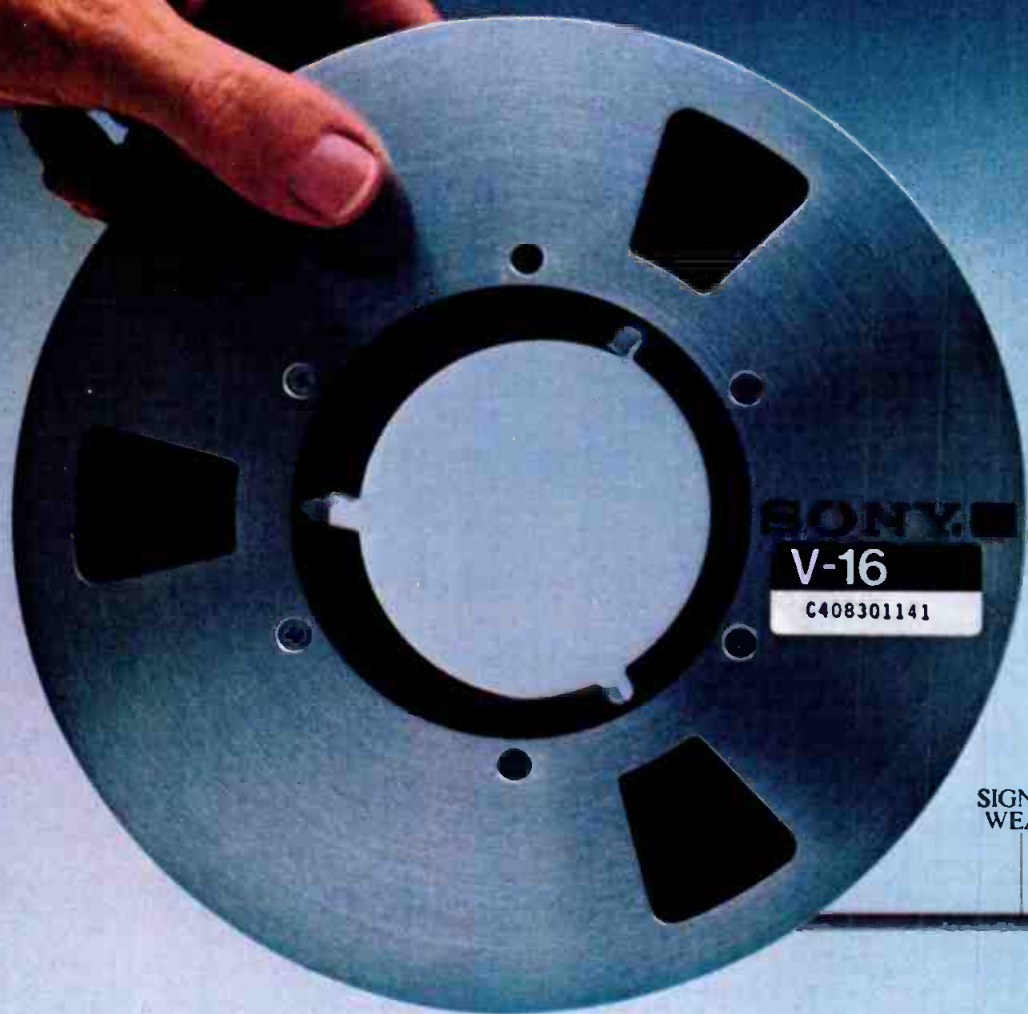
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COLOR S/N		AUDIO SENSITIVITY		FREQUENCY RESPONSE		RUBBING NOISE		PRINT- THROUGH	



ing equipment during special events.

Preparing the story for broadcast

The last decade has seen the world become an electronic village. Geosynchronous satellites and worldwide telecommunication networks have enabled network TV news operations to conduct instantaneous coverage of worldwide news events. ABC News was an innovator in this form of electronic journalism.

For example, *World News Tonight* covers an unusually large volume of

international stories. Because the world situation is so complex, all too often it is easier to tape the story than to transmit it back to New York for broadcast.

Whether it will finally be taped or transmitted, to cover a story a crew follows the producer and correspondent to the action. Once raw footage has been shot, the producer and videotape editor create the finished package. ABC encourages its producers to work in the field, to keep the local continuity and feel of a story that only comes from being on the scene. In some cases, when time is too short, or the locale, for some reason,

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Typical crew equipment

- HL-79D Ikegami camera
- Sony BVU-110 videotape recorder
- Sony BVU-50 videotape recorder
- Sennheiser MK-2, 814 or 816 shotgun microphones
- Shure M-267 audio mixer
- Videotek 5-inch color monitor
- Nicad and silver-cell batteries for camera and VTRs
- Battery charger
- Small lighting package consisting of three lights (Equipment is transported in 20 cases)

Typical travel edit system equipment

- Sony 5850 videotape recorders, modified for time code operation
- Convergence ECS-90 videotape editor
- Shure SE-30 audio mixer
- Videotek RM-8 color monitors
- Asaki or Multidyne signal generators
- Time base corrector
- Frame synchronizer (Equipment is transported in 12 cases)

presents too many problems, raw footage is sent back to New York for editing by a production team.

Most stories are transmitted to New York via satellite. Transmitting domestic stories to New York is simpler than accomplishing the same task from overseas. If the story is a domestic one, the following options for transmission to New York are available:

- The tape can be carried to an ABC affiliate for transmission via the domestic network.

- Local TELCO lines can be arranged on site.

- A satellite transmission dish can be rented for a direct feed to New York.

International news coverage is more difficult. Depending on the country, three methods of transmission are possible:

- The tape may be flown to a friendly country and transmitted via satellite from rented facilities of a local affiliate (for example, RAI in Italy).

- The tape may be brought to ABC's London bureau, from which it is relayed to the United States.

- A satellite gateway may be established with the other networks, often handled from a hotel and transmitted from there. This last method is often used when covering a story from a war zone.



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Special events



The modular control room simplifies coverage of shuttle launches and other Cape Canaveral activities. ABC News brings in modules needed for the task at hand.

In addition to the day-to-day complexities of the world, even more extraordinary events often arise. To cover these stories, ABC News relies on its special events unit. Charles Frye, director of planning for ABC News and senior producer of special events, said an event is considered *extraordinary* by ABC News if it meets one of two criteria: first, if an event is of major importance, and advance planning becomes a necessity (for

example, a space shuttle mission); and second, if an event is a spontaneous occurrence of unusual magnitude (for example, the attempted assassination of the president).

During a spontaneous event, the special events unit takes on a coordination function for ABC News. The unit immediately checks with the assignment desk to learn what *moves* are in place. The objective is to obtain control of the story and decide the best way to transmit the story back to the Broadcast Center. When the situation is under control, the team looks for a new angle to cover the event. Frye said that the team's goal is to get the story on the air in the best way.

Special events gives ABC News control over continuity of the story so that uniformity is achieved throughout the networks' various news programs.

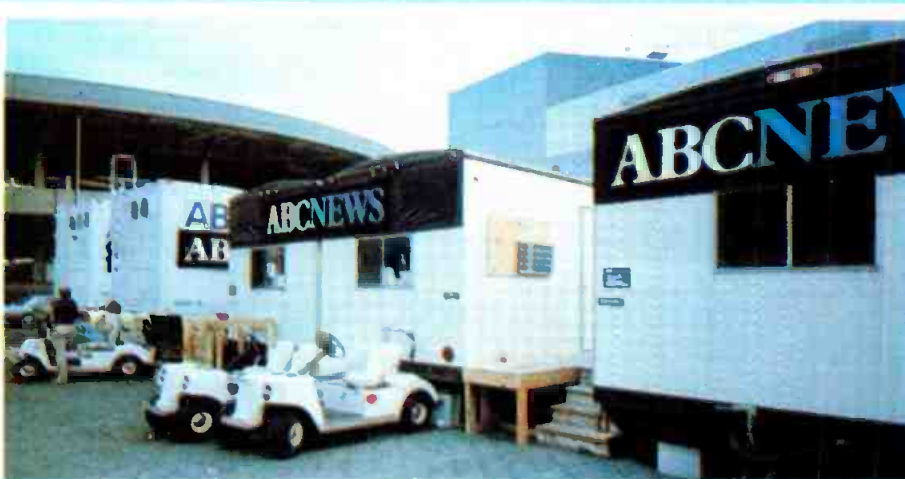
In covering extraordinary events, the unit has a reputation for innovation. As Frye said, "It is important to get the best product by understanding the facilities that are available to the production unit. We constantly keep up with technology in order to be innovative. The question I ask is: 'How can I cover the same event a little differently each time?'"

Out of this philosophy has come many production firsts pioneered by Frye. His most recent is a modular control room. This concept gives ABC the unprecedented capability for producing studio quality originations in the field using standard ENG news equipment packages.

The system originally was used during ABC News coverage of the space shuttle STS-4 mission in the spring of 1982. The system allows the assembly of a news crew's standard equipment package to create an on-site production facility. The system, composed of a series of easily transportable modules, houses the following equipment: a 10-input 1600L Grass Valley production switcher; an RTS camera and IFB communication system; transmission and distribution equipment; and TV equipment monitor walls.

The modular control room is different from a mobile unit in terms of speed of movement to the event. The system can be loaded on a plane and moved anywhere in the world the next day. In two days, ABC can assemble a fully operational control room.

Frye said, "The modular control room is like a Chinese menu. You choose only those modules you need for the production. It has already paid for itself twice over in the amount it has saved in equipment rentals."





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Photos: Steve Farmer

Keeping track of equipment

ABC and BO&E have computerized systems to keep track of their array of ENG equipment assigned to field stories. They keep track of the equipment in two ways. First, a bar code system from corporate fixed assets control has been instituted. Every ABC capital item is tagged and recorded into an on-line database. Second, ABC complements the bar code system with a real time on-line interactive system, the Technical Equipment Location File (TELF).

Elliot Reed, manager of network

Shown are the newsrooms at the Los Angeles and Washington bureaus.

ENG operations, said, "TELF provides a detailed accounting of all BO&E engineering equipment both internationally and domestically. By interrogating a computer terminal, a detailed list of equipment type and the responsible engineer for the particular piece of equipment can be obtained."

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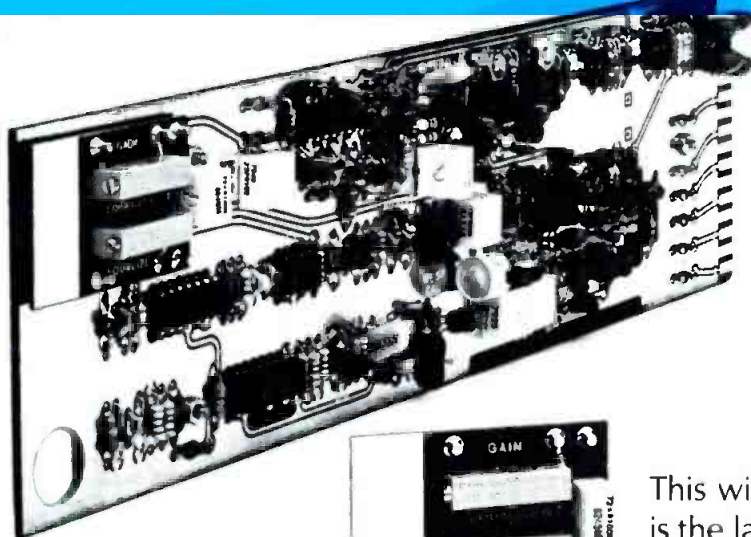
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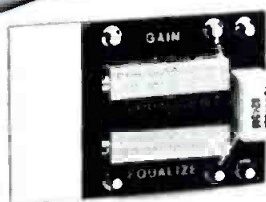
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Load	< 0.05 dB/load at 10 MHz
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Output DC	< ±25 mV at back porch

Timing

Delay	25.4 ns (32.7° at 3.58 MHz)
Adjustment range	typically 6° at 3.58 MHz

Power Requirements

Total power dissipation	< 2 W
-------------------------	-------

Performance

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	< ±0.1 dB to 10 MHz
	+0 -0.2 dB at 15 MHz
	typically -0.6 dB at 20 MHz
Differential phase	< 0.1° 10% to 90% APL
Differential gain	< 0.2% 10% to 90% APL
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equipment required to cover their stories.

World News Tonight

Robert Frye oversees daily broadcast activity. His career in broadcast journalism began when he was a page at NBC. Beginning with the 9 a.m. conference call to all the news bureaus, Frye's day does not end until 7:30 p.m., when *World News Tonight* concludes.

Frye said he thinks his job involves using television to act as a filter that provides viewers with an understandable picture of the world. For more than 20 years, Frye has been a supporter and ardent user of advanced technology. "With this enthusiasm, one finds restraint," he said. "You can overload the story with electronic imagery."

By 10 a.m., a working line-up of the evening's news stories has been established by Frye and his associate producers and writers. Enter Charles Heinz, coordinating director, *World News Tonight*, the person responsible for pulling together the broadcast from a technical perspective. After assessing the broadcast's line-up, the 25-year broadcast news veteran assembles his production personnel and artists, the people who give WNT its distinctive look.

Heinz spoke about the production tools at his disposal. "I'm constantly learning," he said. "You must not let the technology overwhelm you. It eventually makes the broadcast lose sight of what you are there to do—to tell the story. Sometimes I wonder if we should slow down a bit and learn to utilize fully the new production tools. I'm still learning new things about chroma-key. But if you don't keep up with technology, you're out."

One piece of equipment that excites Heinz is the Quantel Paint Box—a dazzling, computerized electronic palette used to compose electronic graphics (one of Barnathan's innovations in the field of electronic graphic production).

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TV-2, the flagship control room of the ABC TV network, is equipped with the latest in computer-controlled special effects switchers, character generators and frame stores. Here Heinz orchestrates the pieces for the night's show. Amid a sea of technology, he pulls together the incoming feeds, performs seemingly endless post-production, and keeps up with the unpredictable events that may change the final product.

Working with TV-2 is TV-9, the smaller control room that backs up TV-2 by assisting with post-production. Supplementing the ABC news operation is a new facility in Washington. This is the only network facility built from the ground up exclusively for news. The unit pre-packs complex news stories out of Washington and feeds the finished pieces with full graphics to New York for show integration.

By 6:30 p.m. in New York, the action in TV-2 is feverish. The broadcast is on the air. Heinz barks out precise cues to the technical director. Every large and small detail falls under Frye's watchful eye. Somehow, the maelstrom of news and commercials falls together and fits precisely to time. *World News Tonight* is a tribute to the interaction between man and machine. [:-:~))]]

Shown are two views of remote production equipment used in the Williamsburg Conference coverage.

A sample run-through with ABC graphic artist Mark Trudello leaves one stunned by the range of the live videographic manipulations the Paint Box can perform. Air brush, almost unlimited color mixing, and selection and symbol construction are only a few of the system's graphic effects.

But despite the dazzling effects of the Paint Box, the news still takes precedence. And nearing the end of the day, all hands move to the control room, TV-2, the integration point for WNT.



Photos: R. Trippett

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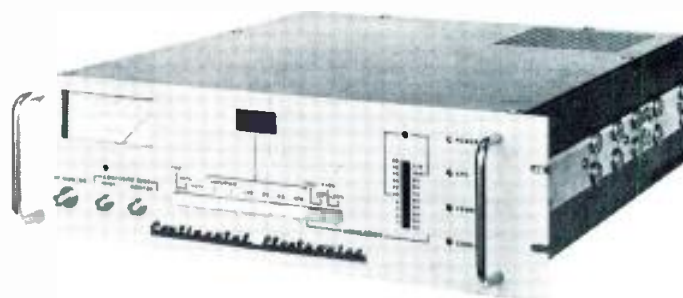
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Multiway audio amplification

By William C. Cheney, president, Applied Technology, Salt Lake City, UT

For many years, bi-amplification and tri-amplification have been used in professional audio systems throughout the world. Reasons for using such systems have ranged from improved sound pressure levels (SPLs) with the same amount of amplifier watts to a subjective judgment of better sound.

Multiway power amplification is done by dividing, with active or passive filters, the complete audio frequency range into two or more sections. These independent frequency bands are amplified by individual power amplifiers, which drive their respective loudspeakers. (See Figure 1.)

The advantages of multiway power amplification include improvements in amplifier/loudspeaker damping, better frequency and transient response, reduced distortion and increased amplifier power. The benefits often far outweigh the added cost and complexity of such systems.

Damping factor improvement

The damping factor refers to the capability of a power amplifier for electronically braking excess diaphragm or cone motion of the loudspeaker. The inertia of the cone assembly, operating within the magnetic

field of the loudspeaker, results in the generation of a back EMF voltage. This voltage generated by the loudspeaker is reduced as the output impedance of the amplifier decreases. The damping factor is the ratio of loudspeaker impedance to amplifier output impedance. The higher the damping factor, the greater the control over loudspeaker inertia. In theory, the best damping factor would be found in a loudspeaker/amplifier system in which the output stage had a 0Ω impedance.

One of the best ways to use power amplifier damping is to directly couple the amp to the loudspeaker. A passive crossover network (as used in conventional speaker systems) is a constant impedance device that can degrade the damping factor, regardless of what power amplifier is used. Eliminating power amplifier damping can severely limit the transient capability of the loudspeaker(s).

Frequency response improvement

Because the best possible amplifier output impedance is 0Ω, the load sees any impedance in the output section of an amplifier as a series impedance. This effect, coupled with the parallel impedance of a passive crossover network used in 2- and 3-way speaker systems, results in the voltage divider network in Figure 2. As the impedance of either device changes, so does the corresponding output voltage. The outcome is a non-linear, or splayed, output voltage, which in turn results in a non-linear loudspeaker output.

Power loss considerations

The insertion loss for most passive crossover networks used in speaker systems is approximately 1dB or 2dB. This figure does not seem significant until you realize that with a loss of just 1.5dB, 30% of the amplifier power output will be dissipated in the crossover network.

Most, if not all, passive crossover circuits are first-order (6dB/octave) or second-order (12dB/octave) Butterworth designs. A passive crossover's

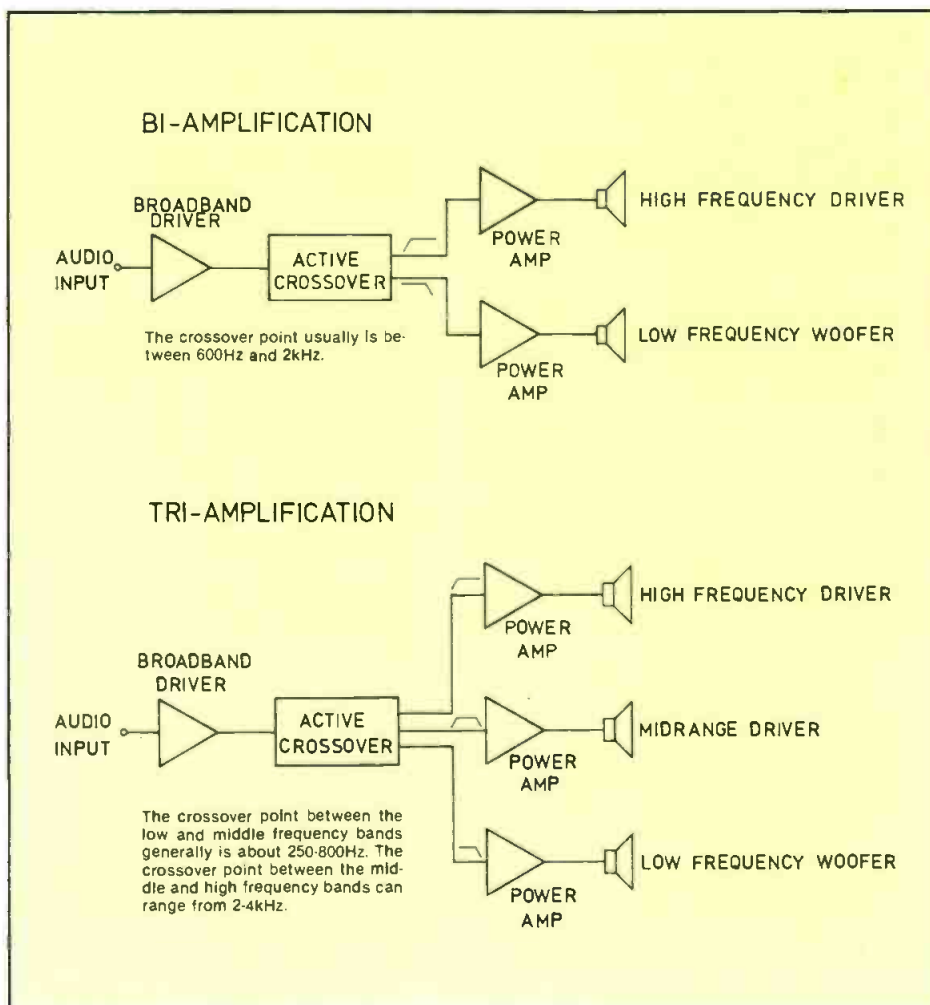


Figure 1. The concept of multiway amplification. The crossover frequencies vary from one system to another (depending on the type of loudspeakers used), but generally are as shown.

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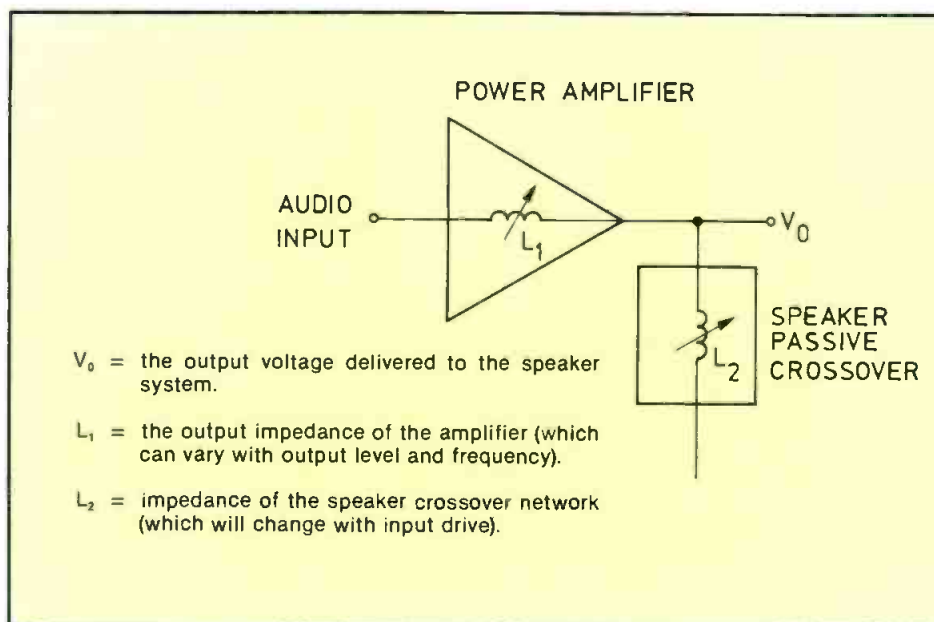


Figure 2. The effect of amplifier output impedance and speaker crossover impedance changes with varying program conditions. The voltage seen by the speakers (V_0) is non-linear, or *splayed*, because of the voltage divider created by the amplifier and speaker combination.

slow roll-off characteristics increase the amount of power delivered to the loudspeaker outside of its intended frequency band. This problem usually is demonstrated by high frequency compression driver failure.

In contrast with passive designs, many active crossover networks used in biamplication and triamplication systems use steeper 18dB/octave roll-off characteristics. With greater roll-off, less power is delivered on either side of the bandpass.

Reduced distortion

Loudspeaker intermodulation distortion is, in part, a function of bandwidth. The wider the bandwidth a loudspeaker must reproduce, the greater the IM distortion may be.

A single power amplifier, driven into distortion, transfers that signal to the passive crossover and to each respective loudspeaker. Thus, in the conventional arrangement, all loudspeakers receive the distorted signal, as the fundamental wave form or as higher-order harmonics. In a multiamplification system, distortion is confined to each respective bandpass section. In simple terms, if the low frequency power amplifier of a multiway system is driven into distortion, the other amplifiers and loudspeakers will remain undistorted.

Increased SPL

The effective power increase offered by multiway amplification is considerable. An amplifier's usable power varies dramatically as the peak-to-average ratios of the program material change. Audio program peaks generally occur at high frequencies. Therefore, a multiway system

can increase overall sound pressure level capability by passing the peaks only to the high frequency section, effectively eliminating amplifier peak overload at low- and middle-range frequencies.

Low frequency audio signals comprise the spectrum of greatest current demand, so amplifier ratings can be matched to the dynamics of the program material to be reproduced. A common division ratio for a 2-way amplification system could be 2:1 (low frequency amplifier rated at a power output two times the high frequency amplifier output). Loudspeaker efficiency is one of the considerations in selection of a power division ratio.

Stations considering the installation of a new monitoring system, or rebuilding their present one, should consider the benefits of multiway amplification, not only because of the improved performance it can provide, but also because of the equipment cost savings that may be realized.

Editor's note:

A monitoring system using multiway amplification should be planned carefully by an engineer experienced in its design. Many different routes can be taken in constructing such a system and, once chosen, parameters are not easily changed. Decisions regarding loudspeaker selection, crossover points and amplifier power, among others, are best left to those experienced in multiway design.

Another consideration when installing a monitoring system is the desirability of limiting the system's bandwidth. To protect the amplifiers, low-pass and high-pass filters often are inserted into the program amplifier chain to restrict the system's low frequency and high frequency responses. A typical low frequency cutoff point is 40Hz. The high frequency point can range from 15-20kHz. Such bandwidth limiting protects the amplifier from high energy, low frequency material and from supersonic noise or oscillations that could damage the monitor system. Therefore, bandwidth restriction also requires careful consideration by the user and monitoring system designer.

||:~::~)))



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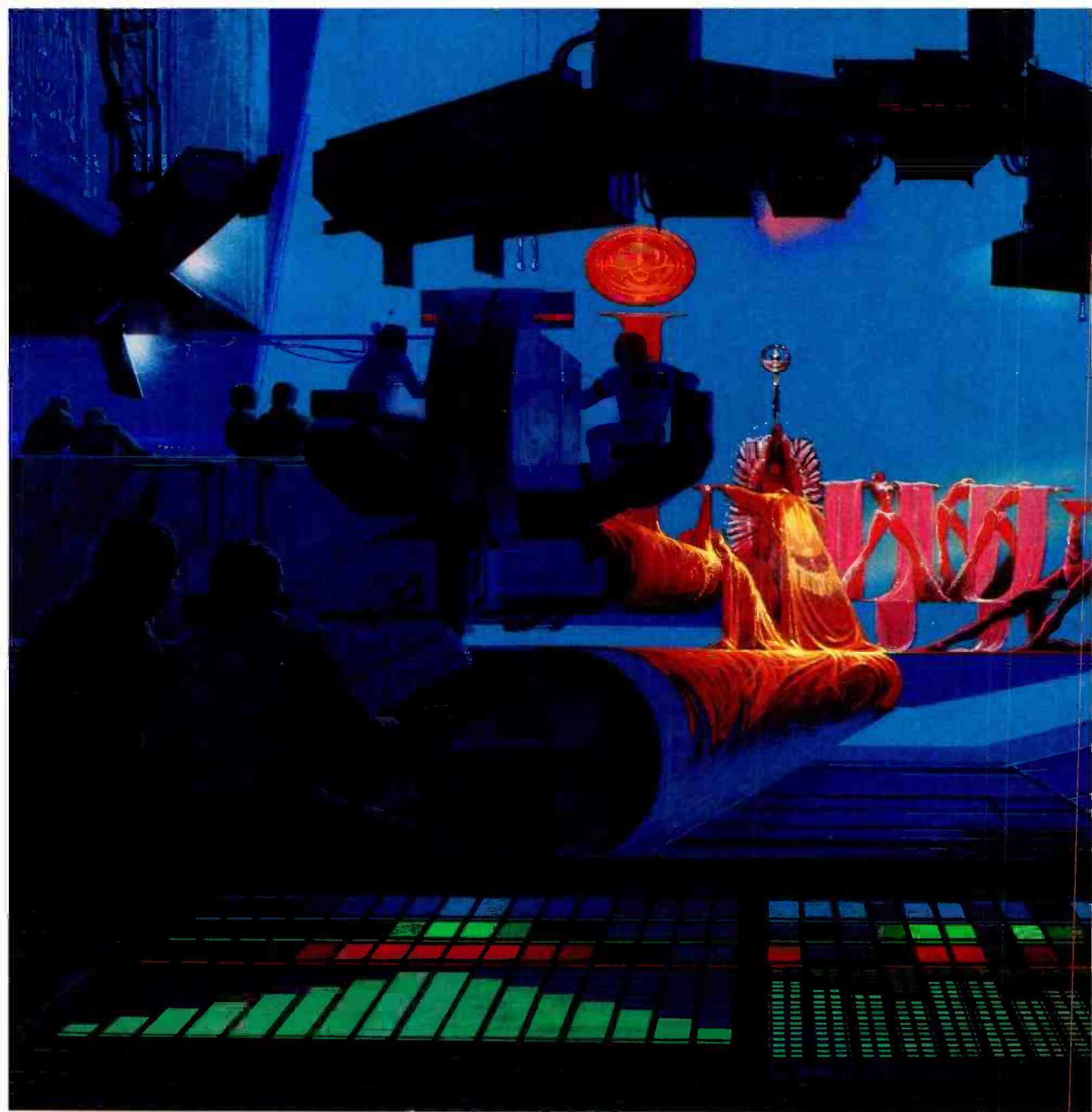
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Monitoring for TV sound

By Roy W. Rising,
systems engineer/production mixer,
ABC-TV, Hollywood, CA

At the dawn of commercial television, monitoring techniques for broadcast sound already were several decades old. Audio reproduction was close to its limits in 1950, but the industry had to back off from top quality TV sound for a few dozen years because the cost of network lines to deliver full range audio was so expensive. However, picture reproduction at home, using current technology, is just now nearing its practical limits. In earlier times, high fidelity TV sound would have been out of quality balance with the picture.

Modern transmission from network operation centers to affiliates across the country is diplexed with video on terrestrial links or sent via satellite using various techniques. Both terrestrial and satellite methods provide superb quality. Some receivers have provisions for feeding a high quality sound system, making it possible to recover the high fidelity signal transmitted. Full-range monophonic audio properly reproduced in the home still is likely to be out of perspective with

the best 25-inch picture. A 6-foot screen justifies 50Hz low end response, but also reveals some visual defects in the picture and might not support good stereo.

To illustrate the quality balance effect of picture vs. sound, consider seeing and hearing outside activity through an open window. The sound heard by the observer depends on the size of the opening (picture). Statistics can be used to relate picture size to audio bandwidth preferences of the public, based on this perception.

Whether an operator is mixing a TV program for a 3-inch speaker or a full-range stereo system, the job is to fit the sound to the picture. Part of the trick is to produce audio that will be right at the viewer's home, and will match the video. Sound production, particularly for monophonic television, still is an interpretative craft. Reproduction aimed at realism remains the province of radio and records. Yet, even there, creative interpretation is dominant. Through it all, one thing is certain. A mixing engineer must hear the most accurate production to yield good reproduction.

The monitoring environment
Although recording studios have ad-

vanced the science of room design greatly, most network audio rooms have had the same acoustic problems forever. An example of major progress at a broadcast plant might be carpeting the tile floors. Although this may improve the situation, it is far from acoustic state-of-the-art. Fortunately, new production facilities almost always have significantly better acoustics than older ones, and monitoring speakers have improved substantially over the years.

Response testing of studio areas with pulse, noise and burst signals has generated interesting graphs, and equalizers have been used to correct flaws revealed by the test gear. All too often, however, the work has improved the graphs more than the sound. A more telling test of a monitoring environment and loudspeaker combination is one known to few in the world of sound production outside of television.

In TV production, there always is a need to feed some kind of sound to a stage set where boom microphones are in use. It cannot be avoided. This monitor audio, if picked up by the microphones, can sound unbelievably bad. The problem is not with the mics, because the actors sound fine.

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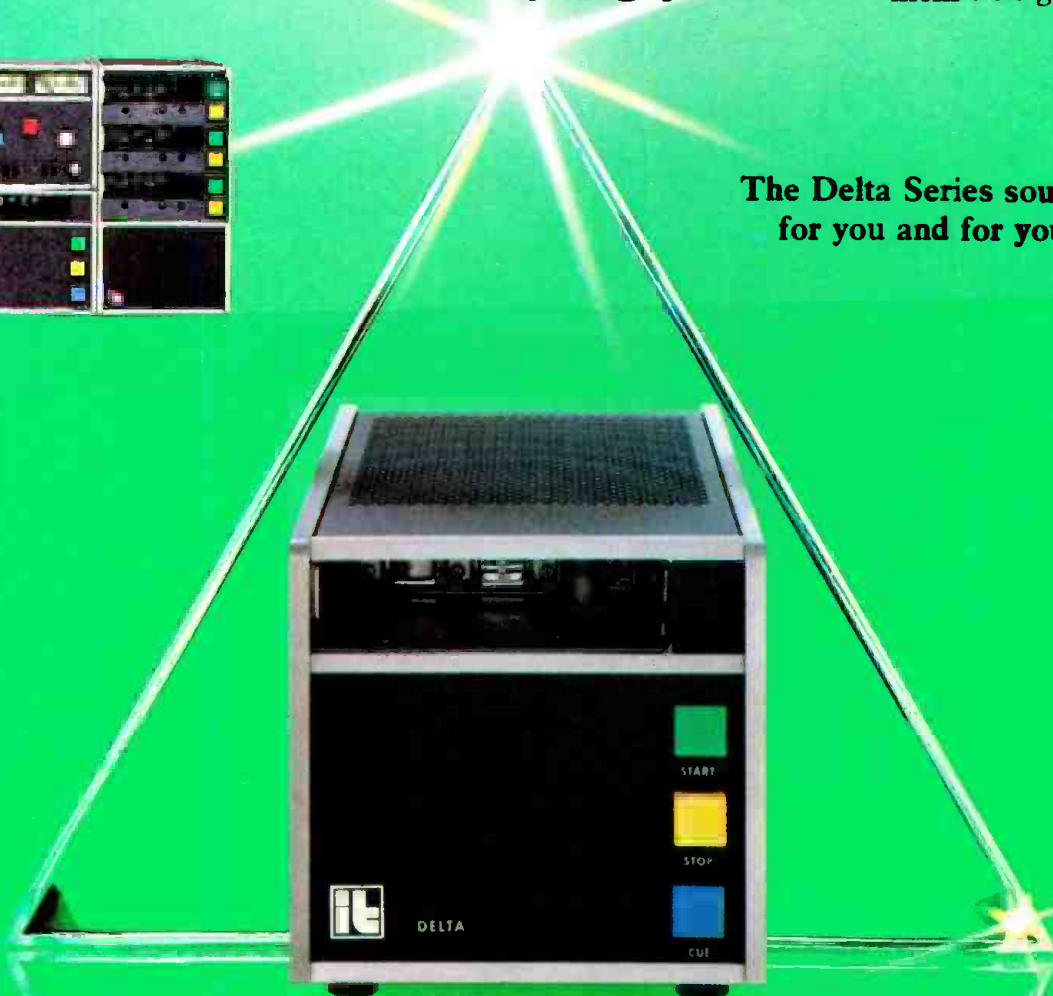
And the average listener won't know that ITC sells more professional cartridge machines than all other manufacturers combined. Or that the Delta Series replaces the Premium Line, previously the standard of value in the industry.

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Solving this problem is not as easy as it may seem. If the stage speaker volume is decreased, the actors generally are not comfortable with the arrangement. Further, if the monitor feed contains a cue they must hear, the actors may become quiet, requiring the mixing engineer to increase microphone gain, which increases the monitor system pickup. Using more on-line sound helps mask the damage caused by pickup of unwanted audio, but then the mix no longer is in balance.

The place to begin correcting such a problem is at the source. Switch out all equalization in the microphone circuits (to guarantee that it is not the cause) and buy some better speakers for the stage floor.

Selecting monitor speakers

Choosing a good monitor speaker for stage use is easier said than done. In November 1978, a series of carefully structured single-blind tests were conducted on 24 speakers from the best-known brands. Only two were found to be suitably accurate. Among the rejects was a speaker often used for control room monitoring at TV production facilities. I found that

2-way systems proved more accurate than 3-way units, due to fewer displaced drivers producing the same sound. Also, systems with better polar patterns offered more accuracy in the reverberant field. A well-designed coaxial speaker would be ideal, but where could you find it?

In late 1981, the tests at ABC-TV included a prototype from Electro-Voice, the Sentry 100. It was more accurate than the best speakers from the 1978 tests. Some bothersome response aberrations were referred to EV for development, which resulted in an improved unit, the Sentry 100A.

With the most accurate speaker I knew of now available, a number of Sentry 100As were purchased for stage set use. The results were almost uncanny. With live voices, recorded music or sound effects, the audio coming back on the boom mic was indistinguishable from the on-line sound (except for room reverberance). With no coloration, the feed to the set could be made at least 6dB louder.

Next, the Sentry 100A was tested in midlevel distributed PA systems on shows using boom microphones. The actor's voices sounded more alive to the audience, and smoother response

yielded higher acceptable sound pressure levels without ringing. Leakage into audience reaction mics almost could be ignored.

The Sentry 100A sounds excellent in huge rooms, and the ear-brain is pleased with it in acoustically poor small rooms as well. Perhaps the room is not so bad. If live conversations do not call attention to the acoustics, a highly accurate speaker should not either.

A common thread runs through speaker accuracy observations during the last five years: Vertical alignment of the drivers is critical. Simultaneous arrival of sound from the drivers at both ears is the clear reason, but there are others as well. The same two ears have a certain degree of sensitivity to vertical displacement of the drivers, and there is a limit to the acceptable vertical angle. From this standpoint, a coaxial speaker theoretically would be ideal.

TV production is done in an environment of level floors and vertical walls. A single microphone picking up multiple drivers in a cabinet seems to be capable of differentiating between vertical arrays and those with a horizontal spread. A possible explanation

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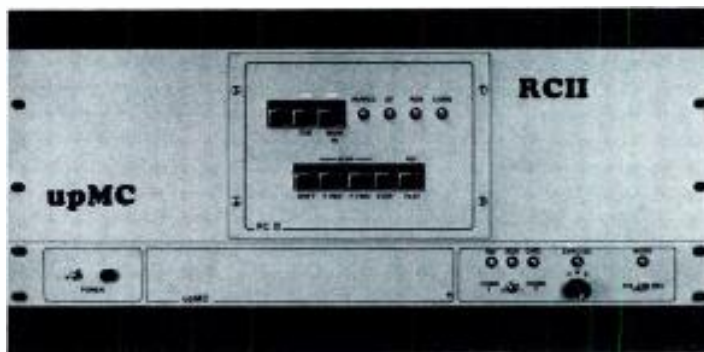
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could be that reflections from straight vertical arrays tend to remain polarized, while reflections from arrays with some horizontal spread tend to become reversed and randomized in unwelcome ways.

Control room monitoring

In addition to the effects of driver displacement already discussed, room size is an important consideration for speaker evaluation. Huge rooms generally give better performance than small ones, because the earliest

coherent reflections of sound in a large room can be considered outside the fusion time of the direct and reflected sound, and thus the ear-brain has no difficulty ignoring them. Reflections in a large room are perceived as just that, not as distortions of the original sound. Most people are not able to separate discrete early reflections in rooms of the size normally used for TV sound mixing.

Another means of differentiating sound is by level. The signal-to-noise (S/N) ratio is an example. When the

noise is almost identical to the monitor sound, more of it can be tolerated. Damaged (reflected) sound begins to interfere when it is about 10dB below the direct sound. The reverberant field in any room is noise, with direct sound from the monitor speaker being the signal. Accurate reverberance is dependent on speaker accuracy, and the room has less of an influence.

Solutions

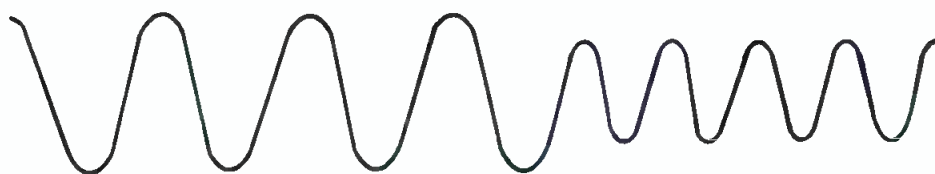
The dimensions of a room, which generally cannot be changed, have the greatest effect on lower audio frequencies. The best defense against room reverberance is to properly mount the speaker system, leaving no space behind it to cause additional middle frequency to low frequency effects. Flush mounting of half-space designs (center wall position) and ceiling-wall mounting of quarter-space systems (corner room position) are recommended, but are not always possible. The new technique of low frequency voicing with computer synthesized first-order correction sounds promising in this respect.

The physics of sound is simplified by dealing with point-source and point-pickup of sound, using speakers and microphones with no diameter. One is then the same as the other. Arguments for close mic placement also can apply to speakers. If there is something analogous to a proximity effect for speakers, it could allow the listener to overcome low end room distortions.

The minimized cabinet size of the Sentry 100A and close spacing of its drivers allow the speaker to approximate the ideal point source. The 100A placed on a table just beyond the console's meter housing gives a good sound to the operator. A wall directly behind the speaker makes it better. Usually, the tweeter should be placed at the bottom, reducing wavelengths of the earliest reflections. The nearby surface that can offer non-polarized early reflections may be the control deck of the console. Raising the 100A or tilting it back will help identify the amount and character of damage from these surfaces.

Near-field monitoring

Near field is the popular term for close-in sound monitoring. Several factors determine the place where this field ends. Subjectively, it is the spot where reverberation and reflections begin to bother the listener. However, the judgment varies among listeners. Technically, it is where the direct sound pressure level ceases to drop 6dB with a doubling of the distance of



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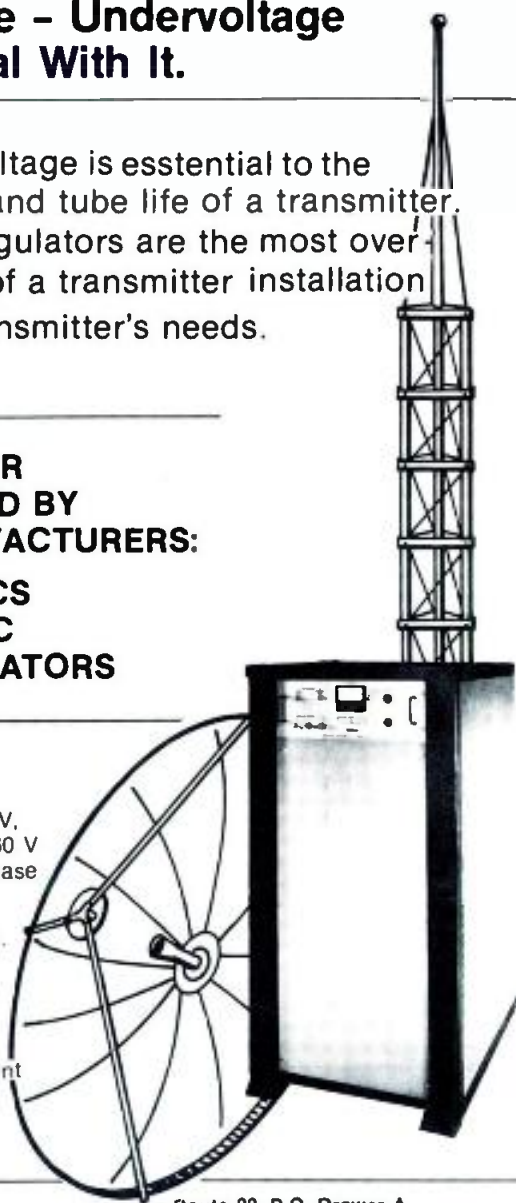
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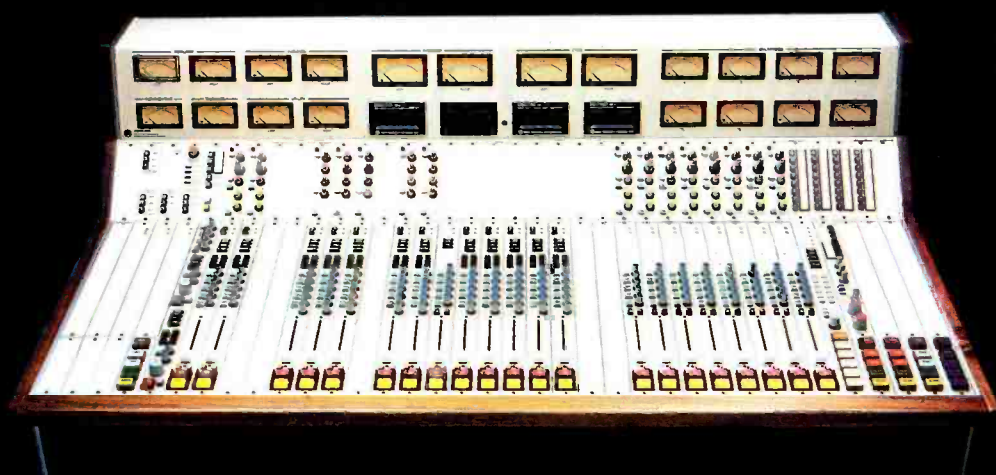
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The proper choice of a studio monitor speaker is of prime importance to accurate TV sound production. Shown are three loudspeakers (mounted using various techniques) in use at ABC-TV's production control rooms in Hollywood.



Mounted on a shelf above the Ward-Beck audio console is a pair of Sentry 100A loudspeakers and a larger size Sentry 500 between them.



A pair of Sentry 1A loudspeakers is mounted on the wall above the console in this studio. A Sentry 100A can be seen just above the video monitors.



The Sentry 505 is designed for ceiling-wall corner mounting, as shown in this production facility installation.

the measuring microphone. This point changes with speaker level.

Rooms have varying critical levels, where the structure and air can no longer absorb energy, and the reverberant begins to crowd the direct sound. (This is the level at which rock groups tend to play, whatever the size of the room.) Mixers may monitor at this level if the room sounds better than the speaker, no matter how close the listener may be to the speaker.

Not all loudspeakers sound good at a distance of a few feet. If the combining effects from a PA cluster 25 feet away are noticeable in the front rows of a large auditorium, then this too is the near field.

Understanding the hazards and advantages of close-in sound monitoring makes a high quality speaker a more valuable tool. Location recording and remote pickups for radio or television always require good portable monitors. Auxiliary areas in production facilities also can benefit from high accuracy speakers that meet budget and space limitations. Note that although some speakers may be mounted horizontally in an equipment rack, the value of vertical alignment will be lost. Regarding the Sentry 100A, EV advises against this configuration. Mounting a speaker improperly in a control room will leave continuing doubts about the sound heard in the facility.

Speaker evaluation

In non-coaxial, 2-way systems, there must be points on the axis where sound from the drivers cancels out at the center frequency of the crossover. This effect shows up as a deep notch on a spectrum analyzer. Some manufacturers seek to eliminate this effect. Crossovers that roll off more than 6dB per octave usually introduce significant phase shifts, which can be heard as damaged additive sound.

A closing word about speaker selection is in order. The history of monitoring systems is interwoven with the development of test instrumentation. Too often a bad-sounding system has been proved excellent—on the graphs. The ear knows better, however.

The quest for speaker accuracy continues, with hundreds of manufacturers and thousands of models from which to choose. Let the listener judge the speaker, and let the instruments then be used to find the reason.

Editor's note:

This article is based on the author's experience in TV production sound recording. The views expressed are those of the author, and are not meant to represent the position of ABC-TV.

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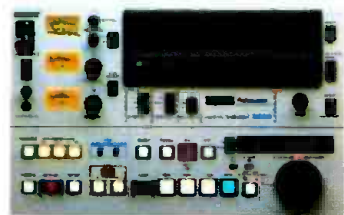


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SONY
Broadcast

Selecting a monitor amplifier

By Bruce Bartlett, Crown Int'l, Elkhart, IN

Engineers judge their stations' audio quality with studio monitor systems, so every component in those systems must be clean-sounding and reliable. In particular, the monitor power amplifiers must work every time they are turned on, and must introduce no sonic coloration.

Monitor amps used in professional studios must meet several stringent requirements, including the following:

- **Reliability**—The amplifier must operate dependably, day-in and day-out. Downtime costs the station money. Also, a dependable power amplifier allows the engineer to troubleshoot other components in the audio chain without worrying that the amplifier itself might be the cause of the problem.

- **Sonic transparency**—The amplifier must add no sound of its own, or else the engineer will be judging the sound of the amplifier, as well as the rest of the chain. Transparency is the result of careful attention to design details. This attention produces an amplifier with low distortion, flat frequency response and low noise. Look for a total harmonic distortion (THD) specification of less than 0.05%, frequency response of (± 0.1 dB) 20Hz-20kHz or greater and a signal-to-noise (S/N) ratio of at least 105dB.

- **Protection circuitry**—In professional installations, the monitor amplifier undergoes much use and abuse. It should be protected against shorted output connections, mismatched loads, RF oscillations, component overheating and input overload.

- **Distortion indicators**—If you hear distortion in the monitored signal, some type of distortion indicator should be available on the power amplifier to show whether the amp is the cause. This provision greatly simplifies troubleshooting.

- **Adequate power and headroom**—Insufficient power results in distortion if high sound pressure level (SPL) monitoring is desired. Be sure that the monitor amplifier has enough power to drive the system's speakers to the desired SPL. Stations should determine their desired SPL listening points to accurately specify the power rating of the amplifier to be used.

Shown are front- and rear-panel views of a 180W/channel (8 Ω) stereo monitor amplifier for studio use. Features include front-panel signal presence and distortion indicators. The rear panel offers the user a variety of input and output termination arrangements. An optional plug-in balanced input adapter can be supplied if the unit is to be operated in an RF field. The unit (a Crown PS-400) is an example of the new generation of amplifiers available for studio monitoring applications. A full listing of monitor amplifier manufacturers and suppliers can be found in the September 1983 *Buyers' Guide* issue of BE.



Power amplifier manufacturers should be consulted on average listening levels vs. suggested amplifier headroom, because specifications of amplifier power may vary from one company to another.

- **Low interface intermodulation distortion**—This newly discovered type of intermodulation distortion occurs only with real-world loads. Back EMF from the loudspeaker (see "Multiway Audio Amplification" on page 38) affects the transfer function of the amplifier driving the speaker, resulting in intermodulation distortion, if not controlled.

- **Outside world connectors**—Check the input and output connectors to be sure that they are reliable and readily available from the manufacturer or local supply house. Ideally, they would be standardized with the rest of the broadcast plant, allowing easy substitution of assemblies.

- **Input stage configuration**—The monitor amplifier should be selected to match the level of the program drive signal available to it. Proper impedance matching also is an important consideration. Balanced input stages should be used whenever the monitor amplifier is located in an RF environment.

- **Chassis mounting**—The amplifier should offer the user a chassis that is easily mounted in an equipment rack or other enclosure. Amplifier mounting should not be neglected, because improper placement can restrict air flow to the unit and, perhaps, lead to premature failure.

Once a monitor amplifier system has been selected, installation should be planned carefully. Proper grounding of the chassis is important not only for RF protection, but also for safety. Speaker cables should be selected to provide minimal power loss. It makes little sense to purchase a high quality power amplifier and then to waste a portion of that power in the line to the speakers.

The studio monitor system may be the most important piece of audio test equipment at a radio or TV station. It is used continually by operations personnel to judge the quality of the entire transmission chain. A monitoring system should, therefore, be selected carefully.

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Audio monitor update

By Jerry Whitaker, radio editor

A radio or TV station's studio monitor speaker is more than just a means to hear the air signal. It is the reference against which the audio quality of the entire broadcast chain is judged. An accurate monitoring system—amplifier and loudspeaker—is needed to ensure that the sound heard in the studio represents the actual on-air audio.

Accurate monitoring also is important in production rooms, where equalization or special effects may be added to the mix. Without a flat, clean monitoring system, the operator cannot judge the correct amount of equalization, reverb or other special effects required in the production.

Selecting a monitor amplifier, as outlined elsewhere in this issue (page 56), should be done with care. Equal attention should be given to the selection of a studio loudspeaker system.

Space limitations prevent a review

of all loudspeakers suitable for monitor use in radio and TV stations. However, the following is a representative sample of some of the newer designs available. For a complete listing of speaker manufacturers and suppliers, consult the September 1983 Buyers' Guide issue of **BE**.

Eastern Acoustic Works. The MS-30 is a new near-field studio reference monitor manufactured by EAW of Boston. The speaker offers essentially flat on-axis and off-axis response, with transient capabilities fast enough to meet the needs of digital audio quality assurance. The MS-30 is designed primarily for reference monitoring in recording studios, broadcast facilities and film dubbing suites.

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Electro-Voice. The Sentry 100A loudspeaker is designed to meet the monitoring needs of broadcast and recording studio engineers in a compact package. It exhibits high efficiency reproduction, high power-handling capability across the audio band, and uniform frequency response and dispersion.



Eastern Acoustic Works MS-30



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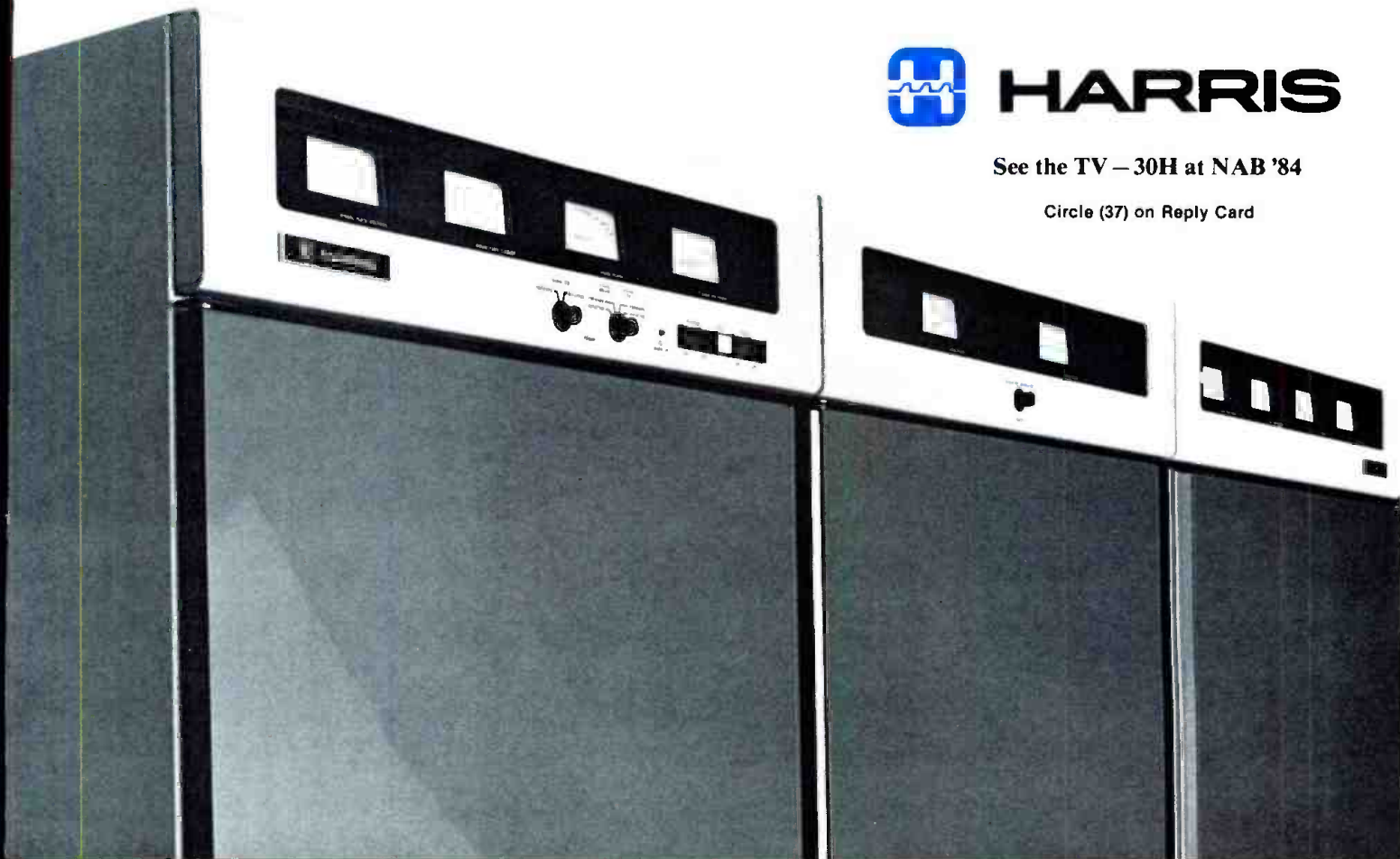
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Circle (36) on Reply Card

The speaker incorporates a heavy-duty tweeter designed for long life and extended high end response. The integral crossover network is a 12dB/octave dual-section design. The speaker also has a continuously variable, shelf-type high frequency response control that allows for adjustment to individual listening preferences, with boost-and-cut capability of +2dB to -4dB from flat.

The low frequency section uses an 8-inch, direct-radiator woofer installed in a vented enclosure. The special venting used in the Sentry 100A results in extended low frequency response, high efficiency and small size.

The loudspeaker is rated for a power-handling capability of 30W (continuous filtered random noise for 15 hours).

Another product, the Sentry 505, is a recently released loudspeaker designed for control room monitoring use. The Sentry 505 is an acoustic match for the Sentry 500, but in an angled enclosure for ceiling/wall-mounting locations. Specifications for the new unit show essentially flat frequency response from 40Hz-18kHz and good efficiency (96dB, 1W at 1m, anechoic).

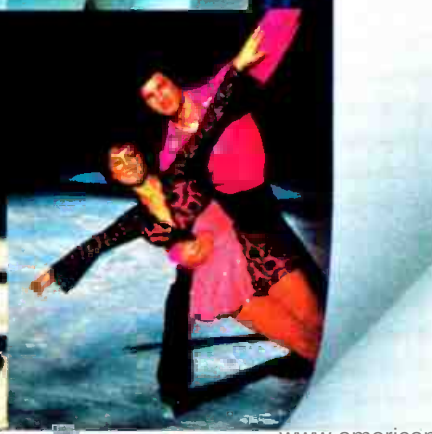
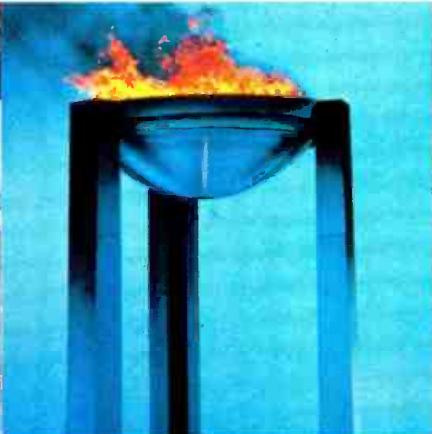


Electro-Voice Sentry 505

The Sentry 505 is a 2-way speaker system using a 12-inch, high excursion woofer and a heavy-duty tweeter. Careful attention to transducer geometry and crossover design provides acoustic phase coherence in the crossover region (1.5kHz), which gives well-controlled vertical and horizontal dispersion of sound in the critical 250Hz-10kHz range.

A 4-position tweeter attenuator is mounted on the front panel, allowing adjustment of the high frequency end from flat response to -9dB in 3dB steps.

The Sentry 505 is designed to handle 100W (average, long-term) power



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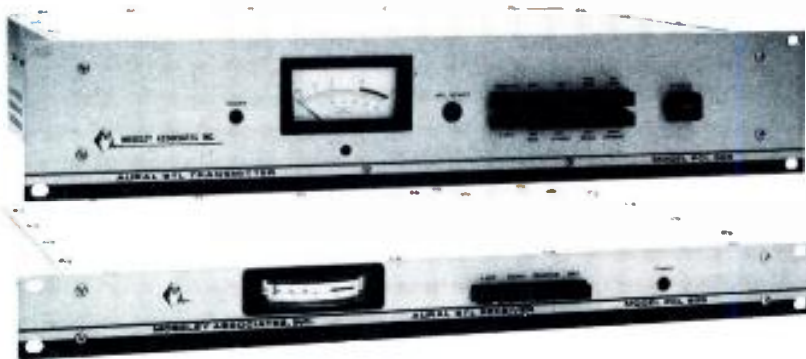
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Carrying a composite stereo signal over a single STL means true direct FM stereo; so, the audio processing units and stereo generator may be located in the studio, accessible and far from intense RF radiation. The wideband input of the PCL-505/C accepts two subcarriers as well as the composite stereo waveform. In conjunction with an SCD-9 Stereo Demodulator the PCL-505/C is excellent for AM stereo.

Two monaural PCL-505/C's used in tandem, in the split-channel method, provide crosstalk-free stereo broadcasting and carry both remote control and SCA subcarriers. The direct FM techniques that provide composite stereo in the PCL-505/C also mean excellent frequency stability in both the PCL-505 and PCL-505/C. Both feature on-frequency RF amplifiers, a carrier driven relay for external uses, extensive multimetering, excellent serviceability and a built-in remote connector for remote control. In case of program interruption, optional automatic transfer panels can switch operation to standby units.

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input. Short-term peaks may reach 400W.

Circle (301) on Reply Card

Genesis Physics Corporation. The model 20 loudspeaker is a 2-way design, packaged in a medium-sized enclosure, which gives wide frequency response and good efficiency.



Genesis Physics model 20

It uses an 8-inch woofer that incorporates a 4-layer, high temperature voice coil with a rubber impact bumper for durability under high power operation. The 1-inch inverted dome tweeter is response-corrected for linear output over its frequency band. The 2-way speaker design also includes a 10-inch passive radiator in a vented enclosure.

The speaker is rated for a power input of 20-100W, depending on the measurement criteria used.

Circle (302) on Reply Card

James B. Lansing Sound. The JBL 4411 loudspeaker is a compact, 3-way monitor designed for broadcast and recording studio applications. The 4411 is a successor to the JBL 4311.



James B. Lansing Sound 4411

Close clustering of the new speaker's 12-inch, low frequency woofer with the midrange transducer and the high frequency dome radiator permits close-in monitoring. The woofer incorporates JBL's Symmetrical Field Geometry (SFG) mag-

netic structure for reduced second-harmonic distortion.

The system's middle and high frequency drivers were developed with the aid of laser technology to produce components with flatter response and greater power-handling capability. The crossover network is designed for smooth transition between frequency bands. The middle and high frequency level controls, adjustable from the front of the speaker, are calibrated to provide settings for a flat direct-field pressure response or a rising axial response that produces a more forward sound, characteristic of older monitor designs.

The 4411 is designed for a power input level of 150W (continuous program material).

Another JBL product, the SLT-1 miniature loudspeaker, is a new addition to the product line. The speaker is designed for professional applications requiring rugged construction and small size.



James B. Lansing Sound SLT-1

The SLT-1 uses a 5/4-inch low frequency loudspeaker incorporating JBL's SFG magnetic structure for low distortion reproduction. A flat-wound, ribbon-wire voice coil also is used in the low frequency speaker for maximum efficiency and good power-handling capability. The high frequency tweeter is a 1-inch, hard-dome radiator designed for extended response and wide dispersion.

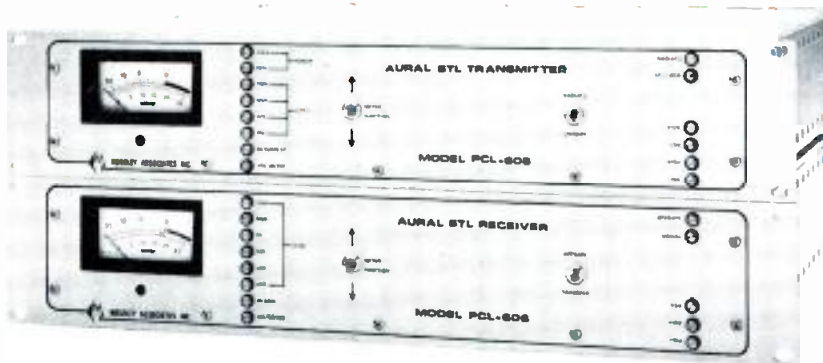
The speaker enclosure is made from acoustically treated die-cast aluminum. The speaker may be mounted horizontally or vertically, and tilted to any angle. The power-handling capability of the speaker is rated at 50W (pink noise).

Other recently released studio monitor products from JBL include the 4312 and the 4401.

Circle (303) on Reply Card

Studer. The 2706 studio monitor speaker is designed for use as a reference source in small- to middle-sized radio and TV control rooms and production suites.

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Studer 2706

The 3-way system uses a 12½-inch woofer, a 2-inch dome midrange transducer and a 1-inch dome tweeter in a bass reflex enclosure. The low frequency transducer is designed so that the magnetic field remains constant over the entire excursion range of the voice coil. This ensures linearity to just below the speaker's clip point,

thereby reducing distortion. Middle and high frequency elements are handled by Studer's newly developed high power dome transducers. Cross-over filter slopes have been selected to match the corresponding mechanical properties of the speaker components.

The 2706 has four threaded holes on the bottom of the cabinet to facilitate free-space installation on a floor stand or suspension bracket. The speaker is rated for a power input level of 18W (continuous broadband pink noise for 8 hours). Peak power ratings can range up to 250W.

Circle (304) on Reply Card

Try before you buy

Careful attention should be given to selecting a studio monitor system. Examining specifications can be difficult, however, because of the different measurement procedures that may be employed from one manufacturer to another. For this reason, if possible, listening comparison tests should be conducted in addition to a thorough examination of loudspeaker specifications and the procedures used by the manufacturer to obtain those specs.

Once purchased by a station, loud-

speakers should be mounted as recommended by the manufacturer. In many cases, the desired performance will not be realized if the speaker is mounted incorrectly.

The time and money spent in selecting and installing a studio monitor system are two of the best investments a station can make in its on-air sound. A studio monitor should be chosen from a line of professional products, not consumer-grade gear. It often is desirable to know what the station's air signal sounds like on a typical home hi-fi system. For such applications, consumer gear is in order. For studio monitoring, however, professional gear is required. A station's air signal is too important to be trusted to a speaker whose quality is subject to question.

Editor's note:

Of the loudspeakers covered in this equipment update, the Electro-Voice Sentry 100A has seen the greatest amount of field use. As documented in the article, "Monitoring for TV Sound" on page 44, the Sentry 100A has become a standard at many facilities. Because the other speakers discussed in this update are recent additions to each company's product line, we would appreciate any feedback that users might have on their performances. BE also invites comments on other monitor speakers not covered here. [:(~:~)]

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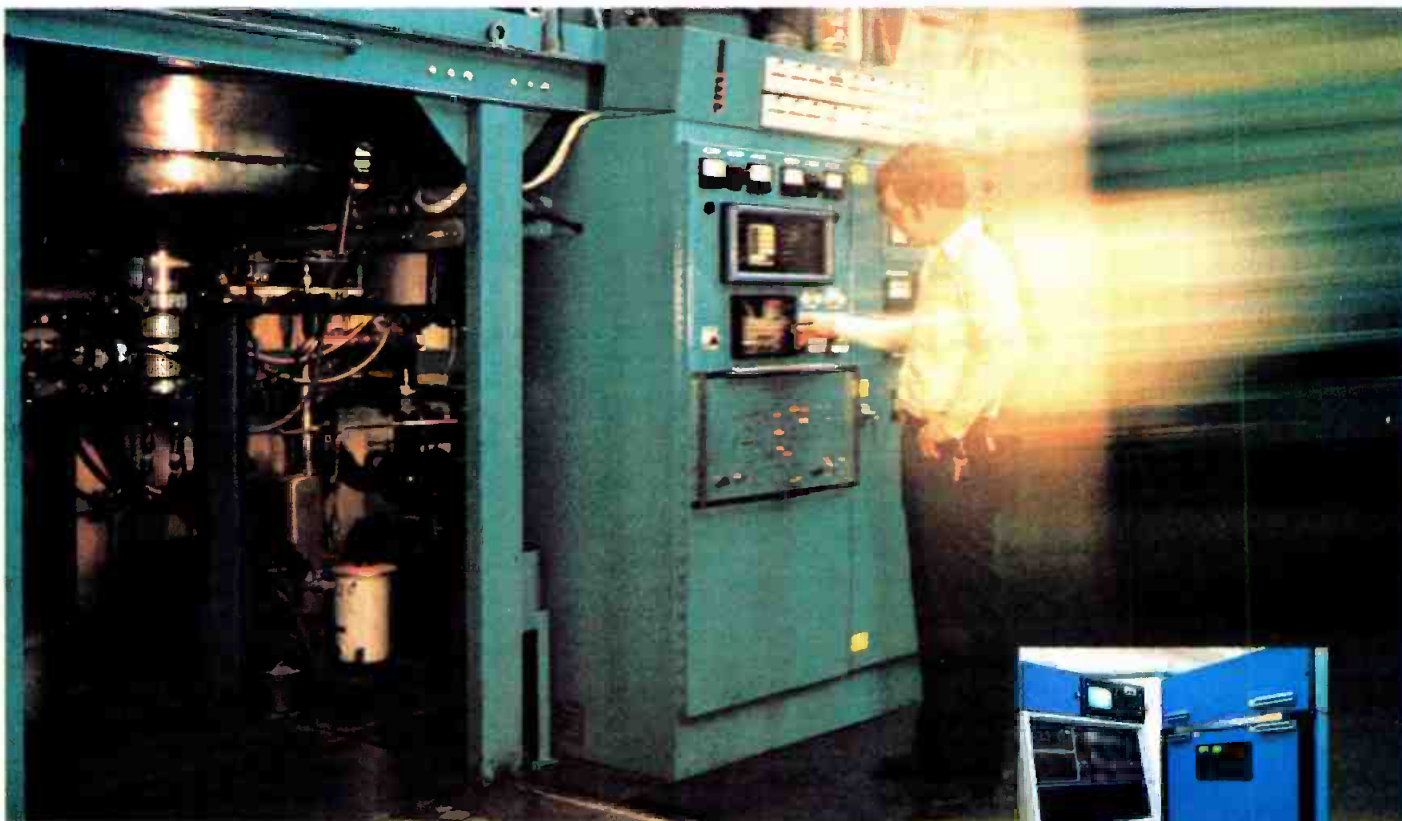
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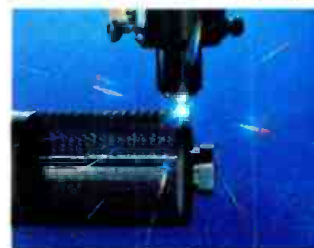
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Circle (43) on Reply Card

March 1984 *Broadcast Engineering* 65

Who's monitoring the monitor?

By Gene D. Ornstead, national service manager, Conrac Division, Conrac Corporation, Covina, CA

To protect the investment made in video monitors, the author suggests common sense ways to keep the best possible picture on the screen.

Why does Preview Monitor One look different from Program Monitor One? Is the registration correct on Camera Three? Who balanced the color on VTR Two? Why does the picture on this monitor look different from yesterday?

Does this sound familiar? These are typical questions asked daily in all types of TV broadcast facilities. The role of the TV monitor in today's broadcast environment needs to be clarified. Operating in concert with the most sophisticated video special effects equipment, high resolution color cameras or the latest videotape recorders, the video display monitor provides the only visual review of all video program material. Therefore, the video monitor is of paramount importance in all facets of studio and production applications, and to all video operating professionals and clients.

Despite the video monitor's important role of reproducing exact video imagery, some broadcast and production facilities still allow performance degradation caused by poor maintenance practices. It is surprising how meticulous broadcast and video production facilities are about the calibration and maintenance of some equipment, yet video monitors only seem to get maintenance attention when they fail. In many cases, a monitor does not get a complete calibrated alignment even when involved in a repair operation.

Most TV monitors in daily opera-

tion are seldom operated and maintained as precision pieces of broadcast equipment. Professional video monitors are designed to display exact video input signals, as seen by the camera or other sources of video, and should be given no less attention than other equipment operated in a facility.

Most monitor problems can be corrected by a routine check or calibration, requiring no more than one hour a week of a technician's time. In most cases, simple periodic checks and calibration can make a major improvement in monitor picture quality, enhancing facilities' overall operation through production of clean, accurate pictures.

Critical parameters

The TV monitor setup parameters most often causing deterioration of picture quality can be classified into six categories: color temperature; gray-scale tracking; CRT convergence and purity; image focus, chroma and phase calibration; and black level and contrast setup. Alignment of any one or a combination of these critical parameters can make the difference between a high quality video image and a poor, unreliable image. In addition to precise monitor calibration, monitor matching and circuit stability also are important. These factors are determined by the manufacturer, however, and account for the higher cost of the best professional monitors. To ensure proper performance of the display monitors in your facility, calibration standards should be relied upon and used faithfully.

Monochrome adjustments

First, before any color picture can be reproduced by a color monitor, you must rely on a calibrated standard for

the color white. Over the years, in-depth study and evaluation has selected Illuminant D phosphor with a 6500°K color temperature as the standard for daylight white. Using this as a standard reference when calibrating a monitor's high light and low light adjustments, you can ensure proper gray-scale and color temperature alignment for maximum color picture fidelity. When calibrating gray scale (color matching) on more than one monitor, the monitors must have CRTs that have the same phosphor colorimetry coordinates and tolerances. This will ensure that the three basic primary color phosphors (red, green and blue), used when manufacturing the CRTs, will match. There are a number of instruments on the market today that assist the broadcast maintenance engineer with color temperature and gray-scale setups. You may want to investigate what type of equipment your engineering department is using and if it is up-to-date and reliable.

Another monitor setup parameter that can cause severe degradation of color pictures is convergence alignment of the cathode ray tube (CRT) and associated circuits. CRT convergence can be calibrated best by using monochrome cross-hatch or dot matrix signals. In the past, broadcast maintenance engineers tended to shy away from convergence alignments because of the complexity of circuitry and difficult alignment. Convergence in one area of the CRT would throw another area out of alignment. Today most professional monitors have active-type convergence circuitry, which separates the CRT into independent alignment areas, making setup alignment quick and less complicated. (See Figure 1.)

Have you called your switcher lately?

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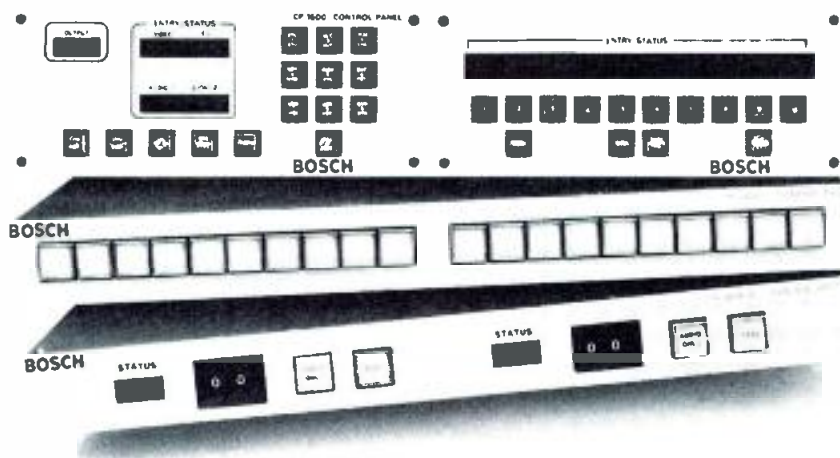
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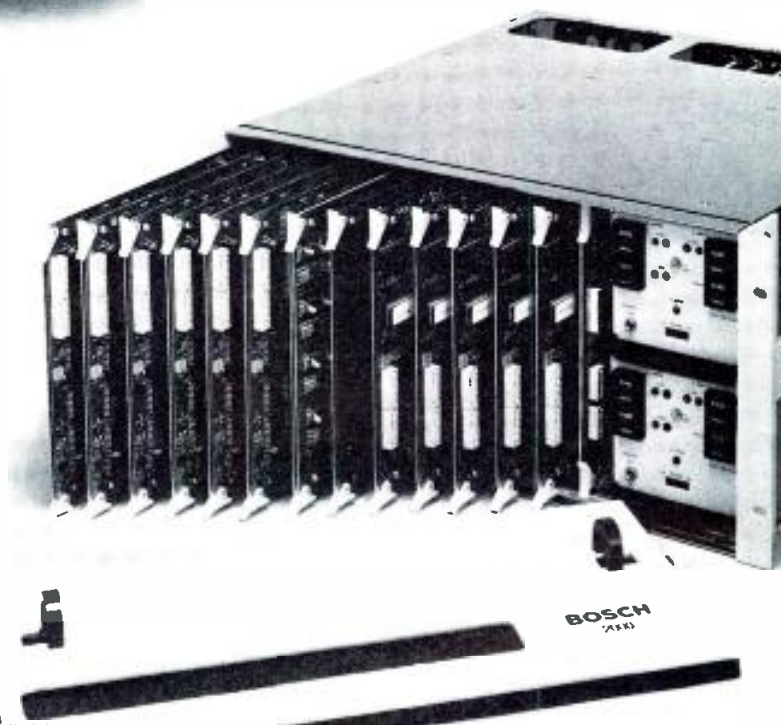
Call your local Bosch-Fernseh office for details on the new TVS/TAS-2000 and other members of the Bosch switcher family. Or write Fernseh Inc., P.O. Box 31816, Salt Lake City, Utah 84131, (801) 972-8000.

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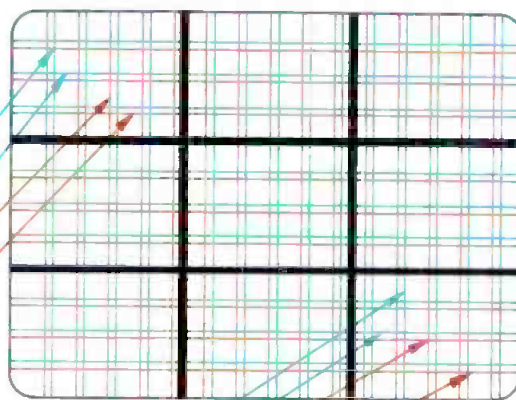
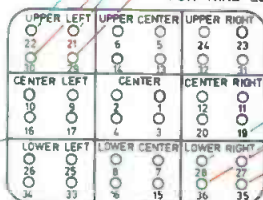


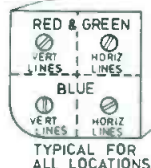
Figure 1. Active convergence provides greater control for each segment of the screen, with individual panel controls for each color.

NUMBERED CONTROLS REFER TO CONVERGENCE PROCEDURE

ADJUSTMENTS ARE TYPICAL FOR NINE LOCATIONS



CONTROLS IN EACH "BOX" ADJUST CORRESPONDING AREA ON THE PICTURE TUBE



Monitors with precision in-line CRTs soon will be available that will meet professional broadcast standards. These new monitors will eliminate routine convergence maintenance while delivering superior stability.

CRT purity alignment plays an important role in today's high resolution, black matrix CRTs. Proper alignment of CRT purity consists not only of even red, green and blue fields, but white-field uniformity as well, requiring a precision alignment of the CRT beam landing after basic purity adjustment has been completed. White-field uniformity should be checked before monitor installation, at all periodic monitor maintenance intervals, and when the CRT has been changed or purity has been adjusted.

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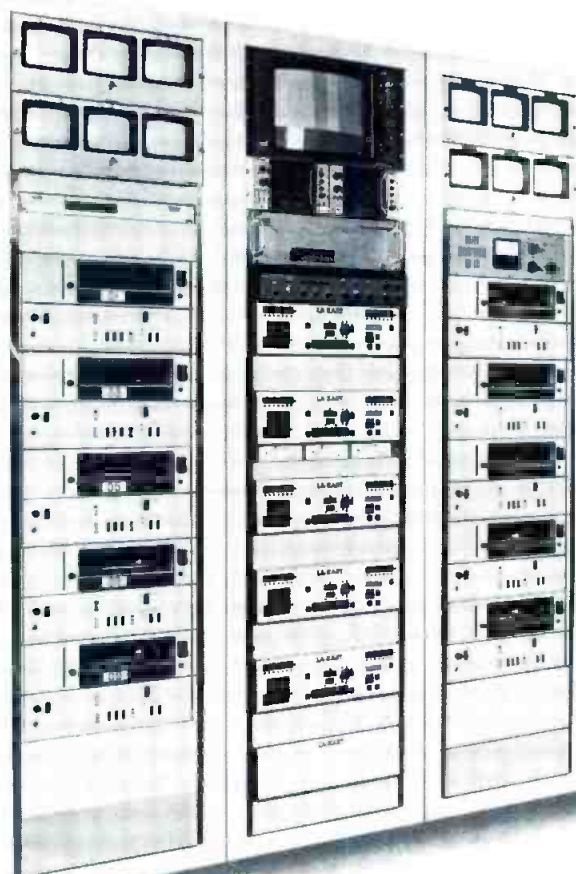
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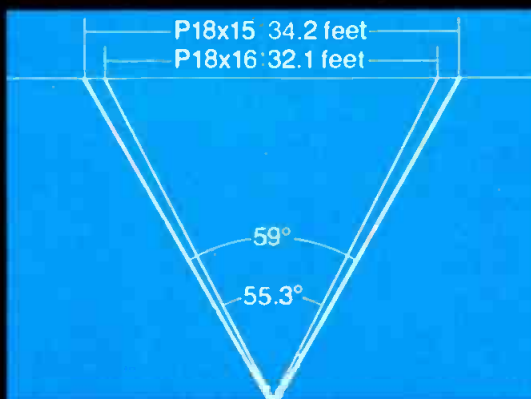
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Color adjustments

Proper color level (chroma) and hue (color phasing) are adjustments made daily to color monitors. In practice, few people concern themselves with exact calibration of chroma and phase adjustments. As long as the colors appear as video operators think they should, they are satisfied and leave further adjustment to the next operator. After witnessing color adjustment using this method, you wonder what the condition of the original program video was and what quality of color was being monitored.

Once again, to guarantee color video quality and be able to preview your video with confidence, you must

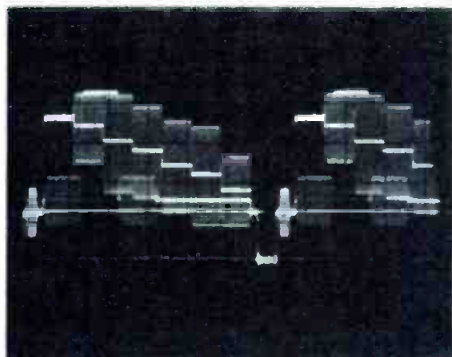


Figure 2. A typical encoded NTSC color bar signal displayed on a waveform monitor screen.

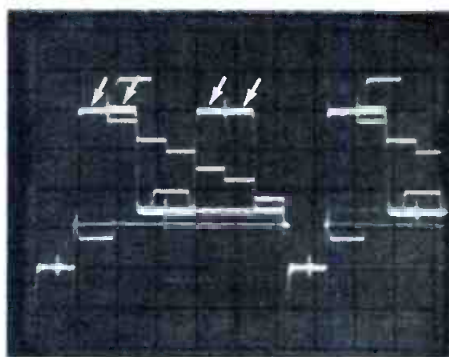


Figure 3(a).

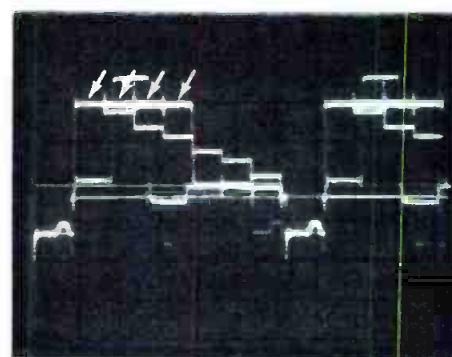


Figure 3(b).

Figures 3(a)-3(c). Properly calibrated, four bars for each primary color are of equal amplitude. Matrixing of red, shown in 3(a); green, in 3(b); and blue, in 3(c), produces the NTSC signal. (See arrows showing indicated bars.)

depend on a calibration standard. Professional organizations and committees have developed color standards from the cycles of chroma-burst on input color signals to a percentage of demodulator error as measured by a vectorscope display. The most widely used standard for color amplitude and phasing calibration is the NTSC color bar signal. (See Figure 2.) The NTSC color bar signal provides the necessary information to properly calibrate a monitor's red, green and blue color circuits.

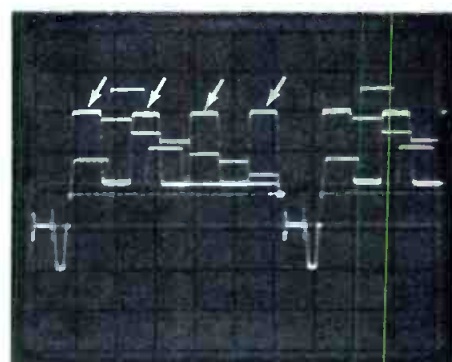
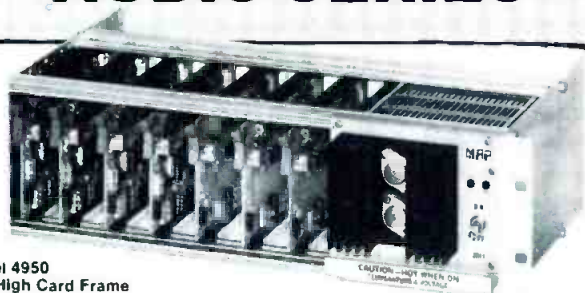


Figure 3(c).

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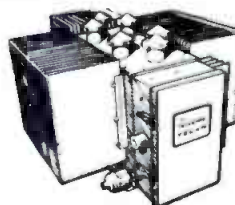
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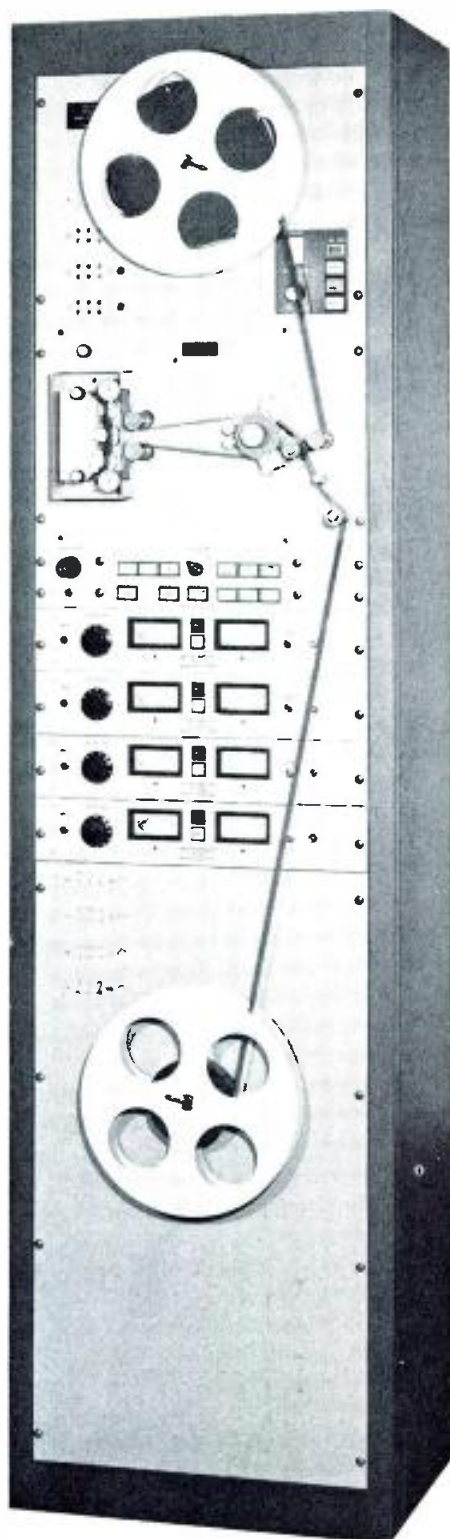


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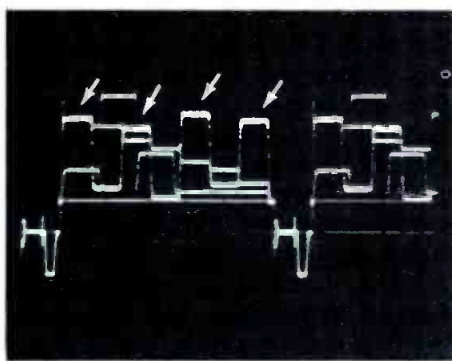


Figure 4(a).

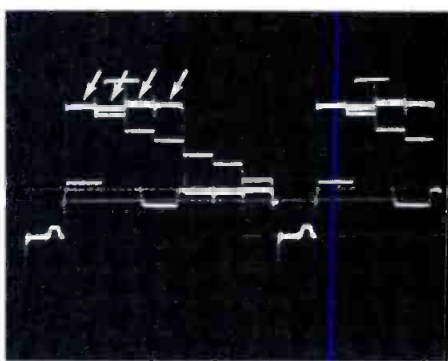


Figure 4(b).

Figures 4(a) and 4(b). Misalignment of blue output video, shown in 4(a), and green output video, shown in 4(b), is indicated by bars of unequal amplitude. (See arrows showing indicated bars.)

Level and equal color bars, as shown in Figure 3(a)-3(c), illustrate proper calibration of the red, green and blue CRT drives using the NTSC color bar signal. Many broadcast facilities tend to check a monitor's color calibration on the blue video output. Using this method does not guarantee proper color calibration on the red or green color outputs. If you must make a quick check on a monitor's color calibration, it is better to use the green video output channel than the blue. The green output is matrixed from the red and blue and will show an error in the proper waveform if an error exists in the red or blue demodulator circuits, as well as the green matrixing circuit. (See Figures 4(a) and 4(b).)

Brightness and contrast

Black level (brightness control) setup and contrast output are the last two monitor setup parameters often misadjusted. Brightness control calibration often is set too low, producing a very high contrast picture, or too high, producing a soft picture. The brightness calibration should be set at visual cutoff of the raster with contrast off. Using this method, you will display a small amount of brightness background when your contrast is adjusted for your selected output.

Contrast output typically is adjusted for 30fL output, using a window or a flat-field input signal. Contrast is the one adjustment that may be calibrated high or low without producing unrealistic picture effects, providing you do not overdrive the CRT.

Extremely high contrast settings will deteriorate the focus of the picture, as well as shorten the CRT's life span. Contrast levels can be calibrated using a light output instrument. In most cases, however, a visual calibration is sufficient.

I have discussed the six monitor alignment parameters most often found to be misadjusted, and shown how monitors easily are misused in today's fast-moving TV industry. Remembering that the video monitor is the visual display most people look at in your facility, you want to make sure you are receiving the best possible performance. Establishing an easy maintenance check list or a mandatory calibration program could bring your monitors into top calibrated condition. As a minimum, a periodic calibration of color temperature and gray scale, CRT convergence, chroma level and phasing, black level and contrast level could separate your facility from your competitors. Do not fall into bad habits and let your monitors go uncalibrated. You will be pleasantly (and profitably) surprised at the results of having the sharpest picture in town. [:-:~)]]



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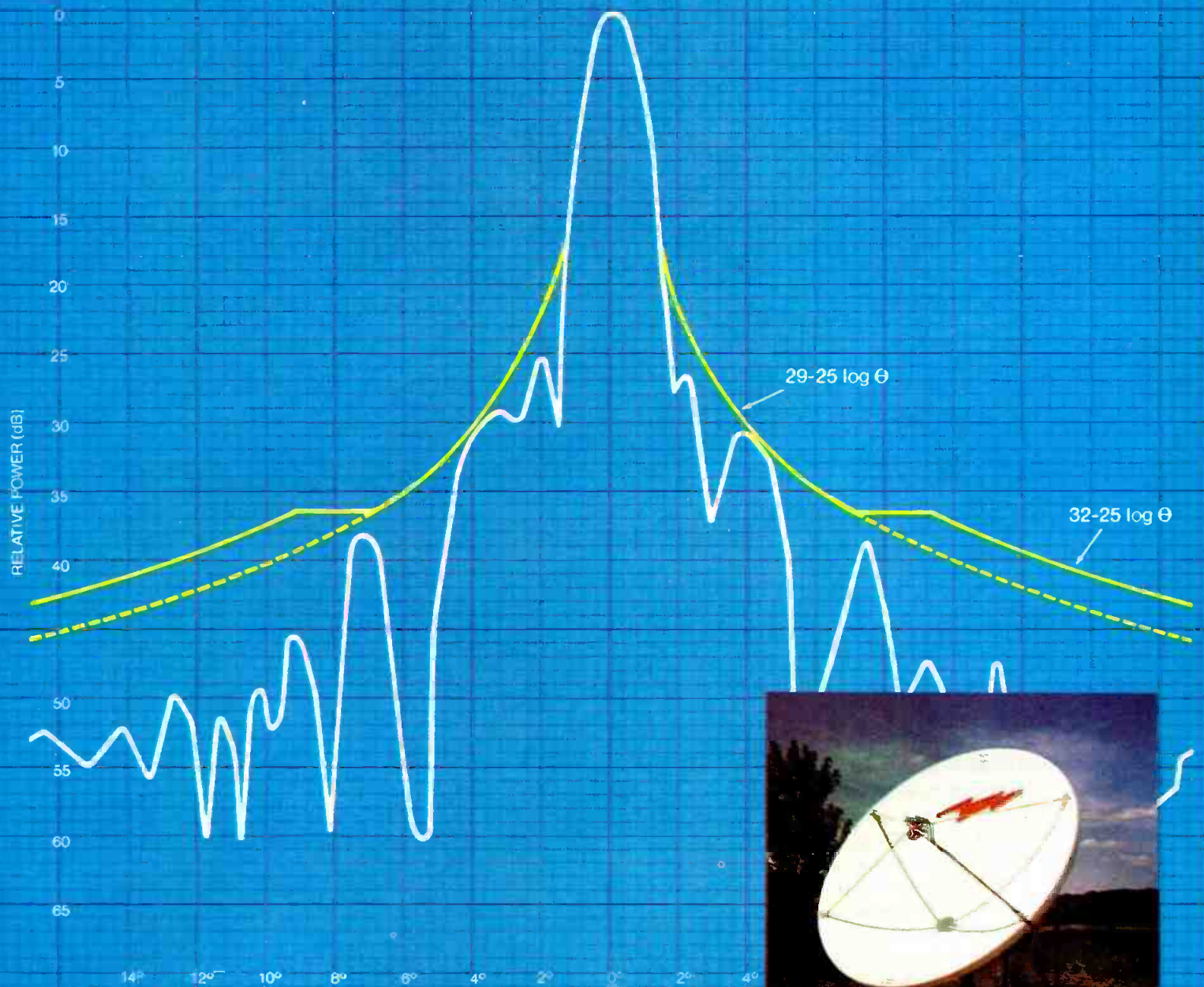
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Video monitor update

By Carl Bentz, television editor

A number of new video monitor products—monochrome and color—appeared during 1983. Size of display, resolution, signal separation and color stability have been addressed in the new models. A brief run-down of products shown at trade shows during the year demonstrates the variety of recently introduced equipment.

Amtron. High resolution CRTs with 8-, 13- and 19-inch diagonals include I/Q-axis decoders and adaptive comb filtering for maximum bandwidth to drive PIL-type tubes.

Barco. A 0.31mm dot-pitch, in-line 9-inch CRT in the CM22 NTSC monitor allows 490TVL resolution with RGB inputs, TTL inputs, pulsecross and underscan capability. NTSC, PAL, SECAM and RGB models of the CM33HRC monitor use a 14-inch dot/black matrix CRT. A non-glare black matrix tube with

0.43mm dot pitch in the CM51HRC 19-inch monitor includes NTSC, RGB, PAL or SECAM models. Master control monitor CVTM D allows multiple decoders with the additional display of VITC ID, time code and user bit information.

Conrac. A PIL CRT in the model 6200 master control RGB or NTSC display may include color-match phosphors and comb-filter separation. Model 2400 provides a wideband, high resolution monochrome display with a 19-inch CRT.

Until now, no component video system on Earth has been complete.

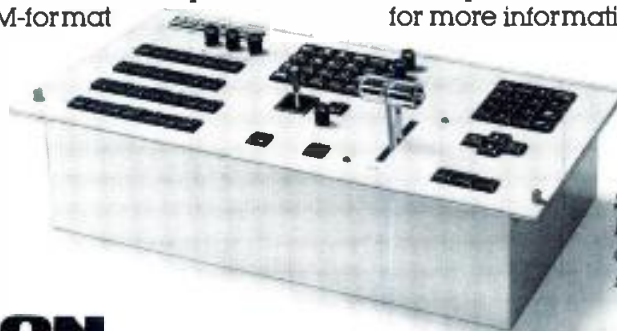
Shintron 390. The world's first and only component video switcher and editor-interface.

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BetaCam (Y, R-Y, and B-Y), and for general purpose (R,G,B). It can be driven by time code, and its special Convergence port along with a standard RS-422 port permit direct interface with most professional editors. And, its two independent microprocessors make it smart enough to perform a wide variety of intelligent, programmable functions.

The Shintron 390 is the missing link. Without it, no component video system is complete. Call now for more information.



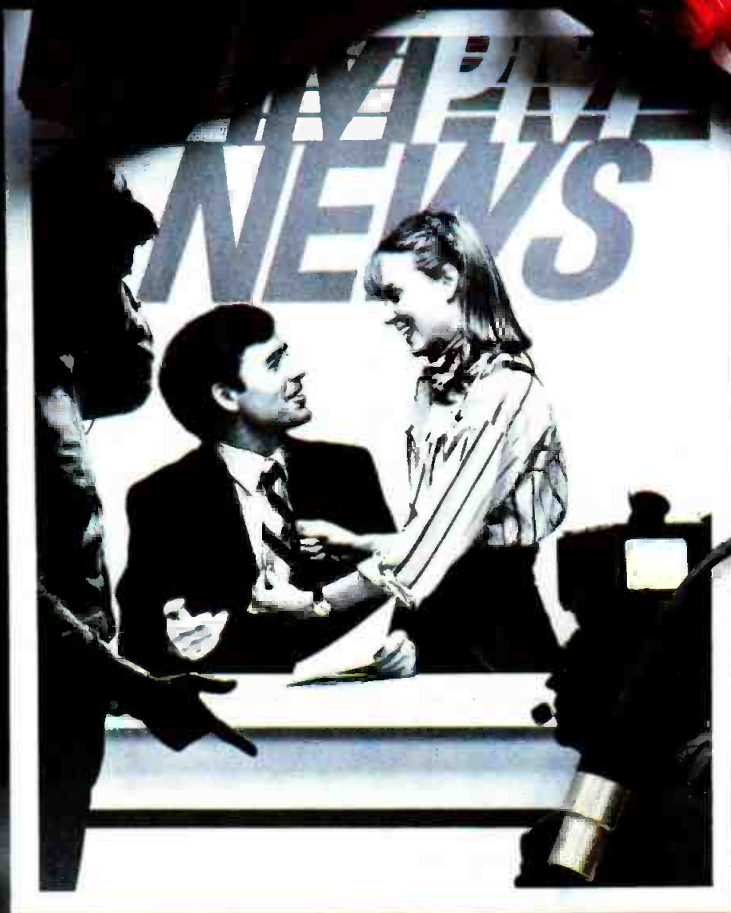
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Sound engineers appreciate the SM83 because its tailored frequency response requires less equalization. They like its low-frequency rolloff too, which quiets on-air rumbling and mechanical and clothing noise.

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

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

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

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

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

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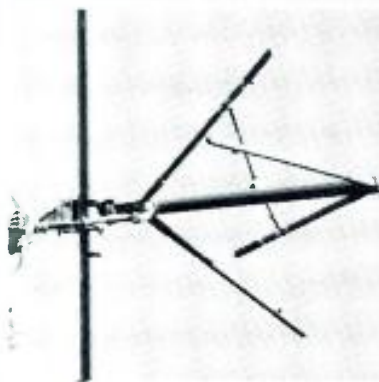


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Electrohome. A 90° in-line CRT, the ECM1301, provides 720x512 pixel RGB data displays with a 0.31mm dot pitch and 25MHz bandwidth. Horizontal scanning covers 14.5-25kHz.

GEC-McMichael. The 14- and 20-inch MCA37BQ and MCA51BQ Grade 1 monitors use interchangeable electronics. Five dot pitch values are available with RGB, single-, dual- and triple-standard units.

Ikegami. Up to 800TVL resolution from a 10MHz bandwidth is possible in the 9- and 14-inch 3H series monochrome monitors. Series 9 includes 9-, 14- and 20-inch displays to

600TVL resolution. The color monitors provide A and B inputs and crosspulse displays.

JVC Company. The TM-R9U studio monitor offers a 9-inch medium resolution picture with pulsecross, and comb filtering for improved color definition.

Lenco. The ICM-200 series includes the 214 (14-inch) and 219 (19-inch) models with 0.62mm and 0.68mm pitch slot mask CRTs, respectively. A 19-inch PIL CRT in the PCK-519-4 monitor achieves an 850TVL resolution with a 0.47mm dot pitch matrix. Underscan, comb filter, pulsecross

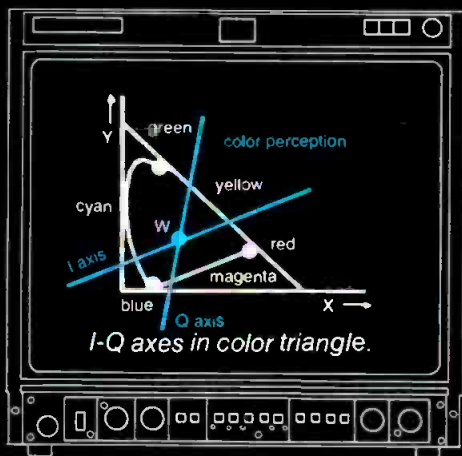
Table I.
Video monitor manufacturers

	Reader Service Number	Monochrome	Color	NTSC 3.58	PAL 4.43	SECAM	NTSC 4.43	PAL-M/N	RGB
Adrian March Electronics/UK	(305)	•		•	•				
Amtron/US	(306)	•	•	•					•
Asaca ShibaSoku/US	(307)	•	•	•					•
Audiotronics/US	(308)	•	•	•					•
Barco (Elector)/US	(309)	•	•	•	•	•	•	•	•
Barco Video & Comm./Europe	(310)	•	•	•	•	•	•	•	•
Bellard/UK	(311)	•		•	•				
Blaupunkt (Bosch)/Europe	(312)	•	•	•	•	•	•		
Bluebest Electronics/UK	(313)	•	•	•	•				•
Robert Bosch GmbH/Europe	(314)	•	•	•	•	•		•	•
Bosch-Fernseh/US	(315)	•	•	•	•	•		•	•
Cohu/US	(316)	•	•	•	•				•
Conrac/US	(317)	•	•	•	•	•		•	•
Cotron Electronics/UK	(318)	•	•	•	•				•
Croma (Autocue Group)/UK	(319)	•	•	•	•				•
Digivision Ltd./UK	(320)	•	•	•	•				•
Elbex Ltd./Japan	(321)	•	•	•	•				
Elcon Electric/Denmark	(322)	•	•	•	•				
Electrocraft Consultants/UK	(323)	•	•	•	•				
Electrohome Ltd./Canada	(324)	•	•	•	•				
Electronic Visuals/UK	(325)	•	•	•	•			•	
Finn (VideoTeam Oy)/Finland	(326)	•	•	•	•				
General Electric CCTV/US	(327)	•	•	•	•		•		
Grundig AG/Europe	(328)	•	•	•	•				
Hitachi Denshi/US	(329)	•	•	•	•				•
Ikegami Electronics/US	(330)	•	•	•	•				•
Jorgen Andersen Ingeniorfirma/ Denmark	(331)	•	•	•					
JVC/US	(332)	•	•	•	•	•	•		
JV Electronics/UK	(333)	•	•	•	•				
KGM Electronics/UK	(334)	•	•	•	•				
Lenco Electronics/US	(335)	•	•	•	•				•
GEC McMichael Ltd./UK	(336)	•	•	•	•				•
Melford Electronics/UK	(337)	•	•	•	•			•	•
Microel/Italy	(338)	•	•	•	•				
Panasonic A/V Systems/US	(339)	•	•	•	•				
Philips TV Systems/US	(340)	•	•	•	•				•
Proton USA/US	(341)	•	•	•	•				
Sharp Electronics/US	(342)	•	•	•	•				•
Sony Broadcast/US	(343)	•	•	•	•	•	•		•
Tektronix/US	(344)	•	•	•	•	•	•	•	•
Thomson-CSF/US	(345)	•	•	•	•	•		•	•
2K Video Systems AB/Sweden	(346)	•	•	•	•				
Velec Sefat/France	(347)	•	•	•	•	•		•	•
Videotek/US	(348)	•	•	•	•				•
Visual Contact/UK	(349)	•		•	•				



SMART

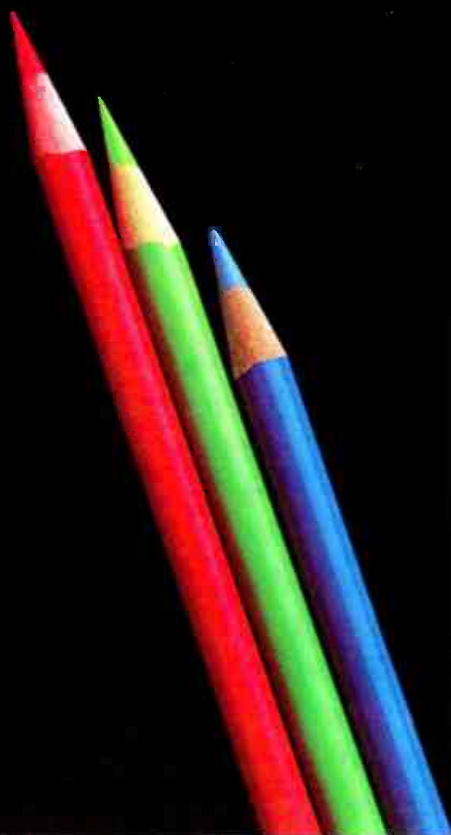
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Panasonic. The BT-S series includes the 1300N (13-inch) and 1900N (19-inch) Quintrix II CRTs with underscan, pulsecross and separate H and V delays. For high resolution, a delta-gun shadow-mask CRT in AT-H130G and ATH190G monitors displays crosspulse pictures with 2ms and 7ms AFC time constants. ENG operations are monitored with the CT-300VT 2.6-inch color receiver/monitor, which uses ac or dc powering. VHF and UHF tuning are possible. Three configurations of the BT-S series include the 700 single ac/dc operated unit, the 701 single-monitor desk-top package and the 702 dual-screen rack-mount model.

Philips. A Grade 2 monitor, the LDH 6200, uses a Hi-Bri CRT of PIL design and offers pulsecross, H-split screen and overscan/underscan.

Proton. The 600M and 600T 19-inch monitors include advanced color stabilization circuits to preserve color purity. Overscan, greater than 370TVL resolution, blacker blacks and precision deflection coils in a black case serve utility monitor uses.

Sharp. A 13-inch XM-1300 color monitor expands the Sharp line of monitors with front-panel switching of notch or comb filtering and a 0.31mm dot pitch CRT.

Sony. Additional models in the BVM, PVM and CVM series expand screen sizes from 3½-30 inches.

Videotek. On VM-13T monitors and RM-13T receiver/monitors, an R suffix (-TR) denotes rack-mounting fixtures. For NTSC, these units include dc restore, A-V demod outputs and isolation transformers. Options include pulsecross, underscan, ACC defeat, blue-gun-only and external sync. An additional model, VM-13PRO, has three looping inputs, tally light and RGB gun switches with a selectable horizontal time constant. For larger displays, the RM-25 includes a slot-mask CRT for NTSC with VHF and UHF tuning, as well as 8-pin VTR, BNC video and miniphone audio connections.

Video monitor sources

Table I lists manufacturers of video monitors. The list is based on Grade 1 (master control) and Grade 2 (utility) monitor units for monochrome and color. The manufacturers also will discuss your monitor/receiver needs.

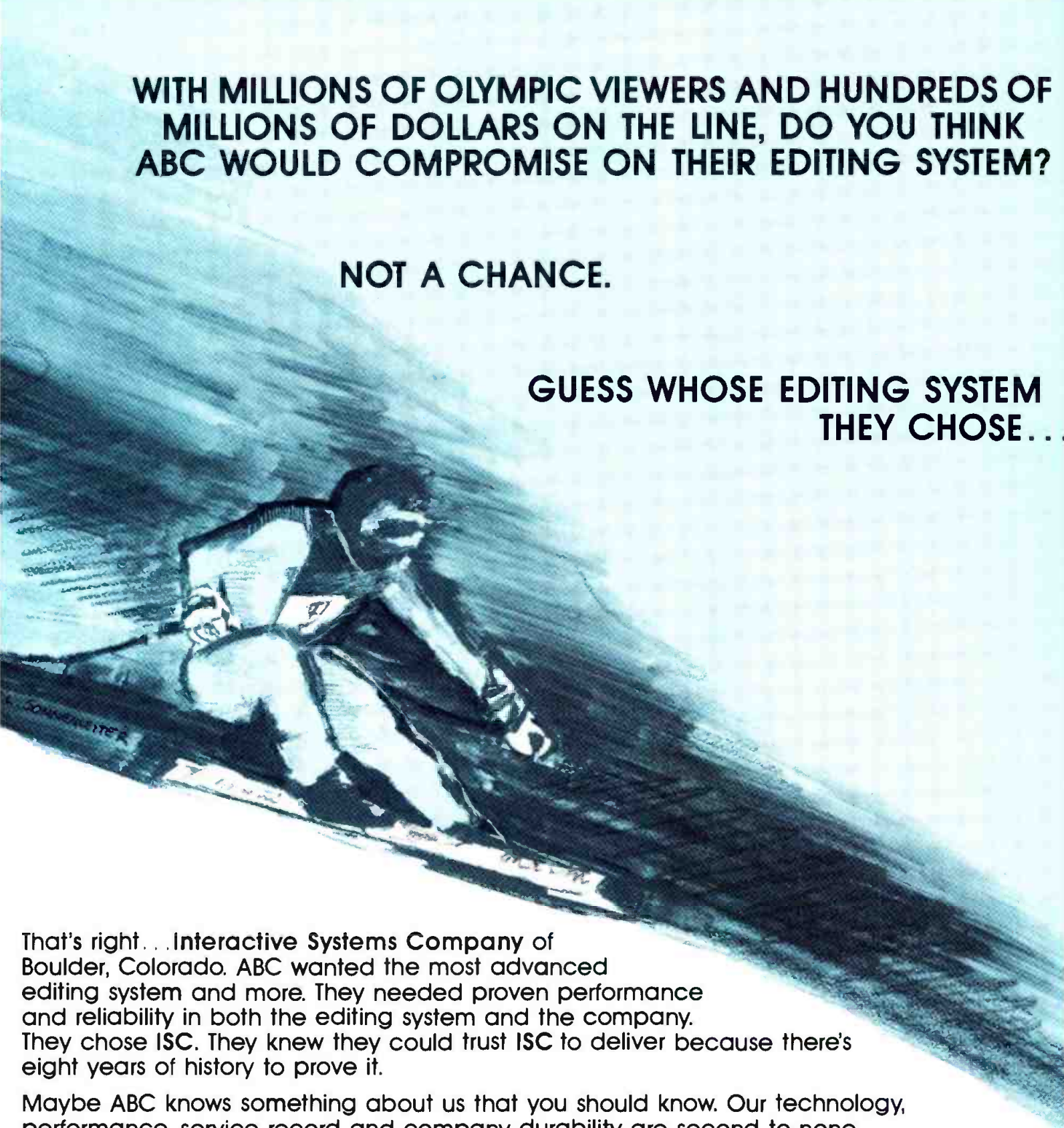
The table allows you to determine if a company builds monochrome and color models, and for what TV standard each model is applicable. Reader Service Numbers allow you to obtain more information.

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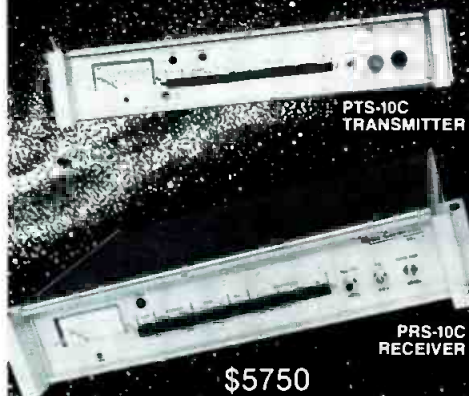
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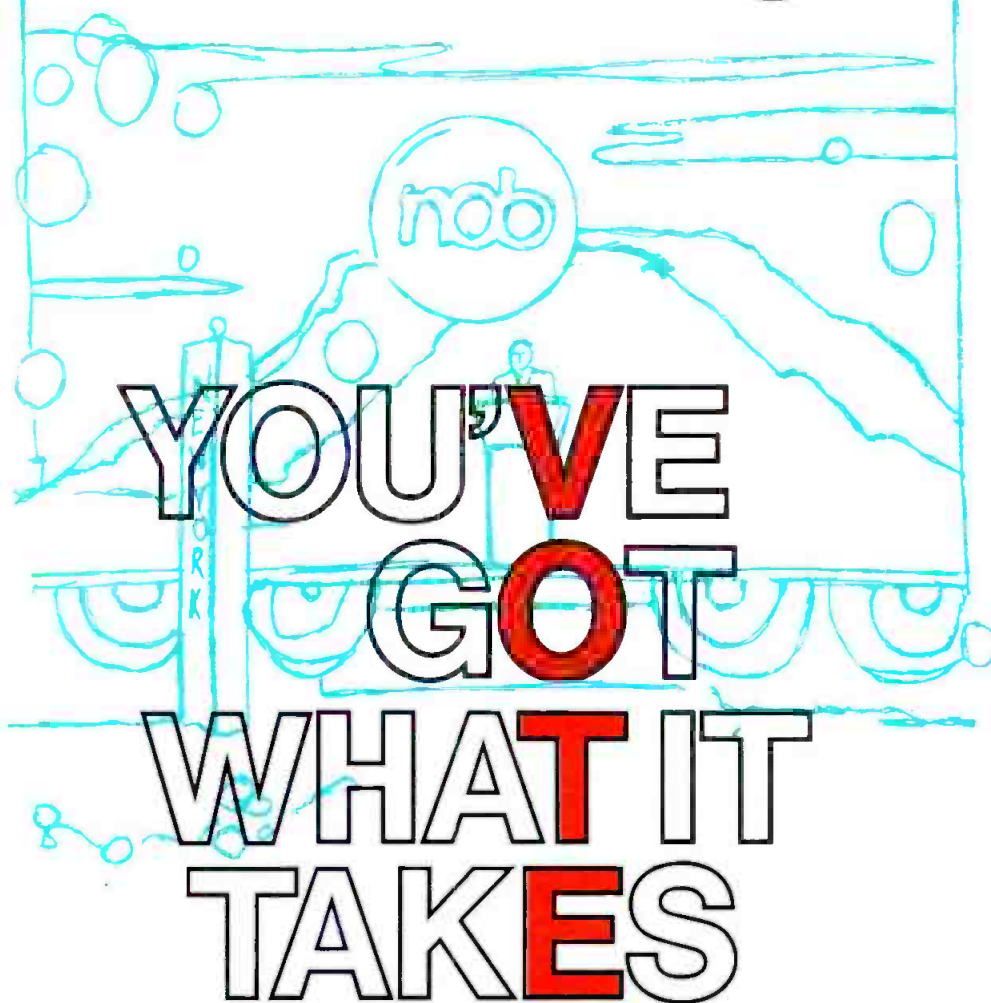
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(817) 295-0965

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NAB-'84/Las Vegas:



- Las Vegas Convention Center
- April 29-May 2

By Bill Rhodes, editorial director

The upcoming 62nd Annual NAB Convention and International Exposition's theme is "You've Got What It Takes," with typography organization on the conference logo that highlights letters spelling "VOTE." These primary and secondary messages remind broadcasters that in this election year they have a responsibility, in the interest of public service, to support the election process. The public relies on radio and TV broadcasters to provide critical timely information on candidates and issues.

The broadcaster's objective is to let people know that, through the voting process, they've got what it takes to make the system work.

NAB-'84/Las Vegas will serve as a forum to marshal technology and techniques to get voters involved. The

NAB will implement strategies to make things happen. When broadcasters return from the convention, they will receive how-to kits to help generate their communities' participation. The kits will outline voter activities across the country and plans that have worked at other stations; provide details on how to use the industry's campaign as a promotional tool; and identify available election-year information and tell where to get it. Also, NAB will provide stations with a debate model to acquaint broadcasters with how to sponsor a candidate debate, including the basics of staging, negotiating, formats and pitfalls.

The sessions

The technical program plans for this year's show are still tentative, but here is part of what will be covered in Las Vegas.

Radio. The following are some topics to be discussed at NAB-'84:

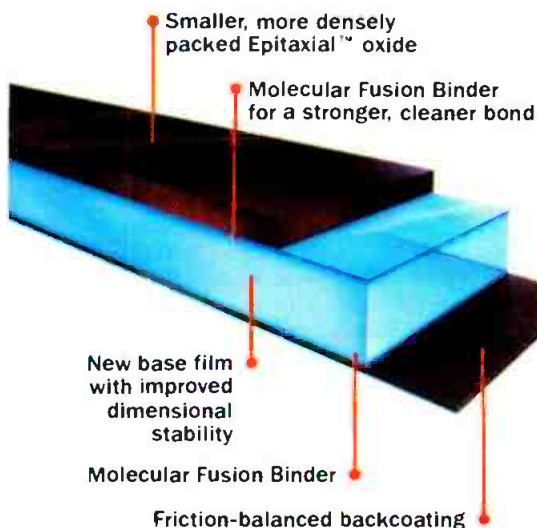
- Computers in Sales, Management, Traffic and Billing, Programming,



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

Introducing the world's first HGX Pro 1/2" Videocassette.

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



The Epitaxial™ contribution: higher video, brighter chroma.

A new, smaller oxide achieves unprecedented packing density. Expect enhanced signal-to-noise. Better definition. And extended replays without signal loss.

Molecular Fusion Binder: longer life bonding for truer-to-life performance.

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

New base, binder, backcoating. Better support for the signal.

No static. No noise. No dust. The molecular-fused backcoating assures diminished mechanical and magnetic noise. And optimum running smoothness, even in high heat.

A shell made to the industry's toughest standards.

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

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

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Stanton Magnetics, an internationally renowned manufacturer of audio equipment, introduces the PBR Series Announcer's Earphone. This earphone offers superb sound reproduction while providing a comfortable, compact design. It is perfect for listening in a variety of applications—i.e., on camera studio work, communication equipment, dictation machines, or for the hearing impaired.

Stanton's state-of-the-art earphone is built with the strictest quality control standards that assure the users of total reliability and ruggedness. It is available in three different impedances and comes with a variety of cord types and plug sizes. Each earphone includes a button receiver, nylon ear loop, rubber ear tip, metal ear adaptor and 5' cord.



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Stanton Personal Communications Division
200 Terminal Drive, Plainview, N.Y. 11803



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Table I.
NAB's hotel reservation form.*

This form must be received by NAB not later than March 25, 1984.

Indicate 1st, 2nd, and 3rd CHOICE	Hotel	Single	Double/ Twin	Suite Parlor and 1 Bedroom	Suite Parlor and 2 Bedrooms
	Aladdin	60.00	60.00	160.00	220.00
	Bristol International	35.00	35.00		
	Caesars Palace	65.00	65.00	175.00/225.00	240.00/290.00
	Castaways	46.00	46.00		
	Continental	42.00	42.00		
	Desert Inn	70.00	70.00	150.00/350.00	235.00/440.00
	Dunes	65.00	65.00	185.00	225.00
	El Rancho	38.00	38.00		
	Flamingo Hilton	55.00	55.00	240.00	320.00
	Frontier	52.00	52.00	195.00	250.00
	Golden Nugget	48.00	48.00		
	Granada Inn	23.50	23.50		
	Hacienda	45.00	45.00	150.00	250.00
	Holiday Inn & Casino	50.00	50.00	175.00	250.00
	Holiday Inn — Downtown	41.00	47.00	87.00	134.00
	Holiday Inn — South	37.00/40.00	37.00/40.00		
	Imperial Palace	44.00	44.00	150.00	190.00
	Las Vegas Hilton	57.00/85.00	57.00/85.00	265.00/600.00	375.00/850.00
	MGM Grand	58.00	58.00	150.00/270.00	215.00/900.00
	Marina	38.00	38.00		
	Maxim	42.00	42.00	120.00/180.00	
	Riviera	65.00/75.00	65.00/75.00	150.00/225.00	175.00/350.00
	Sahara	50.00	50.00	135.00/140.00	
	Sands	65.00	65.00		
	Showboat	31.00	31.00		
	Stardust	36.00/58.00	36.00/58.00		
	Sundance	39.00	39.00		
	Tropicana	60.00	60.00	140.00	200.00
	Union Plaza	34.00	36.00	58.00/60.00	155.00
	Westward Ho	46.00	46.00		

Rates do not include 7% Clark County room tax.

IF YOU WANT YOUR HOSPITALITY SUITE LISTED IN THE CONVENTION PROGRAM, PLEASE INDICATE: ☐ yes ☐ no

Name _____
(Individual in whose name reservation should be made)

Firm or Call Letters _____

Company Phone No. _____

Address _____

City _____ State _____ Zip _____

Type of Room _____ Rate _____

Arrival Date _____ Time _____ Departure Date _____

Names of other occupants _____
(For double/twin rooms or suites)

THIS FORM MAY BE DUPLICATED

*Complete one form for each room desired, indicating first, second and third choices of hotels.

- and Engineering;
- Living with Dereg;
- New Managers Crash Course;
- Radio Allocations Changes (Daytimers, 80-90, Class IVs);
- Electronic Paperless Newsroom;
- SCAs: What's Legal;
- What Isn't Deregulated;
- Broadcasting Investments and Taxes;
- AM Stereo: Chapter II;
- Estate Planning;
- Making Money with Cable Radio;
- Marketing Your Subcarrier;
- Meeting Objections (Sales);
- Negotiating SCA Deals;
- Getting Big Bucks from Political Advertising;
- Finding and Keeping Good People;
- EEO;
- Contests and Promotions;
- Collections;
- Hiring, Firing and Staying Out of

- Court;
 - Spanish-Language Radio;
 - What's My Station Worth?;
 - Making Money with New Tech; and
 - Equal Time, Political Advertising and What Else Was It?
- Television.** These sessions will be divided into two subgroups: information for today and for tomorrow. Those looking at the present include the following:
- Hard Facts on ENG Equipment Investments;
 - Deregulation: Gains and Losses;
 - Dealing Effectively with Alcoholism and Drug Abuse;
 - Marketing Your News;
 - Political Advertising and Programming in 1984;
 - What's Up There for Your Station on the Satellites?;
 - Innovative Revenue Sources;
 - What's New and Effective in Chil-

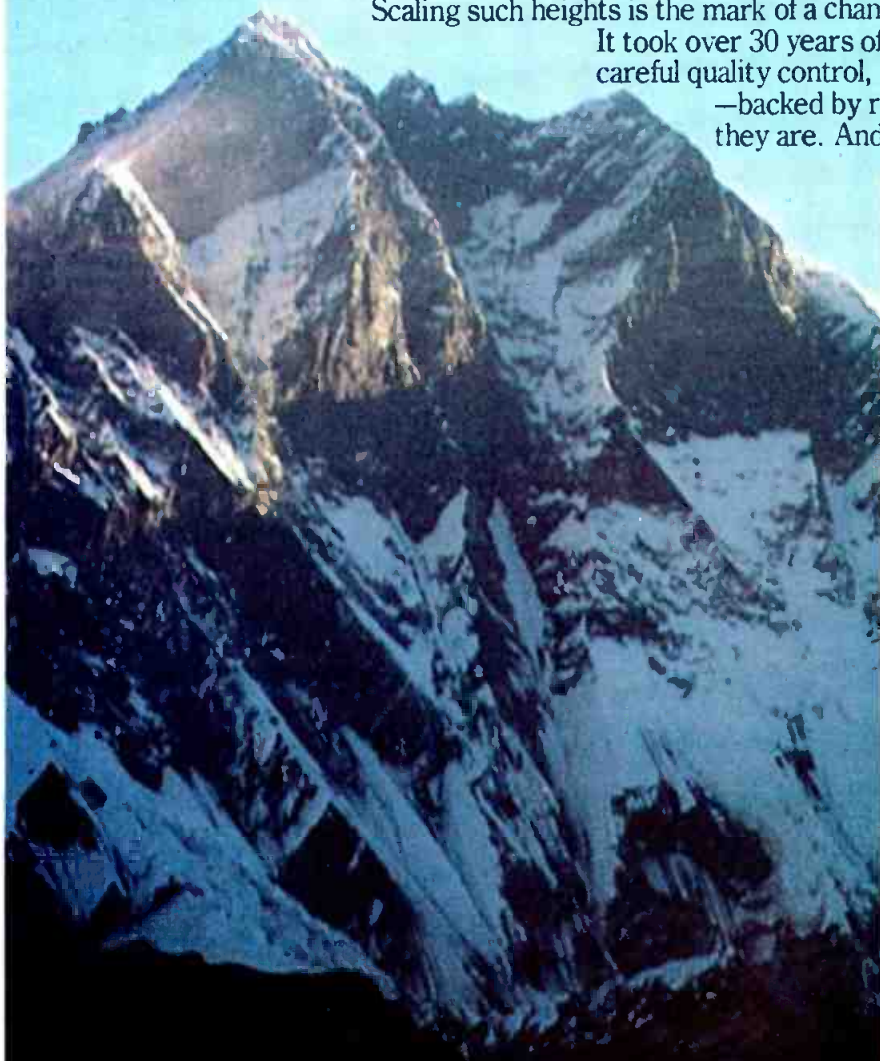
LEADERS ARE ALWAYS FOUND AT THE TOP

AND YOU'LL FIND MARK ANTENNAS AT THE TOP OF THE WORLD.

Mark antennas are at work right now—not only throughout the world—but at the very top of it. You'll find them on the peaks of the world's highest mountain, Mount Everest. And also atop the world's tallest twin buildings, the World Trade Center.

Scaling such heights is the mark of a champion. And that's true of Mark Antennas.

It took over 30 years of innovative design and engineering, careful quality control, and superior long-lasting performance —backed by reliable on-time delivery—to get them where they are. And to keep them there. On top.



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The Mark 5 meter hydraulically steerable antenna system is the only one of its kind. Covers the entire geostationary arc with no change to mount members. Meets 2 degree requirements with Scalar feed. Repositioning rate of 1 degree per second. Standard control has 20 programmable positions plus one position for manual override.



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March 1984 *Broadcast Engineering* 83

- dren's Programming?; and
- Whether and How to Use News Consultants.

Sessions focusing on the future include these:

- The Near-term and Long-term Outlook for Cable Networks, Multichannel MDS, LPTV, SMTV and DBS;
- Broadcast Automation and Computers—Beyond Traffic and Accounting;
- Four Ways You Can Position Your Station for Maximum Results Over the Next Seven Years; and

- Sessions With Congressmen and FCC Leaders on Legislative and Regulatory Happenings and Where You Fit In.

Engineering. Sessions covering radio and TV advances are scheduled to cover the following topics:

- TV: New Technology;
- Radio: New Technology;
- Advanced TV Systems;
- Satellite Systems;
- AM/FM Allocations;
- Spectrum Management;
- Radio Engineering;
- TV Production Engineering;

- Radio Subcarriers;
- UHF Efficiencies;
- Implementing Multichannel TV Sound Systems;
- Broadcast Auxiliary Systems;
- AM Stereo;
- Broadcast Interference;
- Non-ionizing Radiation; and
- Satellite and Digital Transmission.

This year, for the first time, technical sessions will be scheduled for Saturday. Also, the usual workshops will be held on Tuesday evening (May 1) from 7-10 p.m. The guest speaker for the engineering program will be James McKinney, chief of the FCC Mass Media Bureau.

The engineering award

Otis S. Freeman, director of engineering, Tribune Broadcasting Company, and senior vice president, engineering, WPIX, New York, will receive the NAB 1984 Engineering Achievement Award. The award will be presented at the engineering conference luncheon on May 1.

Freeman led the move to erect the transmitting tower on top of the World Trade Center to improve reception in New York. Also, he developed the gen-lock, which allows pictures to incorporate a signal from a remote location.

After World War II, Freeman worked at the Dumont Laboratories on experimental TV station W2XWV, now WNEW-TV, and, as assistant chief engineer, helped design and build WPIX. He became chief engineer in 1953 and has served on the station's board of directors since 1965. Before being named to his present position, he was WPIX's engineering vice president.

The state of broadcasting

NAB president Edward O. Fritts will report on the condition of the broadcast industry. There have been many changes in the past year, and there probably will be as many changes or more in the coming year. Fritts will give his views on those changes, along with NAB's past and future roles.

Government relations

Members of the US Senate and House of Representatives will discuss issues they will deal with in the second session of the 98th Congress, including local carriage, syndicated exclusivity and broadcast deregulation.

Early bird roundtable sessions on Monday and Tuesday (April 30 and May 1) will feature FCC commissioners and senior staff members, who will answer questions and tell how decisions affecting broadcasting are made.

SELECT MCL

KLYSTRON HIGH POWER AMPLIFIERS

Setting the pace with innovative design and engineering MCL offers the finest and most "Energy Efficient" satellite communication amplifiers for high power microwave transmission. Unsurpassed for reliability, unequalled for quality, earth station operators are selecting MCL with unequivocal confidence.

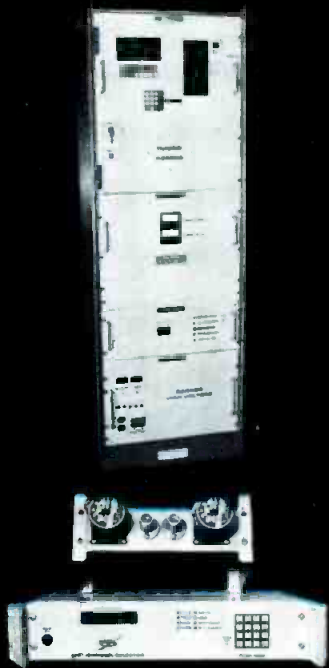
The versatile Klystron Amplifier line Series 10000 is field-proven, constructed for long life, easy access, with solid state power supplies and a host of other needed, tested, exclusive features. The Klystron Amplifier shown is M/N 10667-3.35KW C-Band high gain with microprocessor interface, the latest in the continuously evolving line of MCL's State-of-the-Art Satcom transmitters. Options include the M/N 13049 microprocessor controlled Channel Selector unit.

Used throughout the world, the desirability of MCL microwave transmission equipment constantly grows. This includes Satcom C- and Ku-Band TWTAs (75W-3KW), instrumentation TWTAs, Satcom and instrumentation KFA's, and coaxial low frequency transmitters.

MCL assures you of 24 hour maximum parts replacement; provides 24 hour-7 day access to MCL personnel for assistance in installation or servicing.

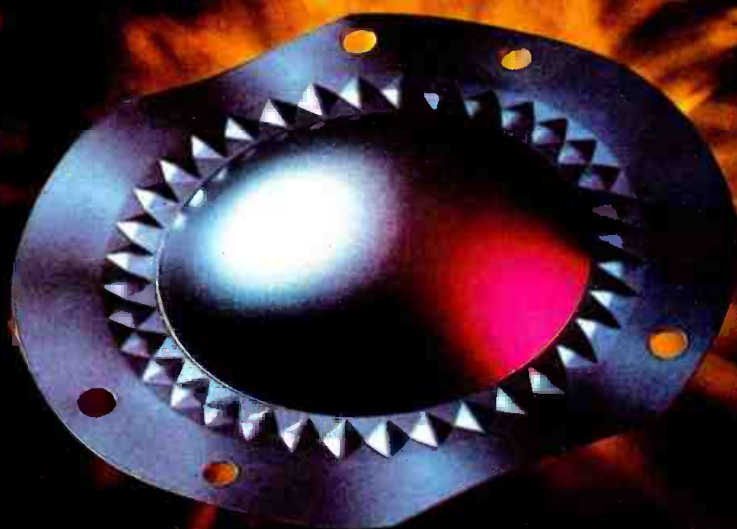
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High frequency sound has always fought with the technology that brings it to the ear. The driver diaphragm has been most vulnerable, pushed to the breaking point, unable to hold uniform frequency response.

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

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

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

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Questions and answers

John Summers, NAB executive vice president, will spar with members of the FCC in a free-wheeling session.

Luncheon speaker

FCC chairman Mark Fowler will address broadcasters at Wednesday's closing luncheon. Fowler will reveal what he foresees for broadcasting's future.

The exhibits

The NAB-'84 equipment exhibit will allow you to examine and compare new technology for radio and televi-

sion, as well as resolve problems with equipment you already have. US and overseas manufacturers will be represented, displaying hardware and software.

Space for this year's exhibit exceeds 280,000 square feet. At press time, approximately 80% of that space was reported as being sold.

Entertainment

Paul Anka, singer-composer with more than 400 compositions to his credit, will entertain the NAB gathering following the NAB-'84 closing luncheon.

Hotel reservations

The NAB has options on rooms at selected hotels. (See Table I.) All reservations must be made through NAB by the Las Vegas Convention Housing Bureau. Registrants must return registration and hotel forms, along with a check for fees and additional luncheons to register and reserve rooms in advance. Mail to Convention Registration, NAB, 1771 N St., NW, Washington, DC 20036.

Inquiries or cancellations should be mailed to NAB Convention Housing, 1771 N St., NW, Washington, DC 20036. Changes in arrival or departure should be made in writing to the attention of the confirming hotel. Saturday arrivals are limited, so reservations should be made for arrival on Friday or Saturday (April 27 or 28).

The Las Vegas Hilton has been designated the *Radio Hotel* and the MGM Grand as the *TV Hotel*. Only two sleeping rooms in addition to a hospitality suite will be assigned at these hotels. All confirmations of rooms will be mailed by the hotels, some of which require a deposit or guarantee. If so, that will be noted on the confirmation and you must remit within 10 days of the date of confirmation, directly to the confirming hotel.

1:~:~)))))

Distinguished Service Award

Elton H. Rule, vice chairman, American Broadcasting Companies, New York, has been named recipient of the NAB 1984 Distinguished Service Award. Presentation of the award will be made April 29 at the opening session of NAB-'84/Las Vegas.

The award, established in 1953, is presented to a broadcaster who

has made "a significant and lasting contribution to the American system of broadcasting by virtue of a singular achievement or continuing service for or on behalf of the industry." The selection of Rule was made by the convention committee during NAB's semiannual board of directors meeting in Hawaii.

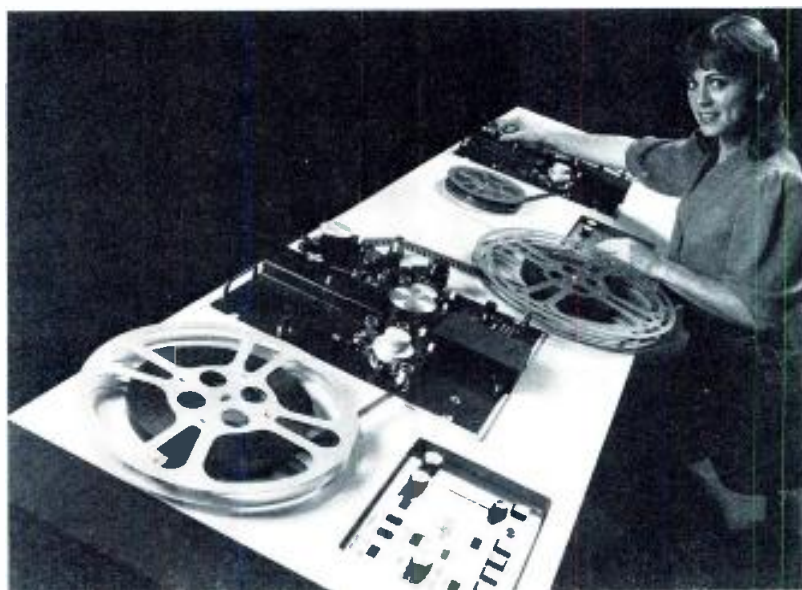
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Videola®, . . . the video Moviola®, . . . is a new and different system for transfer of 16mm or 35mm film to broadcast-quality videotape.

Use of the unique Flickerless Prism® optical system allows a smooth *continuous* film motion, and produces a video image consisting of picture frames being *dissolved* one into the next. The transfer is completely independent of television synchronization and scanning rate, so the film can be transported at any speed while the video image remains sharp and clear, with no sign of flicker, jitter or frame lines.

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VPR-2

CN 234 for
Sony BVH 2000

Dolby noise reduction is keeping pace with today's demand for high-quality sound — everywhere. With the introduction of such products as plug-in modules for VTRs and the SP multi-track unit, it is easier than ever before to protect *all* your irreplaceable audio tracks from hiss, hum, and print-through. From broadcasting to music recording, from video sweetening to motion picture dubbing, Dolby A-type NR reliably continues to fulfill its original promise: effective noise reduction combined with complete signal integrity.

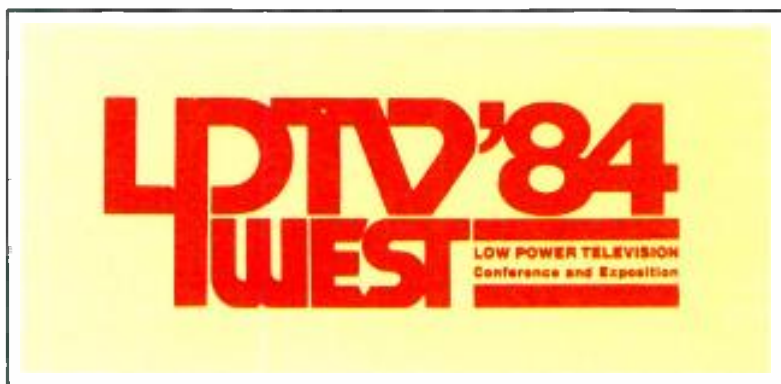
Dolby Laboratories Inc., 731 Sansome St., San Francisco, CA 94111.
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Dolby

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Leitch Video Limited has announced the appointment of Robert A. Lehtonen as president of the company. Lehtonen succeeds James A. Leitch, who has retired but will remain Chairman of the Board. As president, Lehtonen is responsible for all operations of Leitch Video Limited and its U.S. subsidiary.



LPTV notes: An industry begins to expand

By Carl Bentz, television editor

3/4" Video Cassettes RELOADABLE!



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Circle March 27 and March 28 on your calendar. The event is the LPTV West-'84 conference.* The place is the Disneyland Hotel in Anaheim, CA. The reason to attend is that 35 in-depth seminars and approximately 75 exhibitors of LPTV-applicable products and services will provide information on LPTV broadcasting.

Although LPTV East-'83 was a disappointment to many, Don DeKoker, director of member services for the National Institute of Low Power Television (NILPTV), sees solid footings for the industry. At the time of LPTV East-'83, the industry had experienced some setbacks, but recent positive developments suggest coming growth. For example, the number of construction permits (CPs) issued is increasing. Also, the number of LPTV stations now on the air is more than 300, according to DeKoker.

The problem

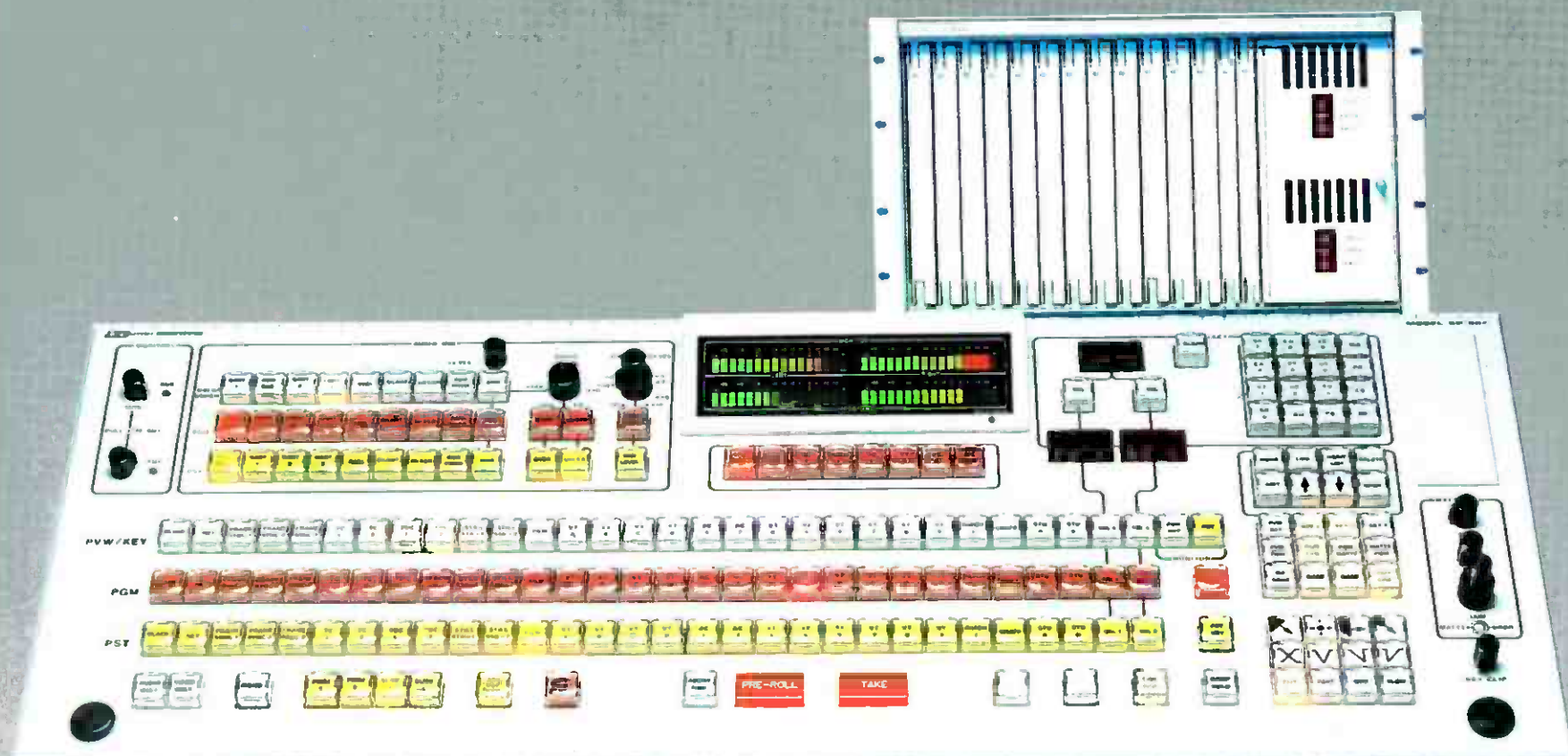
When the FCC first announced

LPTV services, thousands of applications flooded the agency. Unprepared for the deluge, the commission found that the hearings procedure normally used to determine license awardees was inadequate. A freeze was placed on accepting applications until the FCC was capable of dealing with the volume of requests. The commission acquired a new computer with appropriate software and trained a staff to deal with the new service. Most significantly, it decided to use a lottery approach to select license recipients. Unfortunately, these preparations took time and, in the interim, interest in the new service began to wane.

When the first LPTV lottery was held on Sept. 29, 1983, interest was rekindled by 23 CPs awarded. Eight others were decided outside the lottery. The timing of the drawing—held only days before LPTV East-'83—did not allow proper dissemination of information, explaining the reduced turnout (approximately 600, about half the number expected) for the conference. Subsequently, other lotteries

Continued on page 95

*For details on the conference, call 212-966-7526 or 203-852-0500.



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- **Two Models: Three-bus (MC-502) and Two-bus (MC-501)**
- **Event Stack Processor option provides 99 preset events with single-keystroke airing**
- **Plug-in conversion to station automation**
- **Free standing or mated with Utah Scientific Router**
- **All-digital (RS-422) panel/main frame interconnect**
- **All panel functions software assignable**
- **Two assignable inputs with alphanumeric readouts**
- **Plug-in stereo with no obsolescence**
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assignable inputs with
touchpad and
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selection and assignment of
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It is also used for user
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for preroll times and
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Video and audio monitor inputs
can be switched between
preview and preset busses.
Permits previewing a keyed
insert prior to airing when preset
key button is active.

Removable "user" panel for
customer installed switches, etc.

With the EVENT STACK
PROCESSOR (ESP) option
installed operators can enter 99
preset events executing each on
a single keystroke basis. TV
monitor shows list of upcoming
events as well as separate
"EDIT" list.

Three external inputs plus
PREVIEW bus selection are
available as keyed insert
sources. Key fill (upper
button label) can be self,
matte, program or preview
while background (lower
button label) can be program,
preview or matte.

Internal matte generator driven
from program video provides
color fill or background.

The internally generated edge,
drop shadow or outline has its
separate full-range luminance
control.

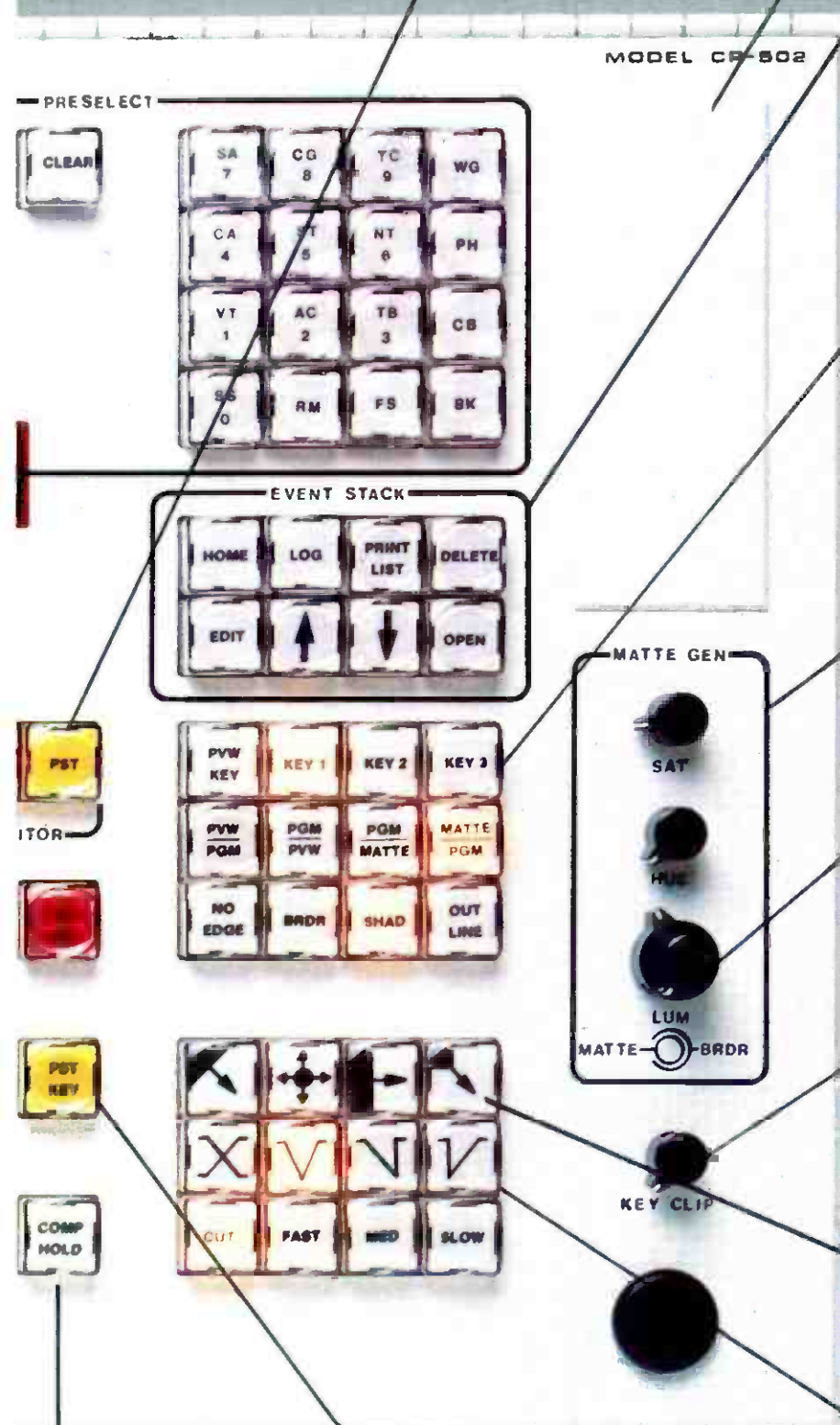
A momentary Push-Switch on
the clip level knob switches the
video monitor feed from the
preview or preset bus to the
program bus for previewing a
keyed insert over program video.

An optional wipe pattern
generator produces over twenty
wipe patterns of which four
are user assignable for control
panel selection.

Four mix/fade transition modes
are presettable as are three
speeds plus cut.

COMPUTER HOLD button
allows the operator to revert to
operation with systems
awaiting program
insertion.

Keyed inserts can be taken
directly or preset for insertion
following the next video
transition.

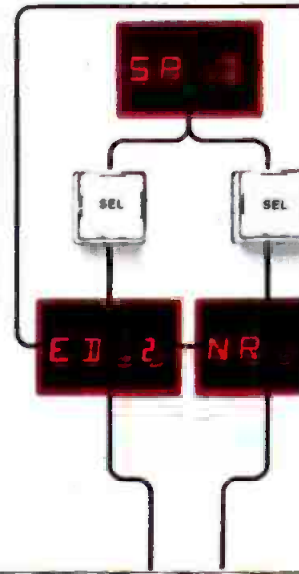
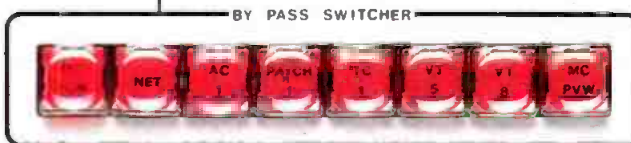
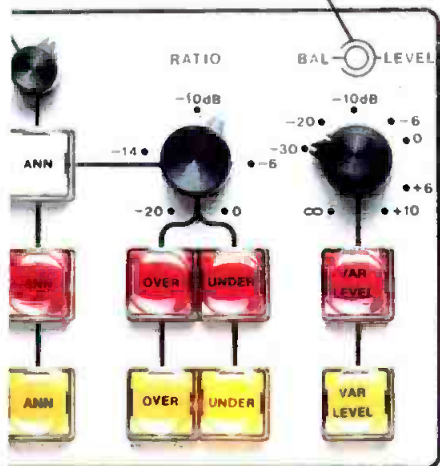


Variable program level can be entered directly or via Preset with automatic reversion to unity gain at the next program switch.

The optional bypass switcher produces clean, vertical-interval transitions and, except for physical mounting of the control buttons, is totally separated from the router and Master Control Switcher.

Solid state stereo VU meters provide a large, pleasing display and come with a scale expansion button to facilitate precise level setting.

Two as associated alpha presets any an Touch alterati such a transiti



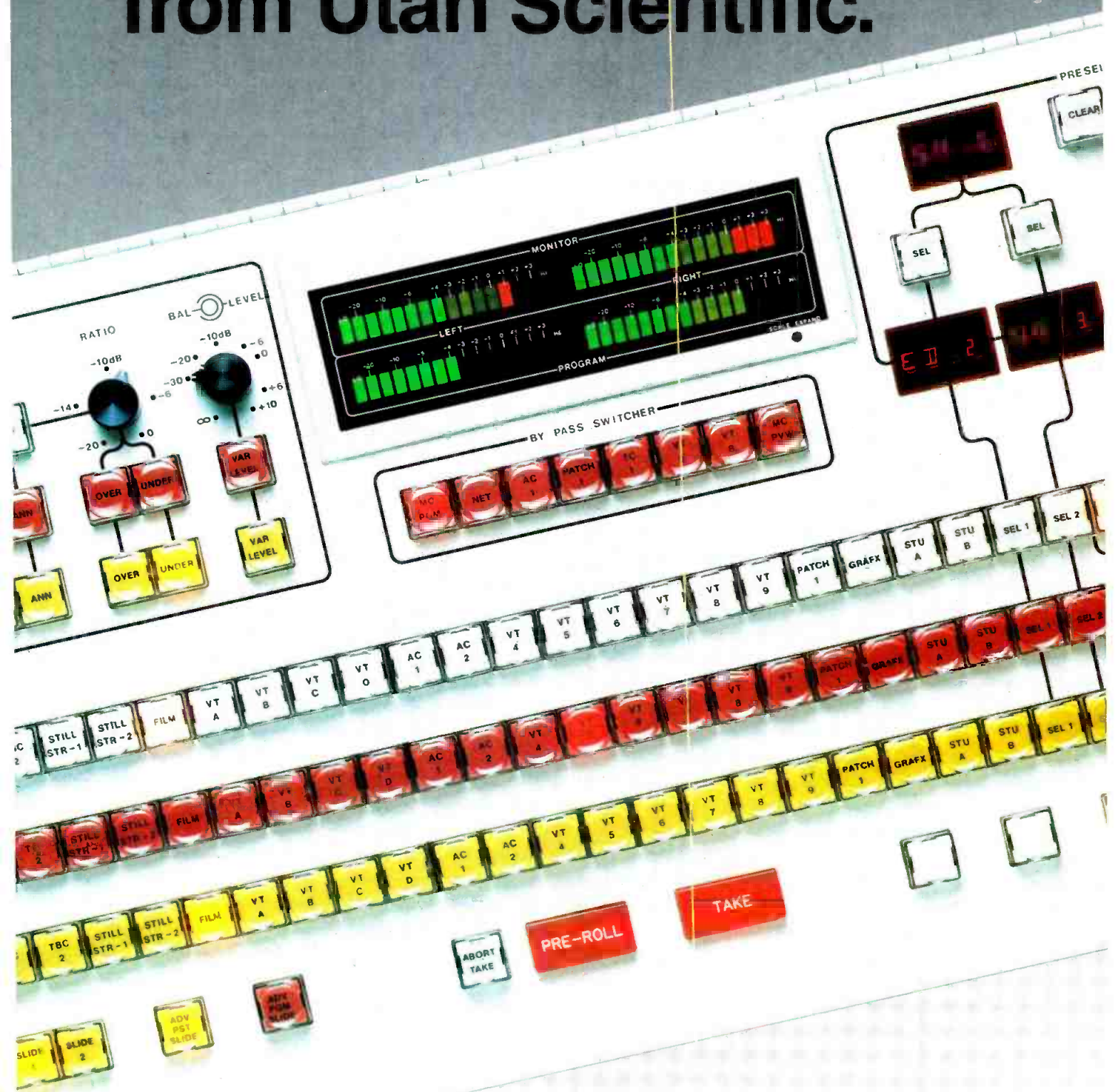
Switches can be aborted during the preroll interval. The ABORT TAKE button is also used for manually resetting the program timer at other than switching transition times.

Switches are executed by depressing the lighted bar, PREROLL TAKE when a rolling source has been preset, or TAKE for all others. Preroll times are separately assignable to each input and user alterable from the control panel.

Internal timers show the preroll countdown and program duration. The program counter automatically resets at each video switch transition or can be manually reset with the ABORT TAKE button. Matting of the time display into the video monitor feed is controlled by the TIME-DISPLAY button.

The C permi manu incorp auton

Master Control Switching and Station Automation from Utah Scientific.



US UTAH SCIENTIFIC, INC.
a DYNATECH company

Two stereo monitor amplifiers produce +24 dBm max. to drive customer-furnished speaker amplifiers or headphones. Pot switches control main frame crosspoints to access auxiliary inputs.

The Preview/Key bus (model MC-502 only) can be used for previewing sources, for selecting key sources or as an auxiliary output bus.

Direct Takes may be entered on program bus buttons. AFV status is indicated by single full brilliance button, while separate audio status is indicated by a flashing button, and backup VTR with a button flashing at a lower rate.

Each system is furnished with 72 (expandable to 108) relays that are assignable to respond to activation of preset bus buttons (machine ready/warning lights), program bus buttons (on-air lights) or the preroll take bar (machine start).

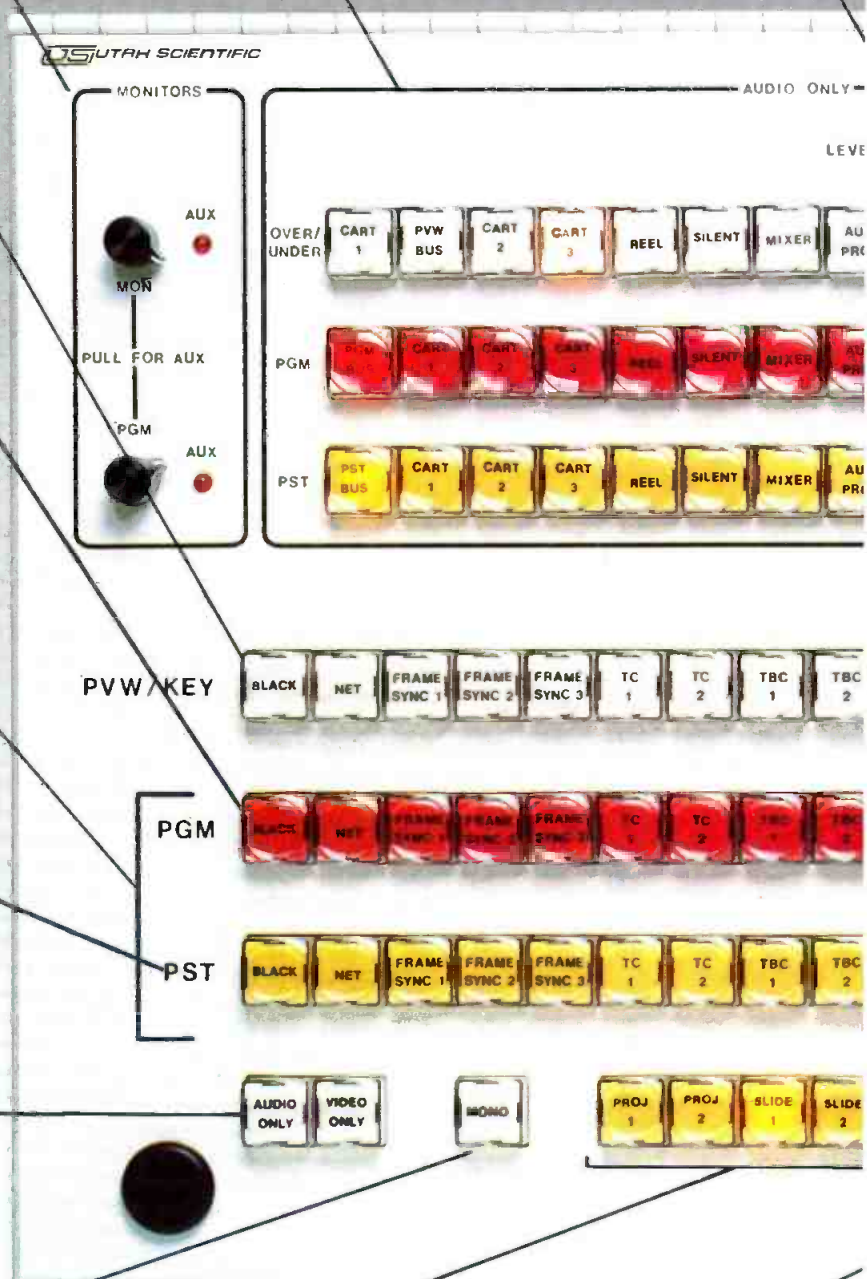
Preset bus permits operator to preselect audio and/or video source(s) plus backup VTR.

Selective switching or presetting of video or audio sources is accomplished by holding down the appropriate button while selection is made. Audio button on Preset and/or Program bus then flashes to indicate breakaway condition.

Astrappable burst-kill circuit permits operator control of color or monochrome output on the program bus.

The audio-only section permits Direct or Preset selection of audio-only sources or placing the audio-only or Preview bus audio sources over or under program audio.

The announce booth level can be preset or faded in or out with this control.



These buttons provide control and status of multiplexer mirror positions on the film island selected on the preview bus.

Slide change buttons are provided for both the Program film island and the Preset film island. Button lights follow the multiplexer mirror position.

MC-501 / 502 Master Control Switchers

In the course of designing this new series of Master Control Switchers, Utah Scientific consulted numerous broadcasters to determine both their present and future requirements for on-air presentation. Reliability, flexibility, transparency, accommodation of thirty-plus sources, built-in machine control, stereo capability, ease of automating, absolute stability, and failure protection were all high priority items in the responses we received. To the extent possible, we have accommodated these requirements in the model MC-501 and MC-502 switchers described herein.

The model MC-501 system provides two busses, PRESET and PROGRAM, with the model MC-502 system including a PREVIEW bus in addition. Each system also includes an 8 x 3 audio-only matrix with over/under mixing capability, either on a direct-take or preset basis.

Each system is designed for stereo audio and can be purchased as such or retrofitted with a single plug-in card. Four LED VU meters are provided for stereo or mono display of program and monitor audio. Two stereo monitor amplifiers are also provided each with two inputs—NORMAL and AUX—and panel mounted level controls.

The switching matrix used is the Utah Scientific AVS-1 router. It may be either a part of the main plant router or may be dedicated to master control use only. In either case, 28 of the audio and video inputs can be randomly assigned, via system software, to as many button columns on the control panel with the remaining inputs assignable via the PRESELECT touchpad to the two assignable button columns. Thus all router sources, properly timed, are available for air.

Digital techniques are used wherever possible. For example, all panel control settings are converted to 12-bit digital and transmitted to the main frame over RS-422 digital pairs.

An integral keyer/matte generator circuit permits various foreground/background combinations of keyed inserts (including self-key) using one of three separate key inputs or the source selected on the preview bus (MC-502 only).

Pre-roll times are individually-assignable, user-alterable, and are keyed into the video monitor feed along with the program duration timer output.

Control relays are user-assignable for machine ready, machine start or tally functions. Backup VTRs are accommodated by a two-machine roll feature.

Numerous options, several of which are unique in the industry, are offered. One is an inexpensive event stack processor (ESP) that allows the operator to preset up to 99 events executing each event with a single key-stroke. Other options are: 1) automatic studio delay compensation; 2) a wipe pattern generator; 3) an independent 8-input bypass switcher; and 4) redundant power supplies.

Model SAS-1 Station Automation System

In conjunction with the development of its software-based master control switching systems, Utah Scientific has also developed a sophisticated, distributed processing, station automation system. This system is a "plug-in" addition to the MC-501/502 Master Control Switchers. It utilizes three or more intelligent terminals, each having dual floppy memories and an associated printer plus a hard disk for mass storage. These peripherals connect to the master control mainframe via its RS-232 port and operate interactively with the switcher microprocessor and its associated memory circuits.

A typical installation has one terminal located in the traffic area where it connects to the station's business service computer (BCS, BIAS, Columbine, Jefferson Data, etc.). Additional terminals are located in the machine room, where pull lists are generated and machine numbers entered, and in master control where on-air switching is managed and the FCC log generated.

In operation, the station log for the following day(s) is off-loaded from the business service computer onto the hard disk where it can be accessed and massaged by each of the three terminals of the SAS-1 system. Media numbers can be entered either by the business system or traffic department while machine numbers are entered by machine operators. When a machine number is entered, all displays are immediately updated and the machine will be automatically rolled and aired when its event time occurs.

The system incorporates extensive error-checking capability, flagging incorrect device names, conflicting times and other errors that could produce an on-air discrepancy.

The as-run FCC log generated by the master control room printer shows actual event times and sources, whether entered manually or via the automation system. This as-run log can then be fed back to the business service along with a discrepancy report that the system also compiles.

Each of the three terminals is programmed via floppy disks with all programming being backed up by hard disk. Thus terminals or printers can be readily interchanged or replaced in the event of failure. Moreover, the system will continue to operate even while the master control terminal is missing, since sixteen events are buffered in the switcher mainframe. The hard disk can also be backed up by the floppies since a single floppy can typically store at least three day's programming and/or FCC logs. This allows the system to operate indefinitely with the hard disk down by manually interchanging floppies between terminals.

Several systems as described above are currently in operation. The system's inherent flexibility also lends itself to numerous alternative configurations without drastic hardware or software changes. Please call us so we can discuss your specific requirements.

have determined successful applicants for additional transmitting sites. The lottery process selected eight in October, 23 in December and 36 in January, showing that the FCC is processing applications faster. It is hoped that increased lottery selections, as many as two or three per week, will clear much of the backlog by the end of this year.

The procedure

When a cutoff list is published, potential license competitors are given 30 days to submit cross-filings for sites/channels included in the list. The commission screens each application to determine if basic regulations are met—namely, the distance of the LPTV installation from any full-service stations on the same channel, possible interference to other radio services and compliance with agreements with Mexico and Canada on LPTV facilities within 250 miles of the US north and south borders. All applications falling within regulatory guidelines are passed along to the lottery selection procedure.* For an in-depth discussion of the procedure, see FCC Update on page 6.

At present

The step-up in lottery selections should be good news for LPTV. Other pleasant news, according to DeKoker, is an NILPTV count of 347 LPTV stations on the air as of Dec. 1, 1983; 44 of them in the contiguous United States. In Alaska, 293 facilities are on the air. DeKoker expects that about 80% of another 109 licensees with outstanding CPs, due to expire during 1984, will be on the air before their expiration dates.

On the average, about six months elapse between issuance of the CP and the station's initial broadcasting schedule. The delay results from decisions in equipment purchasing, engineering, construction and final testing. Even considering this 6-month time period, the number of operating LPTV stations could show a dramatic increase by December 1984.

On programming

What is LPTV offering its viewers? Some local origination is expected for most of the new stations, but networking is the predominant programming source. At the end of 1983, four

The first LPTV station for the Western Pacific was approved in November 1983. Guahan Airwaves, Agana, Guam, will identify as TV-14, with the official call sign of K14AM. Applying originally on Sept. 24, 1982, the group has until Nov. 9, 1984, to begin broadcasting. The station's schedule primarily will consist of foreign language materials for Guam's visitors and ethnic communities. Channel 14 will join KUAM-TV 8 in serving the small island. KUAM has combined affiliation with the ABC, CBS and NBC networks.

primary networked services were the All American Country Music Network, Satellite Programming Network (SPN), Cable News Network (CNN) and the JPD Television Network, all delivered via satellite relay. When JPD TV signed on to Comstar D-4 in September 1983, the service boasted 80 hours per week, with plans to include original programming for LPTV affiliates during 1984-'85. CNN, Atlanta, has offered to negotiate delivery of up to four half-hour segments per day in cases in which conflicting agreements with competitive distribution methods do not exist. Several regional network activities also are being tried.

Some of the new stations are extensions of full-power stations' coverage, as such performing as repeaters/translators for some part of the day, with local material added to the schedule through the use of automatic insertion systems. Signal transportation to these LPTV stations may be via microwave or receive/retransmit operations. Subscription Television (STV) has been tried, but similar to their full-power counterparts, required revenues have forced some LPTV activities to drop their subscription operations.

Should TV translator applications be given precedence over LPTV applications? As of January 1984, translator and LPTV applications were being processed side-by-side. However, existing translator operations may convert to LPTV status by notifying the commission. If translators are given priority, as currently proposed by some of the commissioners, the present conversion rule would have to be changed.

Stumbling blocks

The FCC's major concern regarding LPTV is possible interference to other services. LPTV is a secondary service, and as such may not cause objectional interference for viewers within the Grade B contour of the nearest full-power station on the same or related channels. Generally, LPTV stations will be responsible for degradation of CATV channels if LPTV operating practices violate FCC rules. LPTV stations are not granted the same carriage requirements on CATV as are their full-power counterparts.

LPTV stations must cease operation if a new full-power station on the same channel goes on the air, spaced such that the LPTV transmitter is within the Grade B contour of the full-power station. There are questions as to whether or not an area within the Grade B limit, and shadowed by terrestrial features, should be covered by LPTV, particularly if the programming is not of a repeater/translator nature. Where land mobile radio has been issued licenses in the low UHF channels, LPTV may be curtailed, although some assignments are possible in the top 12-15 TV markets. Repeater and translator installations also take precedence over LPTV. Although the low power service may not cause interference, LPTV operators are not allowed recourse in case of interference caused by other services.

Based on limited transmitter power output levels of 10W VHF and 1kW UHF (in most cases) and highly directive transmitting antennas, however, a large number of sites/channels are available, as demonstrated by the FCC's January cutoff list. Careful engineering practices, aided by reputable consultants, should make the concept work. Yet, almost 67% of the applications reviewed by the FCC have been unacceptable, primarily because of potential interference to primary services.

Advice

For those interested in entering into LPTV broadcasting, DeKoker suggests keeping a close eye on the cutoff lists as they are issued. If a particular site is of interest, applicants have only 30 days to submit completed paperwork to the commission. He said that care should be taken to make sure all is in order. Because of the timing of the lists and ensuing lottery selection procedures, if an application is rejected, reapplying or appealing the commission's decision before the deadline may not be possible. [:-:~))]]

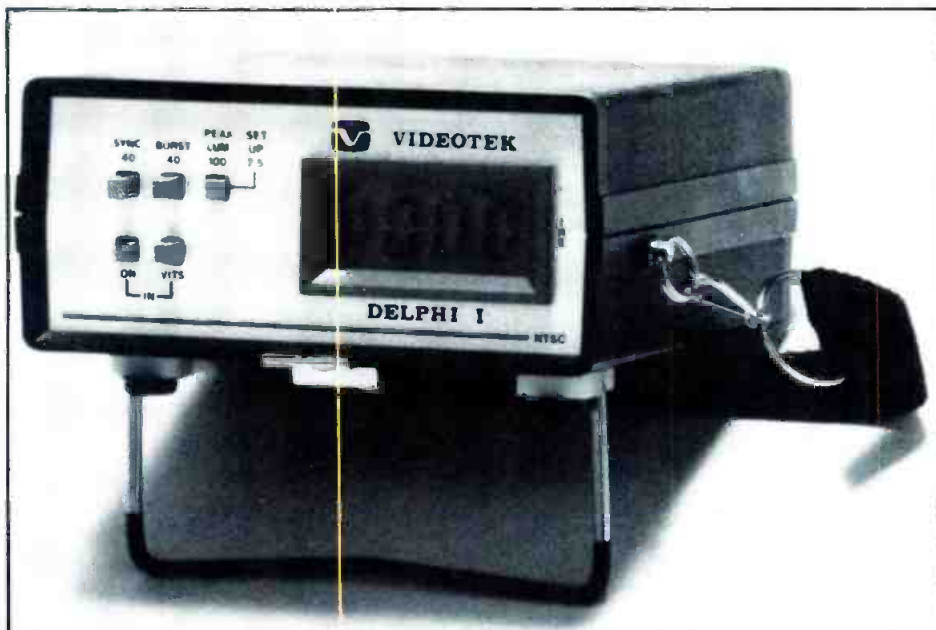
*See "LPTV: A Review of the Rules," BE January 1983. Also, a recently published report, "An Assessment of Low-Power Television for the Non-profit Community," is available for \$5 from Publication Sales, Corporation for Public Broadcasting, 1111 16th St., NW, Washington, DC 20036.

Field trials: Videotek Delphi I digital waveform monitor

By Carl Bentz, television editor

Traditionally, *Field Reports* published in **Broadcast Engineering** have been based on one facility's applications and evaluations of a piece of equipment. Departing from tradition, this article reports findings from engineers at two broadcast stations.

Verifying the existence or level of a video signal in the studio is not always convenient with a rack-mounted or portable waveform monitor or oscilloscope. The project becomes even more difficult in an on-location production setup. The Videotek Delphi I dc-powered digital waveform monitor was developed with such problems in mind. Using an LCD display, the portable unit indicates (in IRE units) sync amplitude, burst



Delphi I

With our Automatic Remote Control System your transmitter — and your personnel — will operate with increased efficiency

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plus 16 status channels. The automatic functions — pattern shift, transmitter restart, power control — are pre-programmed in accordance with station license requirements and controlled with an accurate master clock.

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Basic System	\$4,995.00
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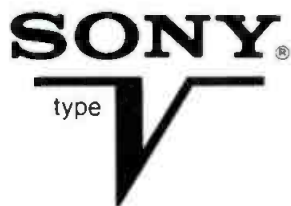
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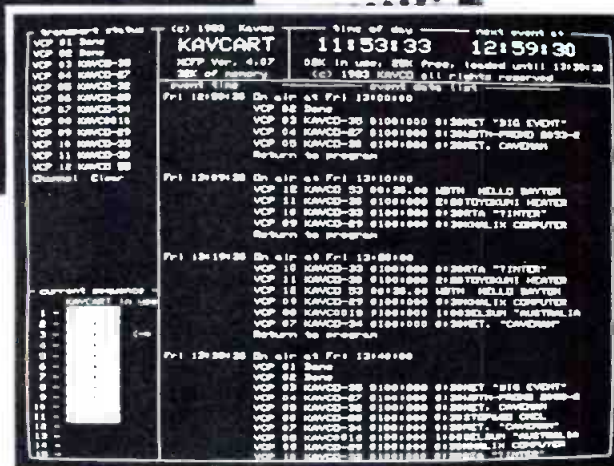
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amplitude, peak luminance, setup level and VITS.

Two broadcast stations in Kansas City, MO, recently were given the chance to use one of the Delphi units in their operations. The users, at KCTV-TV 5 and KCPT-TV 19, found the instrument to be convenient for several station tasks. Also, they thought that the battery operation or ac adapter powering added to the Delphi I's flexibility.

Specifications

Housed in a 2.75" x 5.13" x 5.25" package, Delphi I connects to a video source as a look-through item on a video line or may be switched to present a 75Ω termination load to the cable. Two 9Vdc rechargeable nicad batteries allow the instrument to be operated anywhere for five hours of continuous use. A shoulder strap and carrying case or a belt clip make the device easy to carry in the field, while a fold-down stand is attached to tilt the front panel for bench-top uses. The instrument weighs 19 ounces.

Designed for NTSC TV measurements, five buttons on the front panel select all functions. Sync and burst amplitudes or peak luminance are shown on the LCD readout in IRE-calibrated units. Setup is read by capping the camera with the Peak luminance switch pressed. For VITS use, Peak luminance and the VITS buttons are pressed, activating a circuit that checks for VBI signals from Lines 14-21. Typically, the reading is approximately 80 IRE units.

Users' comments

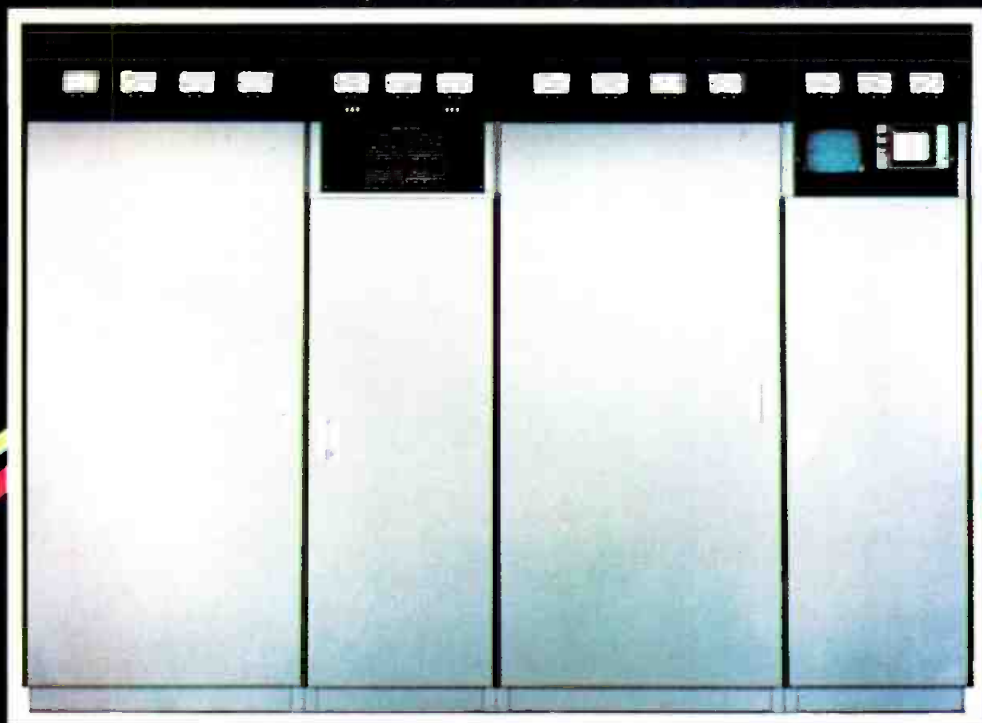
John Long, chief engineer at KCPT, used the Delphi I in shop and ENG situations. Long said, "The instrument is well-suited to ENG activities. The accuracy and repeatability of measurements turned out to be very useful in the field." He also said that the operation is sufficiently straightforward that any engineer or technician quickly can make sure that the video level from the camera is correct.

An advantage results from the numerical readout. Long said, because variations in readings (which often result from the way that different people view and interpret a CRT display) are avoided. As deregulation progresses and more non-technical people become involved in level setting and monitoring, the numbers, which require no interpretations, will prove valuable. Long said he would consider buying such a device for use at KCPT for remote and studio setup, and maintenance.

Joe Snelson, chief engineer, and Clifford Lynch, ENG maintenance supervisor, both of KCTV, also were pleased with the test unit. Although

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10kW/30kW/55kW model shown

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Manufacturer's specifications:

Delphi I

Accuracy: 1 IRE or 1%, whichever is greater between +15°C and +35°C.
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Maximum inputs for rated accuracies:

Blanking to peak white—1V (140 IRE).
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Burst—0.4Vp-p (56 IRE).
Hum—100% of peak-to-peak input signal.

Minimum detectable levels:

Peak luminance—4 IRE.
Sync—25 IRE.
Burst—10 IRE.

Transient response (luminance mode):

Will capture a white level peak as short as 2μs in duration.

Video input: Loop-thru >18kΩ impedance. Return loss > 40dB to 4 MHz.
Switchable termination 75Ω ± ½ %.

Power source: Two 9V nicad rechargeable batteries (supplied). Five hours continuous use before recharging or two standard 9V alkaline batteries—approximately 40 hours use or 9V charger.

Power consumption:

0.25W.

Size: 2 ¾" x 5 ½" x 5 ¼"

Weight: 19 ounces. Optional carrying case available.

Price: \$799 list.

Snelson had limited time to use the unit, he thought that the metering system's repeatability and accuracy were good. He asked if an additional function—reading of SC/H-phase of a signal—could be included in the measuring capability.

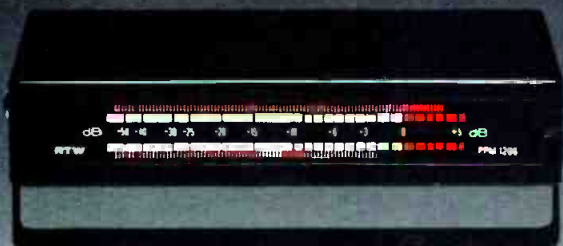
Lynch took the digital waveform monitor into the field, and found it helpful in checking out cabling for an ENG setup. Other applications, he said, would include identifying the proper cables in the field or the studio, and checking for a faulty cable. The small size and light weight made it handy, he said.

Final notes

The three engineers agreed that there was no real substitute for a waveform monitor when checking the quality of the video signal, and that vectorscopes and video monitors are essential items in a complete ENG package. But for many purposes, when only a quick check is required and the equipment load capability does not allow the weight and size of typical test instruments, the engineers concluded that a digital waveform monitor system (such as the Delphi I) would be a valuable addition to the test equipment to avoid non-standard video levels and setup cabling problems.

!:-:~)))

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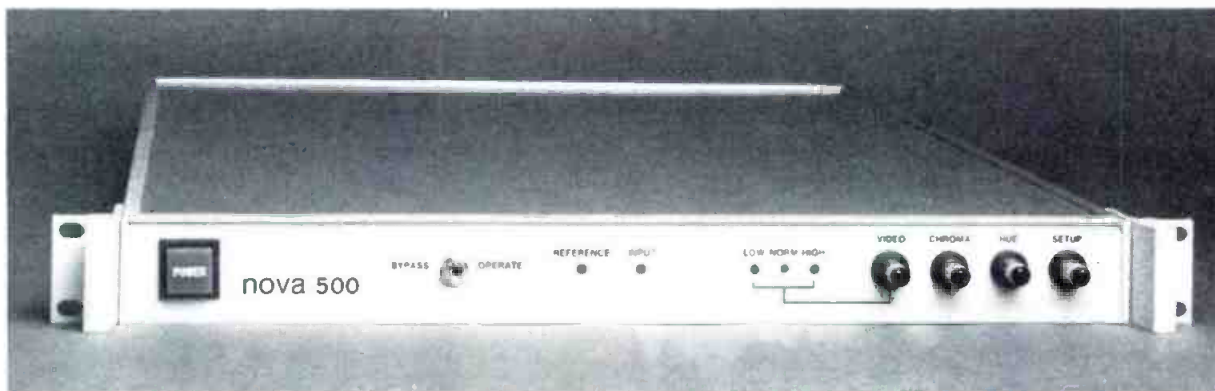
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AM stereo processing

By Ronald R. Jones, president, Circuit Research Labs, Tempe, AZ

With AM stereo broadcasting about to become a reality for many stations, new transmission problems will need to be solved. One of AM stereo's most important concerns will be the new audio processing technology it requires. AM stereo technology is different from existing FM stereo technology, and so are the respective problems of processing.

FM stereo and limiting

In FM stereo transmission, the left- and right-channel information can be described fundamentally as sent via the same transmission path during equal and alternate time periods. At any instant, the total modulation is equal to the sum of the audio channel being transmitted and the fixed-amplitude stereo pilot. When properly

balanced, this system results in the 100% left-channel-only, 100% right-channel-only and 100% both channels (monaural during stereo) audio limits being equal to one another. This has formed the basis for the separate left- and right-channel limiting requirements that restrict both channels to the same amplitude.

AM stereo monaural compatibility

AM stereo broadcasting has brought about the need for a different form of audio limiting: *stereo matrix limiting*. It is called stereo matrix limiting because the processing action has been shifted to the matrixed sum-and-difference axis of the stereo sound field. This method significantly differs from the conventional FM system,

which operates on the left- and right-channel axes.

It is important to understand why matrix processing is needed for AM stereo broadcasting. Its use is essential to achieve monaural vs. stereo compatibility. With AM stereo, generation of the algebraic sum and difference of the left and right channels occurs before the point of stereo modulation. This difference, as compared to FM stereo transmission, makes conventional audio processing incompatible and matrix processing necessary.

AM stereo limiting patterns

The diagrams shown in Figures 1-3 are in a form that easily can be seen on an oscilloscope when monitoring the X-Y lissajous patterns pro-

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In 1981, the Series II MTR-90 provided even faster, more accurate tape handling, and was the first audio machine to offer

a serial port for computer control of the transport functions.

Along the way, we've worked with every major synchronizer and video editor manufacturer to provide our customers with the interfaces they require. Synchronizer interface connectors are now standard equipment on all MTR Series recorders.

Our commitment to audio post-production continues.

In 1983, we adopted the IEC standard for center-track SMPTE/EBU time code recording on 1/4-inch tape. We also developed a 1-inch C format audio layback recorder conversion kit for the MTR-90, and an RS232C Serial control port for the MTR-10/12.

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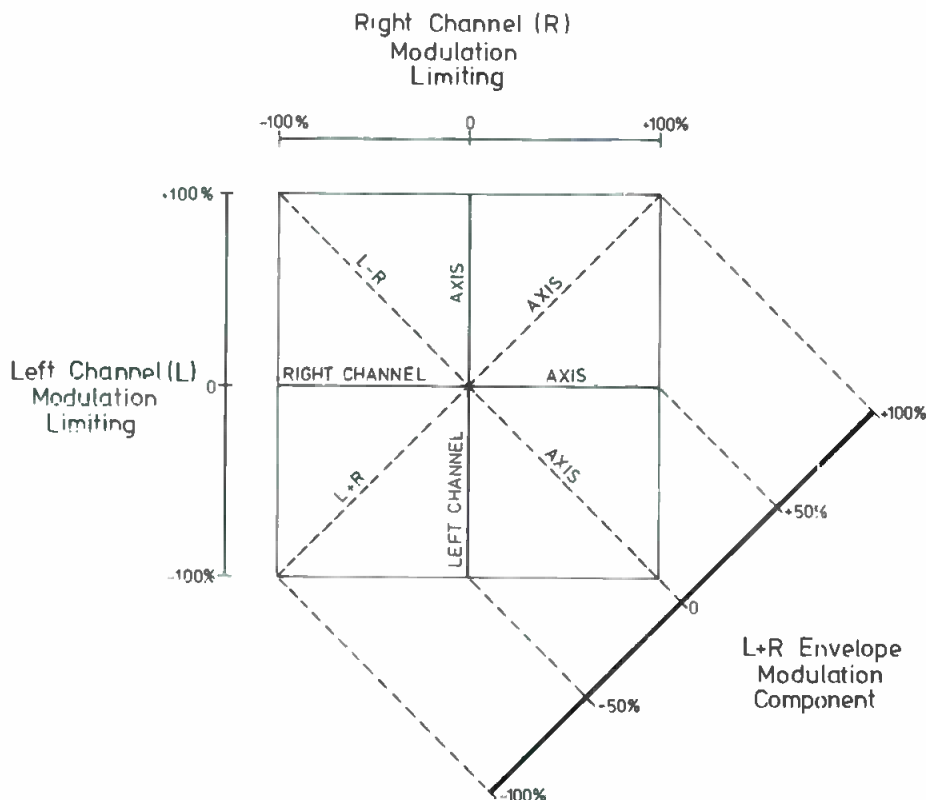


Figure 1. Conventional left and right stereo limiting pattern.

duced at the right and left outputs of the station's limiter or stereo modulation monitor. If the limiter has L + R and L - R outputs instead, the patterns will be shifted counterclockwise by 45° from those illustrated. Field experience has shown that once familiarity with these patterns is gained, the patterns often are more helpful in checking for proper processing alignment (and show more information about what is being transmitted) than any modulation monitoring system.

Conventional limiting

Figure 1 illustrates the oscilloscope X-Y display of the right and left limiter outputs of conventional stereo limiting. When applied to AM stereo transmission, the amplitude limit levels of the left and right channels must be set equal to each other for proper stereo balancing. As shown, the levels are perpendicular to the right- and left-channel axes and intersect with each other to form the L + R and L - R modulation limits. The L + R axis represents the main monaural component broadcast by the AM envelope of the transmitter, and the L - R axis represents the main stereo information component transmitted by phase modulation of the car-

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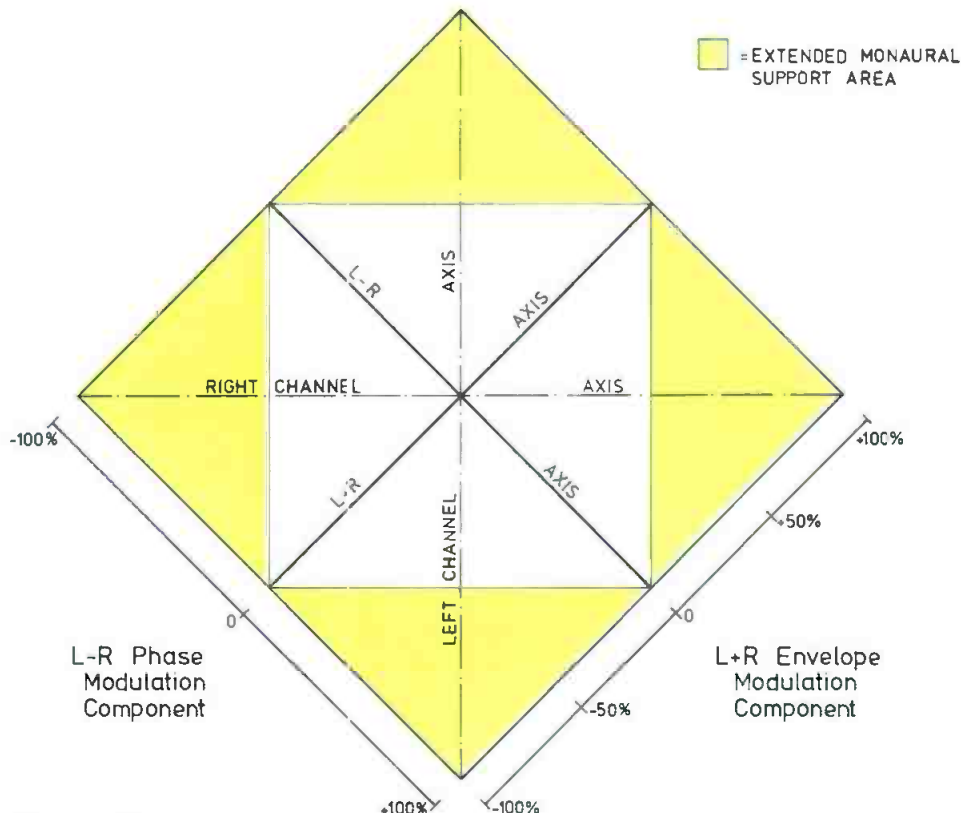


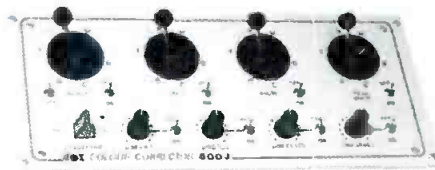
Figure 2. Full monaural support matrix stereo limiting pattern.

rier frequency. As long as the program input is mostly monaural, this limiting system produces nearly full 100% envelope modulation, and monaural reception remains normal.

However, Figure 1 also demonstrates that such limiting creates serious monaural transmission and

reception problems during varying stereo conditions. When stereo inputs temporarily shift to the full left-only (vertical) or right-only (horizontal) modulation axis, stereo reception is acceptable, but monaural is not. The L + R modulation component is forced to drop to 50%, as shown by the dotted line intersection of the lower right modulation scale with the tops of the left- or right-channel limit levels. This

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indicates an immediate 6dB drop in loudness during monaural reception, an unacceptable condition to AM broadcasters, because existing monaural coverage (as well as monaural loudness) is reduced.

Although most stereo program material does not contain substantial amounts of single-channel passages, this form of limiting causes a significant loss of monaural loudness and coverage on nearly all stereo program material. The losses usually are directly proportional to the stereo content

and become greater as separation increases.

Full matrix limiting

Figure 2 represents the oscilloscope X-Y display of the right and left limiter outputs of full monaural support matrix limiting. With this system, output levels of the L+R and L-R signals are adjusted for equal modulation (which is the point of maximum separation). As shown, the amplitude limit levels are perpendicular to the L+R and L-R axes, and intersect with

each other at the left-channel and right-channel axis. When stereo inputs temporarily shift to the full left-only or right-only axis, these limit levels allow the L+R component to remain at a 100% modulation, which maintains full monaural reception compatibility. The shaded part of Figure 2 highlights the increased areas of monaural support modulation produced by this system, compared to the previously mentioned conventional left and right limiting process.

Unfortunately, further analysis shows that stereo reception will have a 6dB increase in the single-channel mode. Although this is going to be noticeable to the audience, critical listening tests have demonstrated this increase to be far more acceptable than the loss of 6dB in monaural loudness. Also, remember that most stereo programming does not contain full single-channel audio.

Modified matrix limiting

Under light and moderate amounts of limiting, full matrix processing produces outstanding results in monaural and stereo. However, heavy amounts of limiting or processing can produce different results. Extreme levels of audio processing, as demanded by many existing AM radio stations, may cause certain types of overloads in present stereo receiver decoding circuits. To reduce the chances of such problems, a modified full matrix processing system has been developed by Circuit Research Labs.

Figure 3 represents the oscilloscope X-Y display of the right and left limiter outputs of the CRL modified monaural support matrix limiting system. The significant difference between this limiting pattern and the one shown in Figure 2 is visible in the left and bottom corners of the illustration. Here, the corners formed by the L+R and L-R axes are removed by an adjustable single-channel limiting network. This system allows full monaural compatibility during most stereo conditions, but causes a reduction of L-R and negative peak L+R modulation levels during left-only or right-only stereo conditions. As shown in Figure 3, the single-channel limits are set for a left- or right-only L+R negative peak of 70%, instead of the 100% level that would occur without such limiting.

This modified matrix system is designed to reduce potential problems associated with AM stereo transmissions. At the removed corners shown in Figure 3, L+R and L-R modulation components are at maximum and can cause decoding difficulties. If

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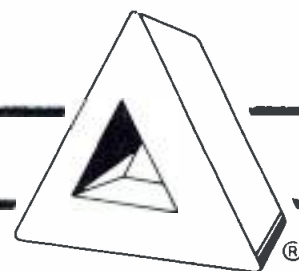
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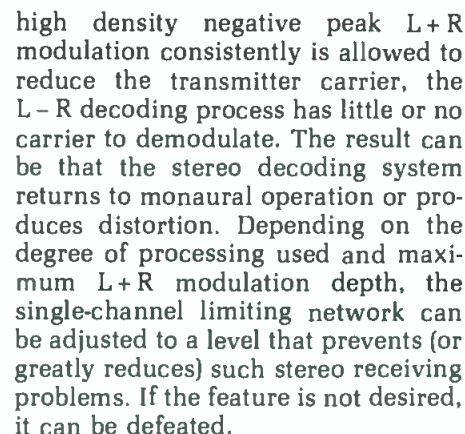
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This information is only the beginning of what will be needed to make AM stereo transmissions successful. Only time and the introduction of *typical* consumer receiver technology will be capable of giving the full information necessary for proper adjustment of AM stereo processing.

Much of the information contained in this report was obtained with the assistance of personnel at the research laboratories of Magnavox and Motorola. However, the conclusions and viewpoints expressed are based *only* on the author's research.

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VRM2270	0-2270	10.0	Slide Switch	*3.00	.5	40
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FCC update

Continued from page 6

tions, which the current cutoff system encourages.

A preference for translators

In the same rulemaking notice, the commission invited comments on the issue of whether TV translator proposals should be given priority over LPTV applications in the processing scheme, and, if so, how such a priority system should be implemented. One proposal is to give priority treatment to TV translator applications proposing to fill in a full-service facility's city-grade Grade A or Grade B contours.

1984 and beyond

The implementation of computer processing and lottery selections will produce significant numbers of new LPTV grants during this year. Informal predictions are that lotteries for all technically sound applications now on file will be completed by mid-1985. The freeze then would be lifted to allow applications to be filed under the window procedure described previously. These developments mean that an LPTV industry most likely will be taking shape by late 1985.

Station totals released

The commission has announced the following totals for broadcast stations licensed as of Dec. 31, 1983:

AM radio	4733
FM radio	3527
FM educational radio	1122
UHF commercial TV	331
VHF commercial TV	531
UHF educational TV	173
VHF educational TV	114
UHF low power	67
VHF low power	185
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Total TV	1401

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Acoustic phase cancellation:

The problem and its solutions

By Greg Silsby, Electro-Voice, Buchanan, MI

The quality of broadcast audio is affected directly and substantially by selecting the proper microphone for a particular task. But even after careful microphone selection, it often is discovered that microphones sound different under different conditions. One major contributor to this change in the microphone's apparent frequency response is acoustic phase cancellation.

Acoustic phase cancellation is a phenomenon that may occur when two or more microphones are mixed, or even when a single microphone is subjected to an overdose of reflected sound. Figure 1 shows a typical mic'ing situation that can result in phase cancellation problems. The variables (D_1 , D_2 and D_3) are changed and the frequency response results are shown in Figures 2-5. It can be seen that severe phase cancellation problems can result from this common microphone arrangement. Although the sound arriving at each microphone is

identical, originating at the same source, it arrives at the two microphones by paths of varying

lengths. This causes a difference in the arrival times and a resultant phase cancellation at certain frequencies.

The curves given for each of the previous examples (Figures 2-5) are FFT (Fast Fourier Transform) derived displays of the actual frequency response of the two microphones combined with respect to a sound source positioned as shown. The FFT analyzer and its companion microprocessor were used to compare the combined output of two matched, calibrated microphones with the output of one of the two mics by itself. If no phase cancellation occurred, no difference would be seen on the X/Y plot, just a straight line.

It does not take much study of the response charts to discover that no matter which way the microphones and sound source have been oriented, the summed response of the two mics is, in a word, awful. These experiments reveal graphically what the

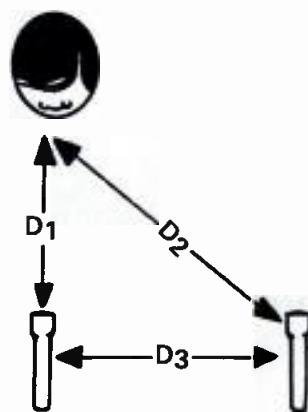


Figure 1. A typical microphone arrangement showing the variables (D_1 , D_2 and D_3) involved. Figures 2-5 show the effects of distance variations upon frequency response in the voice range.



Figure 2. $D_1 = 12$ inches, $D_2 = 21.6$ inches, $D_3 = 18$ inches.

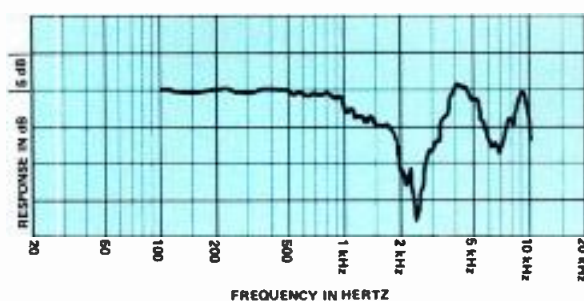


Figure 4. $D_1 = 18$ inches, $D_2 = 21.6$ inches, $D_3 = 12$ inches.

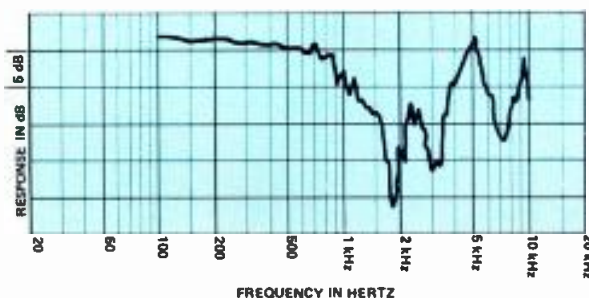


Figure 3. $D_1 = 24$ inches, $D_2 = 30$ inches, $D_3 = 18$ inches.

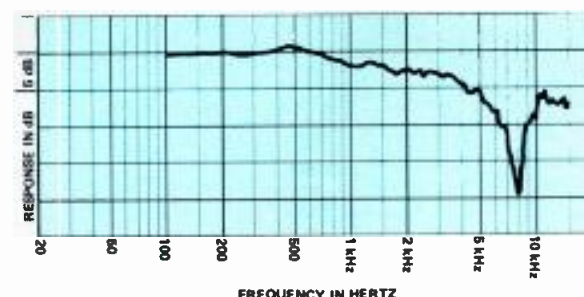


Figure 5. $D_1 = 5.5$ feet, $D_2 = 6$ feet, $D_3 = 2$ feet. Note that this positioning provides the best response curve of the four examples. However, the distances involved make such an arrangement impractical.

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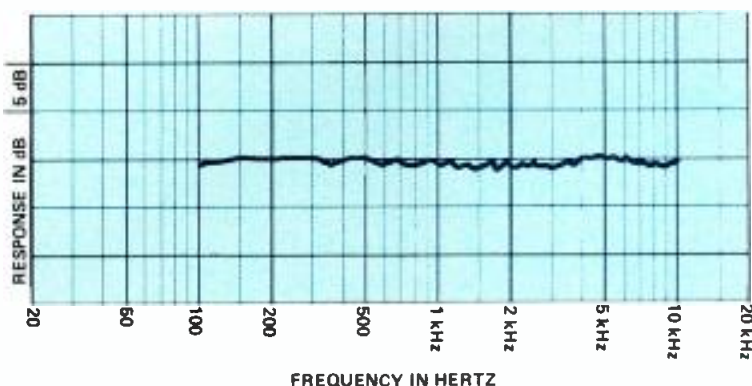


Figure 6. Redundancy microphone positioning. No phase cancellation occurs if both mics should happen to be open simultaneously.

ear often perceives as a comb-filter or notch-filter effect that sweeps up and down in frequency, and even changes in Q, as the variables (D_1 , D_2 and D_3) change with the movement of the microphones or sound source. In more subjective terms, the resultant sound may be termed as hollow.

Unfortunately, such problem-causing situations may arise frequently in some facets of broadcast audio. One classic example is the podium with a pair of microphones spaced apart to provide on-mic coverage as the speaker turns his head to address all of the audience in front of him. The curves shown in Figure 2 and Figure 3 are typical of the problems caused by this common approach. If the output of these two microphones is summed and fed simultaneously to a house sound system, there likely will be gain-before-feedback problems as well. Add the insistent creeping oscillation of a system on the brink of exceeding unity gain to the already intolerable frequency response of the microphone pair, and you will have the quality of sound that causes people to check the credits to see who handled the audio.

The simplest solution to the problems caused by this spaced-pair podium mic technique is to use one mic only, placing it in front of the speaker and toward the center of the podium. Figure 6 shows two microphones adjacent to each other. This type of positioning often is employed when redundancy mic is desired for such critical applications as live broadcasting. Normally, only one of these mics would be open at a time. The second is strictly a backup system. Sometimes the two mics are used to feed separate systems, such as house PA and broad-

cast. Each then may still be used as backup for the other.

Adjacent pairs of cardioid mics may at times be angled inwardly with their axes crossed and their diaphragms closely spaced. This may be done to purposely broaden the acceptance angle of the two mics while maintaining some cancellation at the rear. The microphones' close proximity allows their diaphragms to occupy nearly the same point in space, thus reducing sonic time path differences to the extent that negligible phase cancellation will occur should their output be summed. (See the curve, Figure 6.) The same formation is often used as a 2-mic stereo pickup technique, which offers good mono compatibility.

Obviously, there are many times when the outputs of two or more open microphones must be mixed. How do you then avoid phase cancellation? The phase cancellation problems previously discussed occur when two signals from a single source at the same or nearly the same amplitude are allowed to combine at something other than 0° phase angle. The result of reducing phase angle error has been shown by placing the two pickup elements close together.

The 3:1 rule

The amplitude difference between the two combined out-of-phase signals also can be influenced through careful microphone placement. A good rule of thumb to follow in mic placement is called the 3:1 Ratio Rule. To eliminate the problems demonstrated in Figures 2-5 by employing the 3:1 Ratio Rule, D_3 must always be at least three times D_1 . Figure 7 shows examples of both the violation and enlistment of the 3:1 Ratio Rule. Subjective tests have shown that an amplitude difference of

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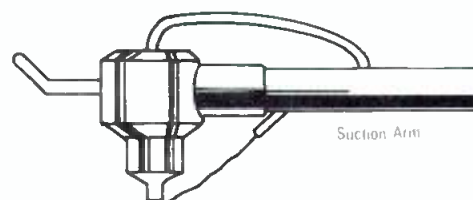
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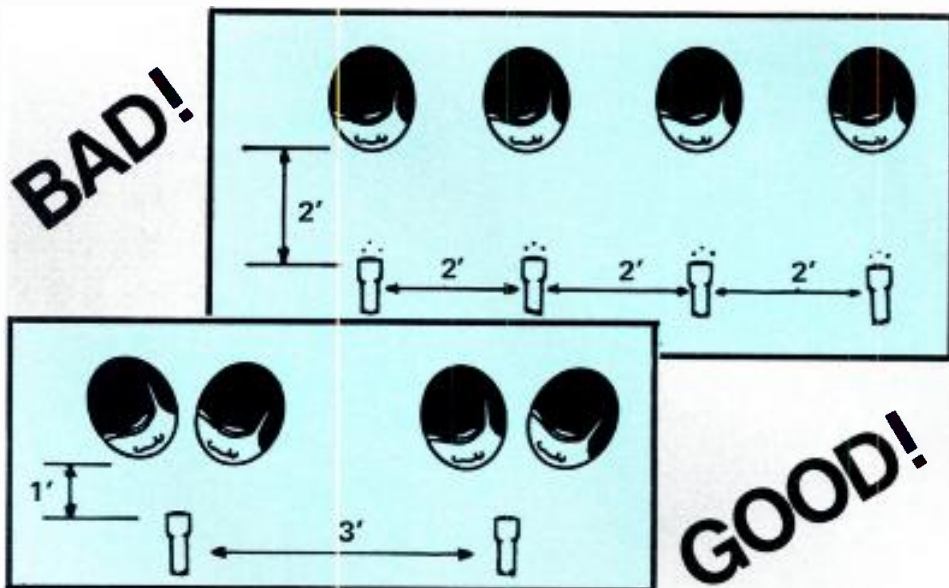


Figure 7. Examples of the 3:1 Ratio Rule, which defines optimum multiple microphone placement, obeyed and violated.

at least 9dB between the two signals will reduce the phase cancellation to an inaudible level. The 3:1 Ratio Rule is a means by which this 9dB minimum difference may be approximated quickly in most multiple mic setups.

The amplitude variance desired also may be achieved by judiciously using the mixer's gain or fader controls. The audio engineer who maintains equal gain settings at the console for two boom mics that have met at center stage, for example, is asking for trouble. Attentive monitoring on an accurate control room speaker system will reveal audible phase problems, especially in relatively simple program sources such as voices and most solo instruments.

Barrier micing techniques

Acoustic phase cancellation also can occur in a single microphone system when reflected energy from a nearby barrier (for example, a music stand, podium, table, weather map or floor) is introduced at the microphone's diaphragm at a sound pressure level (SPL) within 9dB of the direct sound. Such problems may be avoided by increasing the reflected path length, shortening the direct sound path length or positioning the microphone so close to the barrier surface that the direct and reflected sounds arrive at virtually the same time, in phase. The latter practice also results in a higher microphone output caused by the additive effect of the two in-phase signals.

Figure 8 and Figure 9 show two special microphone holders that allow easy micing in the near-barrier position for minimal phase cancellation. The Electro-Voice 411 Mike Mouse is constructed of acoustically transparent Acoustifoam and is intended

for use with such microphones as the E-V RE10 or RE15 super cardioid dynamics. The E-V 370 barrier adapter plate employs the same principle, but holds a miniature omnidirectional condenser.



Figure 8. The Electro-Voice 411 Mike Mouse barrier adapter, which is used to hold a mic in the near-barrier position for minimum phase cancellation.

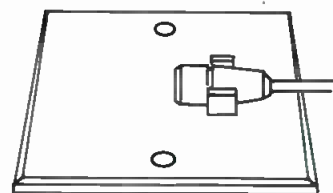
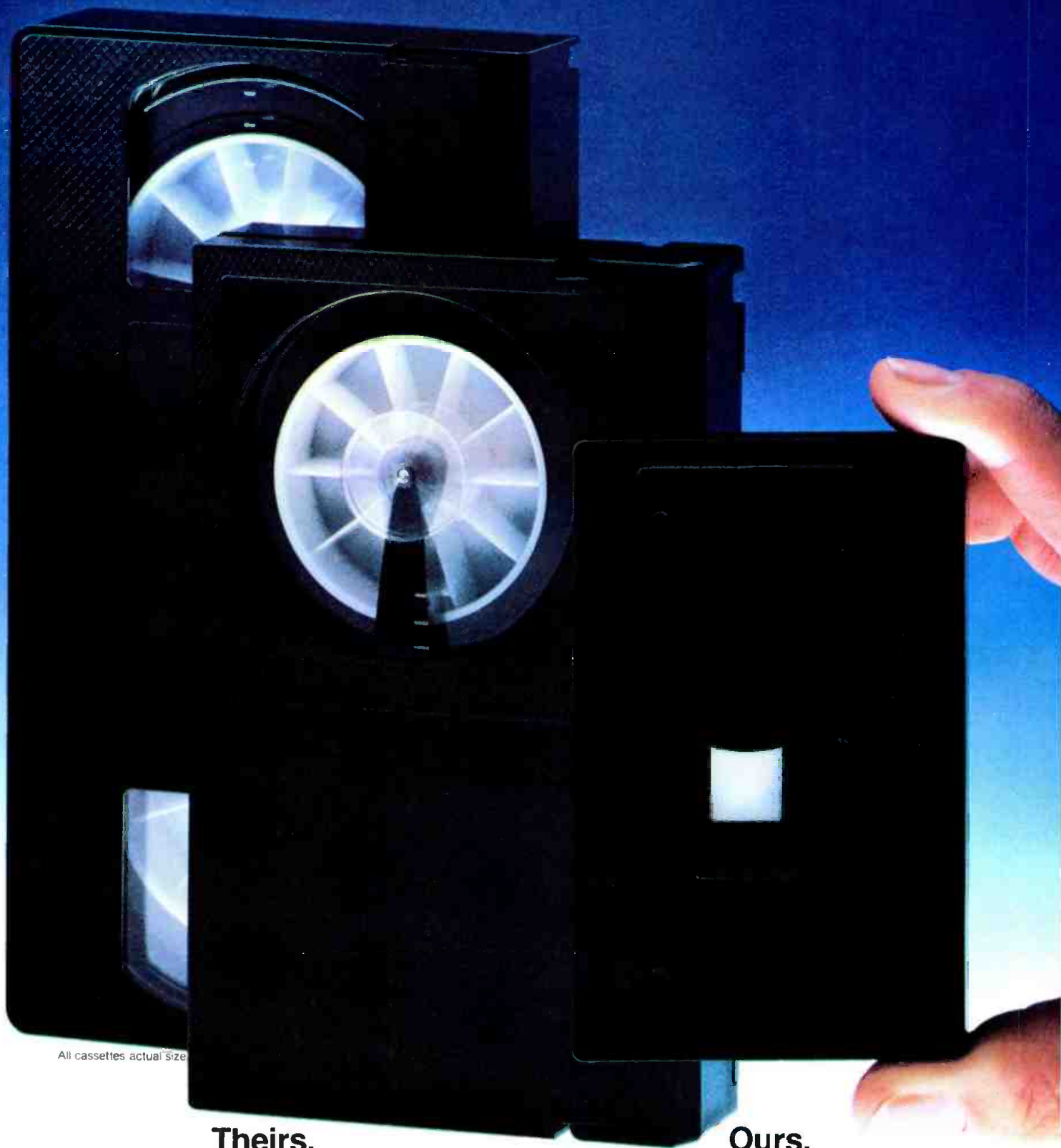


Figure 9. The E-V 370 barrier adapter plate with a C094 microphone attached. This unit is used for near-barrier micing techniques.

The results of barrier micing techniques will vary due to the influence of such things as the size of the barrier, the reflectivity and resonant characteristics of the barrier, ambient noise or reverberant energy problems, and other nearby reflective surfaces.

Eliminating acoustic phase cancellation problems in multiple- or single-microphone usage is one of the most interesting micing challenges. It is hoped that the information contained in this basic primer can assist you or your sound people in furthering the art, with the help of a little science.

||:~>))))



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BOSCH

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Automated audio tests

Tektronix's SG 5010 generator and AA 5001 programmable audio distortion analyzer couple with IEEE-488 computer-controlled test systems for THD, gain/loss, S/N and IMD measurements. Test results are shown on a color CRT or transferred to an 8-color pen plotter for hard-copy documentation.

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DBS uplink

The Thomson-CSF TH 2445 klystron amplifier provides 1.5kW carrier power at 17.3-18.1GHz for DBS transmitter uplink system applications.

Circle (351) on Reply Card

Digital TBC

The Nova 500, for 3/4- and 1/2-inch non-segmented VTRs with sync and derived subcarrier inputs, results in a full-bandwidth time base corrected signal. The 8-bit 4X subcarrier sampling in the Nova Systems product gives maximum picture fidelity.

Circle (352) on Reply Card

Microwave link

NEC America Broadcast Equipment offers the TVL-800-6F ENG microwave link. CMOS and FET devices reduce power requirement and enhance performance. Options include 0.3m and 0.5m dish or plane antennas, 5W power amp, battery packs and cables.

Circle (353) on Reply Card

Test tapes

Standard Tape Laboratory offers special test tape and film materials for use with Sound Technology 1500A and 1510A instruments. For reel, cart, cassette and film formats, these tapes provide measurement of level, azimuth and AF response of tape and film equipment.

Circle (354) on Reply Card

Audio ID storage

Brabury Ltd. offers the BBC-designed MASS solid-state audio signal storage system. To replace tape-loop systems, MASS handles 32-second messages with a 3.25kHz bandwidth or 16-second passages of 6.5kHz bandwidth, based on 8-bit digital technology.

Circle (355) on Reply Card

Wireless mic receiver

Dynex II processing allows a 108dB, A-weighted dynamic range in Cetec Vega's R-42 Pro Plus. A 92dB S/N

rating and 16-pole IF filtering for adjacent channel rejection are featured.

Circle (356) on Reply Card

Component switcher

The Crosspoint Latch 6116 component video switcher operates on any of the standard component formats including RGB, as well as encoded signals. RS-232 and RS-422 ports allow interfacing to editing controllers.

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Mobile production truck

Focus One by MZB & Associates provides complete mobile production facilities with cameras, switching, graphics, audio, tape, communications and total sync facilities in a 44-foot, custom-designed, air-ride trailer.

Circle (358) on Reply Card

Editing system

Eagle III from Videomedia features A/B roll editing control with list management, printer output, 250-event memory, multilevel transition control and the Videomedia/Echo SE-3 production switcher for key, wipe and EMEM-type functions.

Circle (359) on Reply Card

U-matic time code

For improved time code operation with Sony Type 2 and Type 5 3/4-inch VTRs, VideoLab has introduced Time Code Retrofit. A restored output signal with 25µs risetime is obtained, while diode clamping eliminates adjustments.

Circle (360) on Reply Card

Electronic programmer

The United Media model 500 sequencer, for post-production and technical TV operations, is programmed from the company's Commander II editing system, paper tape, RS-232 equipment or front-panel controls. Storage and sorting of 320 commands, a built-in time code reader, and 0.01s or frame accurate timing are featured.

Circle (362) on Reply Card

Remote-control options

Moseley Associates provides CRT and logging printer options for the MRC-1600 remote-control system. A Viewpoint A2 CRT terminal allows instant readings of telemetry and status conditions of all 16 control channels. A TI 850 log printer provides user-selectable logging intervals, log

headers and choice of channels.

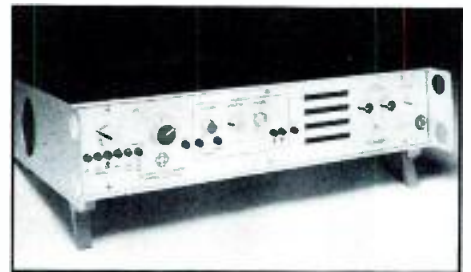
Circle (361) on Reply Card

Verification system

An X-Y scope, dual average-reading VU meters, peak LED meters and a time code oscilloscope display on the AM-1 from B & B Systems allow verification and monitoring of stereo audio and time code phase.

Circle (363) on Reply Card

Dimensional sound mic



Audio + Design Recording offers the Calrec Mark 4 Soundfield Microphone and Ambisonic Surround Sound System for improved stereo and dimensional sound reproduction. Four condenser capsules, mounted in a tetrahedral format under encoder control, reduce phase errors and achieve true sound coincidence.

Circle (364) on Reply Card

Automated video carts

The DC-8, pre-packaged 8-transport automatic video cart machine from Broadcast Systems may be programmed for 98 events. The system easily handles 10-second spots back-to-back or sandwiched between longer video segments.

Circle (365) on Reply Card

Oscilloscope camera

You can document your CRT displays with the Tektronix C4 camera. Hand-held, the C4 combines camera and CRT hood for various screen sizes. Polaroid 612, 667 and Polacolor ER-type photographic materials may be used.

Circle (366) on Reply Card

Digital reverb

Reverb and direct sound may be varied continuously in any of four time settings and input/output levels with the Yamaha R1000. LSI technology is used in the design.

Circle (367) on Reply Card

VCR gauge

Measurements made with a Tentel HPG-1 head protrusion and eccen-

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GAINES

tricity gauge check on head tip wear and head drum run-out on Beta, VHS and U-matic recorders. The gauge, in its carrying case, comes with a 16-page setup and troubleshooting guide.

Circle (368) on Reply Card

Nicad analyzer

Alexander Manufacturing includes a microprocessor in the TA1500 battery analyzer to control conditioning and charging of most nicad batteries. Specific voltage and capacity ranges are set at the factory.

Circle (369) on Reply Card

RF sensing

Two units from Video Aids of Colorado use RF sensing for activation. An RF power switch provides a 12-second delay before activation of any desired equipment, while the RF alarm sounds an audible signal. Both operate in the 0.5mV range.

Circle (370) on Reply Card

Posterizing effects



Two independent video colorizers in the Knox Color Box have full control over luminance, hue and saturation. The Color Box allows posterized effects from a black-and-white or color key camera input over downstream video. The stand-alone system also may gen-lock to system video.

Circle (371) on Reply Card

Enhanced graphics software

Expanded weather and sports data display software for the Aurora Systems Aurora 100 digital video-graphic and animation system interface to data from the WSI data service. An optional preview channel also is available for the system.

Circle (372) on Reply Card

Audio interface

Unbalanced equipment is properly interfaced to balanced professional audio systems through the Logitek PAI-4 Pro Audio Interface. Level changing circuitry and impedance matching are included with playback level controls.

Circle (373) on Reply Card

Microphones

The Bogen Division of Lear Siegler has announced a line of mic systems, including the MTT-920 electret tie-

clip unit, the MDO-710 moving coil dynamic studio model and the MSC-620 super cardioid dynamic unit for close micing needs.

Circle (375) on Reply Card

Frame synchronizer

The FS-18 frame synchronizer from NEC America Broadcast Equipment Division features options for TBC, frame-freeze and 4-field color processing in a modular format. Options may be added as requirements change.

Circle (376) on Reply Card

Audio fader

Mystr conductive plastic elements in the Waters Whisper Glide faders complement smooth-action designs. Sable, glass-hard resistance elements and precious-metal contacts give long life without contact noise.

Circle (377) on Reply Card

Effects patterns

Forty patterns in a 4"x5" format fit the Great American Market Mini Scene Machine pattern projector for spectacular projected effects

Circle (378) on Reply Card

Editing software

Learn keys and auto clean/scroll are two of 30 enhancements for CMX 3400 editing system software. The new software features are based on extensive testing in major post-production facilities.

Circle (379) on Reply Card

Dual-beam feed assembly

Scientific-Atlanta has announced an adjustable dual-beam, dual-polarized feed system for 4.6m and 5m earth station antennas, allowing a single antenna to be used for reception from adjacent C-Band satellites at 3° or 4° spacing.

Circle (380) on Reply Card

Videocassettes

Super High Grade (SHG) videotape from Canon USA uses ultrafine 0.3µm particles on a reduced friction backing. Designed for the Canon VR-20A 4-head VCR, the tape materials work well with all VHS machines.

Circle (381) on Reply Card

Digital multimeter

Autoranging in the A.W. Sperry Instruments DM-6590 Electro-Probe digital probe multimeter simplifies operation during measurements on hard-to-reach points of crowded printed circuit assemblies.

Circle (382) on Reply Card

Steerable polar mount

Magnatech's zero-offset polar mount features a rotary actuator for con-

tinuous 130° arc positioning. A uniform 2.5°/s speed repositions the earth station antenna from Galaxy 1 to Russia's Gorizont in 48 seconds.

Circle (383) on Reply Card

Newsroom composition

DATA NEWS by Beston provides interconnection of all news copy writers, the producer's position and the talents' prompters along with disk memory archive and storage, remote prompter control and a vertical interval encoder for Line 21 closed captioning or teletext.

Circle (384) on Reply Card

Visual special effects



Four pattern holders for the Great American Market Mini Scene Machine handle 4"x5" glass or steel effects and transparencies, 35mm transparencies and standard size patterns. Pattern rotation also is possible.

Circle (374) on Reply Card

Digital audio mixer

No analog processing remains in the Neve Electronics DSP digital signal processor console system. Extensive use of fiber-optics combines with a total digital 16- and 32-bit design to eliminate interference from external RF or electrical fields.

Circle (293) on Reply Card

Teletext terminal

The Frame Creation Terminal from Jasmin Electronics includes editing features with a full range of character sizes, colors, backgrounds and graphic patterns. It is compatible with Prestel, CEEFAX and Oracle systems, as well as TV monitors and video digitizers.

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[:7:~))]]]

SOUNDCRAFT SERIES 2400, BBC TELEVISION, GLASGOW.



Sound on Vision

Some rather discerning people are using Soundcraft Series 2400 master recording consoles. They've established that Soundcraft performance and reliability meet the rigorous standards broadcast and video post production impose – within some fairly tight budgets too.

In conjunction with Television Projects in London, Alan Bunting, the Audio Manager for BBC Scotland, specified the Series 2400 for their new dubbing suite – making this the second 2400 the BBC have purchased for their Glasgow studios so far.

If you'd like to find out why more and more Soundcraft consoles are being specified for broadcast and post production audio mixing, contact Soundcraft or your Soundcraft distributor today.

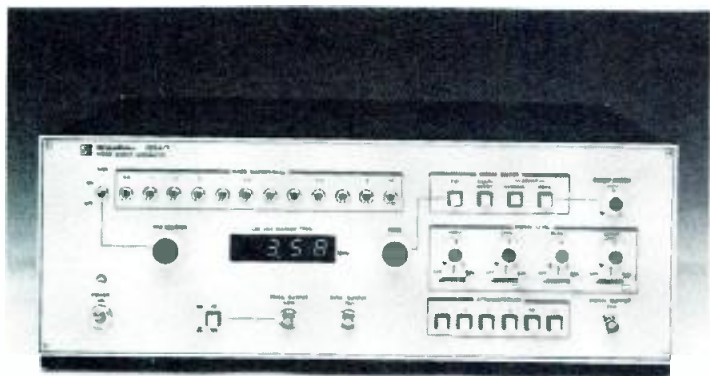
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people

Gordon W. Gummelt will assume the newly formed position of supervisor of field operations for Harrison Systems Ltd. Broadcast Systems Division. Gummelt was promoted from a field engineering position.

The NAB has announced the appointment of **David E. Parnigoni** as senior vice president, Radio. He succeeds Wayne Cornils, who resigned to become executive vice president of the Radio Advertising Bureau. Most recently, Parnigoni was an NAB regional manager for Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont.

Stanley D. Becker has rejoined CMX Orrox as director of engineering. Becker formerly was manager of systems engineering at Harris Video and also directed engineering projects at Ampex and Echo Science.

David G. Kennedy has been appointed president of dbx. Kennedy, former vice president of finance for Instrumentation Laboratory, served with that company for more than 17 years.

Broadcast Technology has announced the appointment of **Rex Nathanson** as BTI's director of engineering. Nathanson was formerly senior project engineer with CBS Technology Center, working on projects including CBS' noise reduction systems for phonograph and video-disc systems.

George M. Kanda has been appointed quality assurance manager, 3M's Magnetic Audio/Video Products Division. He will be responsible for product testing and qualification and quality engineering.

Hitachi Denshi America Ltd. has announced the appointment of **W. Arnold Taylor** as executive vice president, marketing and sales, for the Broadcast and Professional Video Products, Test and Measurement, and Visual Products Divisions. Taylor has more than 25 years of marketing and general management experience in the broadcast industry. He has held senior marketing positions at Ampex Corporation, Sony Corporation, Compact Video and, most recently, RCA Commercial Communications Systems Division.

John Parke has been appointed director of TV sales at Harris Corporation's Broadcast Transmission Division. Parke will direct the Harris sales group selling transmitters, antennas, satellite systems and microwave systems to TV stations. Parke comes to Harris after serving for nine years as vice president of marketing for Acrodyne Corporation.

Barco Industries has appointed **Hugo R. Vandamme** as general manager and managing director of the company and its operating companies. This appointment will fill the gap in the company brought about by the death of **Michael J. Plaisier**, the former general manager and managing director.

Ronald H. Fried has been named president and chief operating officer of ADDA Corporation, Los Gatos, CA. Fried formerly was vice president, marketing and sales, having joined the company in 1982. Before that he was vice president and general manager, Toshiba Broadcast Electronic Systems, Sunnyvale, CA.

Videomedia has appointed **Steve Hall** as field service and training manager. He will be responsible for coordinating all field service activities and will generate ECNs and manual changes when necessary.

EECO has announced the appointment of **Tim Thompson** to product specialist, video products marketing, Video Products Division. Thompson's responsibilities include sales and technical support, market research/analysis and new product planning. Also, Thompson will provide application engineering support to distributors, OEMs and end users.

EEV has announced the appointment of **Kees van der Keyl** as product sales manager for EEV's broadcast products in Arizona, New Mexico, Oklahoma and Texas. van der Keyl has an extensive background in the electron tube industry, including positions with Philips Electronics Industries, Amperex Electronics and Panavision Electronics.

!:->))))

Editorial

Continued from page 10

that when updates have been made in their facilities, multiple audio cables have been included in any new wiring.

Perhaps the biggest problem faced by TV stations will be getting incidental carrier phase modulation (ICPM) interference, produced within the transmitter itself, under control. The reduction to less than 5° of phase error is expected to be more of a problem for VHF stations than for UHF stations. The 5° is stipulated to reduce buzz interference.

We hope that the commission will consider the EIA/BTSC recommendations and the comments that recently have been filed with the FCC by the BTSC, requesting that a lengthy set of definitions and rules, included with those comments, be incorporated into Volume III, Part 73 of the FCC Rules and Regulations. Many strides have been made toward picture improvements. Should not the US viewing public also be given enhanced, and better quality, TV sound? Japanese and, more recently, German, viewers already are enjoying the new technology. Is it not our turn?

!:->))))

Satellite update

Continued from page 13

to provide high quality TV signals to receiving antennas in the 2-foot-diameter size range, with a good margin included for fading caused by rain at the higher Ku-Band frequencies. Because the DBS band is the 12.2-12.7GHz band, the rain fade problem is worse than it is at the lower frequency portion of the Ku-Band used by the medium power satellites.

In summary, the technical risks associated with high power DBS satellites are significant. The feasibility of the high power DBS delivery system is not assured, particularly in view of the competition to come from medium power satellites.

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Special Note:

The number of tour delegates will be strictly limited. Persons interested in participating should inquire early.



EQUIPMENT SALES

Comark Communications has announced the receipt of orders totaling more than \$800,000 for high power, UHF TV transmitting systems for China. The orders are for 30kW and 55kW systems to be used to broadcast programming within China.

Larcam Communications Equipment has received an order for a model F 32kW parallel transmitter configuration for RPC-TV/Channel 4 (Corporacion Panamena de Radiodifusion SA) in Panama City, Panama. The new transmitter, which will replace the station's existing transmitter, will give RPC-TV the highest transmitter power in the Central America and Panama area.

Broadcast Systems has been awarded approximately \$500,000 for the purchase of equipment, including complete design and installation services, by KINT-TV/Channel 26, El Paso, TX. BSI will provide equipment for production and master control. The company also has been selected to supply equipment valued at about \$500,000 for Jimmy Swaggart Evangelistic Association, to be used in its new product facilities in Baton Rouge, LA.

Thirty-nine **Angenieux** zoom lenses were used to televise the COPAN Olympic Games in Caracas, Venezuela.

Microdyne has announced a \$260,000 contract to supply satellite network distribution equipment to the Alabama Information Network (ALANET). The system is being purchased by the Troy State University Foundation, operating in partnership with ALANET. The initial system will consist of a 2-channel uplink station in Montgomery, AL, and 52 downlinks to be located in Alabama, Georgia, Tennessee and Florida. An additional 30 downlinks are scheduled to be added to the network at a later date.

The **Eimac Division of Varian** has purchased a new multipoint distribution service (MDS) TV transmitter, which it will use to test the vacuum tubes it manufactures. The transmitter is a product of **Electronics, Missiles & Communications (EMCEE)** of White Haven, PA.

Ampex Corporation has announced the installation of its 200th Ampex Digital Optics (ADO) system at Today Video, a production facility in New York City. Today Video is using the ADO for production and post-production and interfacing the Ampex system with other units to create unusual special effects.

The Meyer Television Network of western North Dakota has announced its decision to purchase 18 JVC KY-950U 3-tube color cameras.

NEW ADDRESSES, DIVISIONS

Eventide has moved to a new 20,000-square-foot facility at One Alsan Way, Little Ferry, NJ 07643. The new phone number is 201-641-1200.

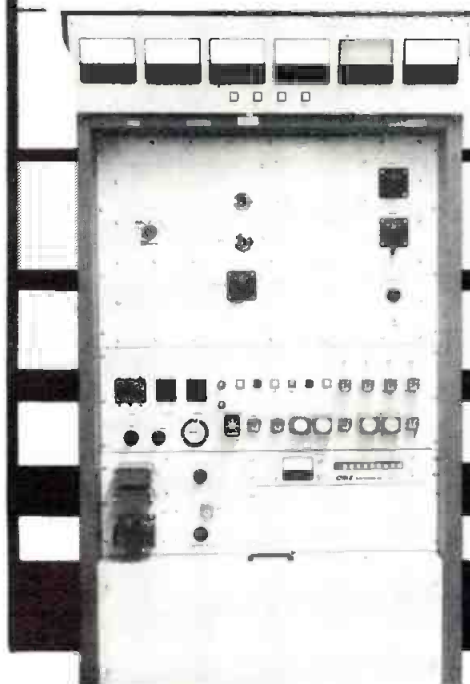
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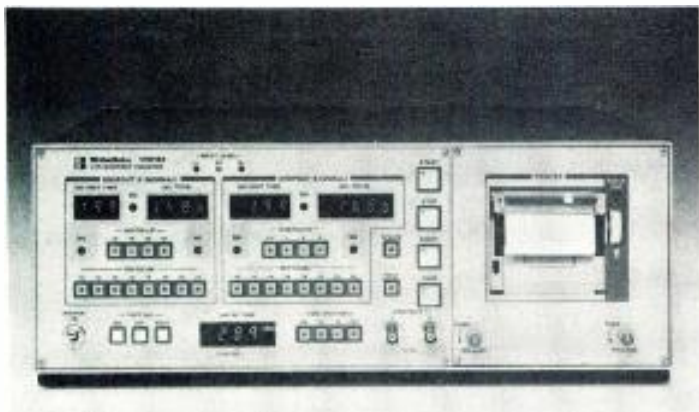


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filiate of Mitsubishi Electric Corporation, responsible for all professional digital audio systems marketing in North America, has opened its New York City sales and support facility at 555 W. 57th St., in Manhattan. The 2500-square-foot facility is the primary sales base for the eastern United States as well as the support headquarters for North America.

Sony Broadcast Products Company has relocated its East Coast headquarters to a facility set on two acres at 1600 Queen Anne Road, Teaneck, NJ. The move enables the company to house its sales, product management, order processing, credit, general administration, service department and executive offices under one roof for the first time.

RCA Broadcast Systems is now operating out of its new headquarters, located at Paint Works Corporate Center, P.O. Box 900, Gibbsboro, NJ 08026.

Riviera Capital Corporation has established a special division, **Riviera Broadcast Leasing**, which will be dedicated exclusively to servicing the special needs and requirements of the broadcast industry. The new division is headquartered at 220 Avenue I, Redondo Beach, CA 90277. Telephone number is 213-540-9895. The division also will be operating from Riviera's newest branch office in Encino, CA, as well as out of its Huntington Beach, CA, office and other locations throughout the country.

Angenieux Corporation of America has expanded its marketing and sales headquarters in the United States and relocated them. The Miami headquarters also will service South America. The new offices are located at 770C N. Kendall Drive, Miami, FL 33156. The telephone number is 305-595-1144. Fully staffed regional offices will continue to operate in Hudson, NH, New York and Los Angeles.

CORPORATE DATA

Modulation Associates has announced that it has signed a contract with Durham Life Broadcasting in Raleigh, NC. The order specifies Modulation's new dual-redundant, 2-channel solid-state uplink to transmit network programming to the Durham Life Broadcasting affiliates. The contract also calls for an undisclosed number of downlinks for these affiliates. The specified downlink equipment is the Modulation MC-SAT multichannel demodulation receiver.

DigiVision has expanded its staff by adding a national service department. Heading the new department of service technicians is Glenn X. Gold, Jr., with a broad background in the areas of electronics, management and hands-on experience as an electronics specialist. Gold's initial responsibility as national service manager will be the servicing of DigiVision's first high tech product in the field, a real time high quality full-motion color video display system—the DRGB-343 high resolution digital video converter.

Tektronix has announced the formation of the **Tektronix Development Company**, a 100% owned subsidiary, which will sponsor or invest in projects or companies at startup or early stages of growth. Investment is expected to be primarily in technologies developed within Tektronix that are outside the interest areas of existing Tektronix divisions.

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CHIEF ENGINEER—PROGRESSIVE RADIO GROUP seeking Chief Engineer for 3 station group operation. Experience required. Group benefits, salary negotiable. Call Bob Lindstrom, 405-252-6090. E.O.E. 3-84-11



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VIDEOTAPE OPERATORS: The Christian Broadcasting Network, Inc., an evangelical Christian ministry, has immediate openings for videotape operators. Applicants must have at least four years experience as a videotape operator with a strong technical background including a thorough knowledge of the television signal and its relationship to videotape. Current experience in 1", 2" and 3/4" formats, including machine-to-machine editing, film-to-tape transfers and standards conversion is desired. If you feel led and want to serve, send resume in confidence to: Personnel Specialist, The Christian Broadcasting Network, Inc., CBN Center—Personnel Dept., Virginia Beach, VA 23463. CBN is an Equal Opportunity Employer. 3-84-11

VIDEOTAPE EDITORS: The Christian Broadcasting Network, Inc., an evangelical Christian ministry, has immediate openings for videotape editors. Applicants must have at least four years experience in computer editing with overall experience in videotape operations including experience as a senior operator or supervisor. A strong technical background including a thorough knowledge of the television signal and its relationship to videotape is necessary. Current experience in CMX 340, Convergence 103 & 104 systems desired. If you feel led and want to serve, send resume in confidence to: Personnel Specialist, The Christian Broadcasting Network, Inc., CBN Center—Personnel Dept., Virginia Beach, VA 23463. CBN is an Equal Opportunity Employer. 3-84-11

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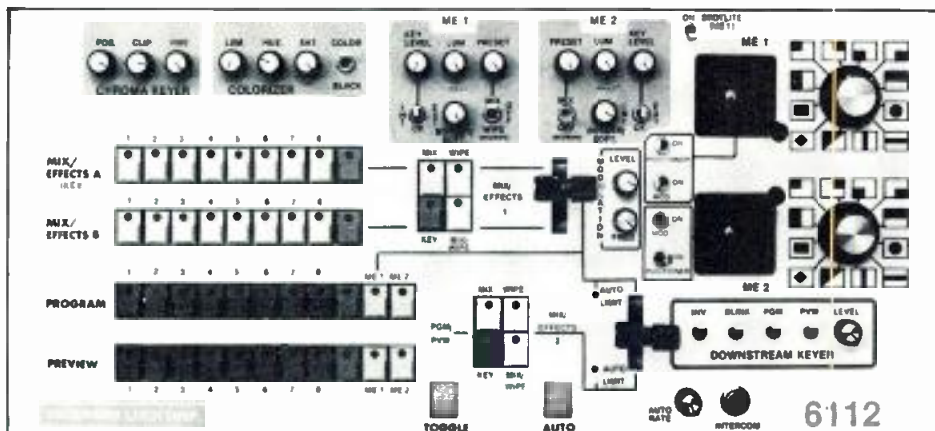
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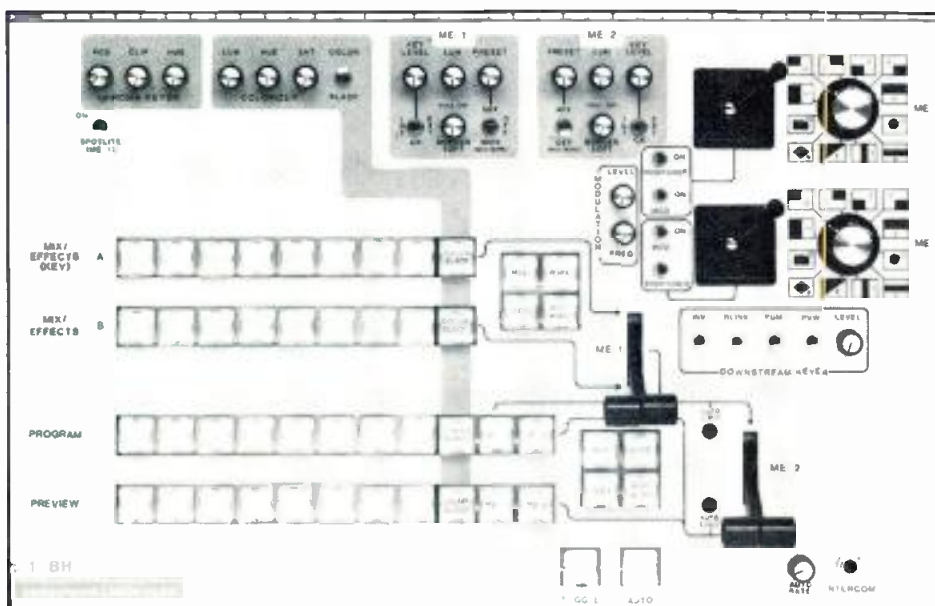
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