

# BROADCAST engineering

August 1981/\$3



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# BROADCAST<sup>®</sup> engineering

*The journal of broadcast technology*

August 1981 □ Volume 23 □ No. 8



**THE COVER** this month shows the audio production facilities of King Productions in San Francisco—a facility in which careful attention is given to high quality audio sound. This facility is a subsidiary of King Broadcasting Company, which also owns KYA AM-FM. This radio station uses much of the material it produces. King Productions boasts state-of-the-art design and instrumentation that includes 4-track and 8-track studios to provide commercial audio producers with the ultimate in recording equipment and engineering.

A future issue of **BE** is scheduled to cover a case study of the production facilities shown here as well as the design of KYA AM-FM.

This month quality audio signal handling is being stressed. See the contents page at the left for specific subjects to be covered.

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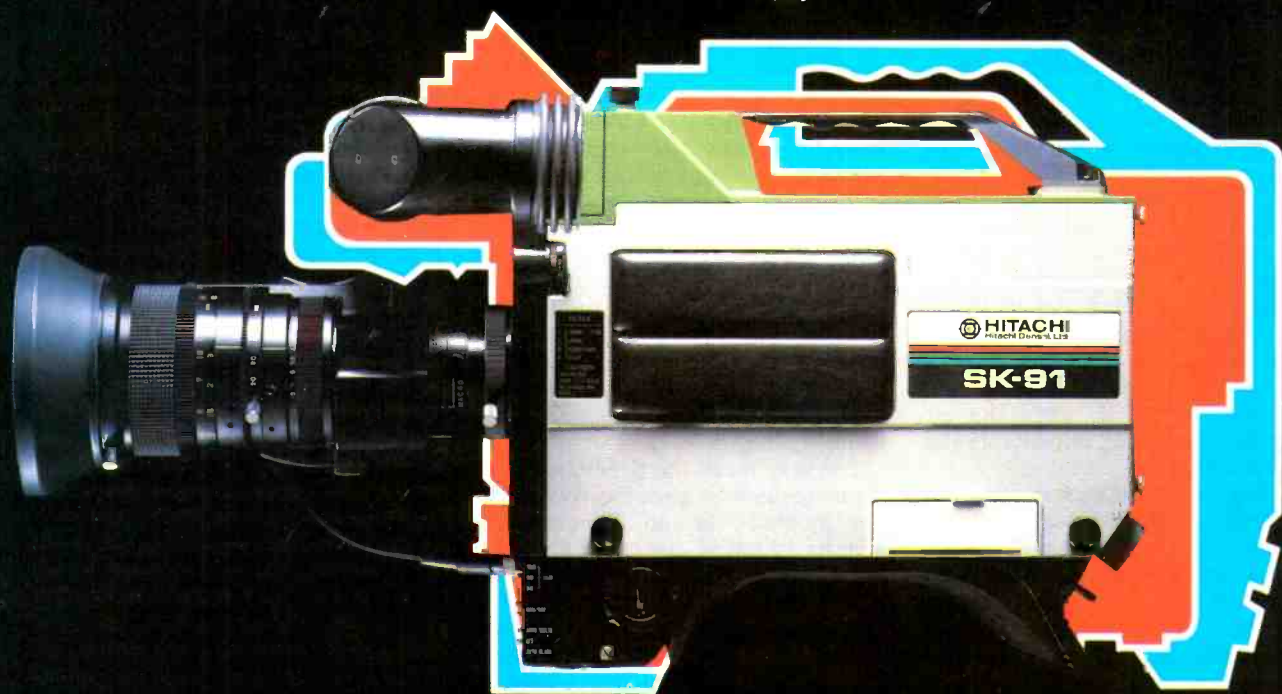
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## NEXT MONTH

The September issue will be the 14th Annual Buyers' Guide Special Issue. It will provide a comprehensive directory to products and sources for broadcasters.

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# FCC update

August 1981



**Editor's note:** The following are excerpts from a speech given by Mark S. Fowler, chairman of the Federal Communications Commission. Fowler addressed members of the Oregon Association of Broadcasters on June 12 in Newport, OR.

I am delighted to be with you at your annual convention. As some of you may know, this is my first address to a broadcast group since becoming chairman of the Federal Communications Commission.

While you and I work at opposite ends of this great country, we in Washington are surrounded with a condition that contributes to the unique charm of this state. I refer, of course, to fog. Now in Oregon, fog is a balm, sometimes a soupy balm, but a balm nonetheless. It calms the environment, soothes its inhabitants and makes things grow.

The fog in Washington is different, for I refer to indoor fog, one that obscures the environment, clouds thinking and prevents things from growing. It is a most conducive atmosphere in which to cultivate, along with all sorts of funguses, a bureaucracy. In fact, production has been so plentiful that we have been exporting bushels of paperwork for decades.

I believe that one clear message of the 1980 elections was this: Dispel this fog, the pervading environment in Washington that induces not better government but bigger government. I view my job at the Federal Communications Commission as an important part of carrying out this mandate for a leaner, less intrusive federal presence throughout this country. In this effort, we at the commission intend to cooperate fully with the Congress in its efforts to modernize the Communications Act.

Like the great Lewis and Clark who explored the Oregon territory more than a century ago, we in Washington have a similar mission. We must hack through the dense regulatory underbrush transplanted from the 19th century and try to create order from chaos. For the laws which to this day guide the commission derive essentially from the same laws that chartered, in 1887, the Interstate Commerce Commission. Whatever the validity of those regulatory notions in the age of the buckboard and the waltz, their relevance must be ques-

tioned in the age of minicam and microwave.

You and I both know, however, that announcing that we are going to cut through the regulatory underbrush is much easier to say than to do. When I say the commission will unregulate, I am making a promise I intend to keep. I and my fellow commissioners have established "unregulation" as a primary objective to be vigorously pursued in the months to come.

Now, what does this unregulation process mean to you in radio and television? Before coming on the commission I reviewed the legislative history of the Communications Act. In doing so, it becomes easy to see why broadcasting was so trussed up in statutory thongs by the Congress.

You may recall the Greek legend of Prometheus who gave the world fire, the symbol for enlightening the masses. In return, the angry gods tied him to a rock. Well, broadcasting was and is, the fire of our own era. The legislative history of the 1934 Act reveals that the Congress at that time regarded you with the awe, suspicion and apprehension that describes how ancient gods were supposed to have viewed Prometheus. Radio was an unknown force, with the power to light the lives of people like nothing that had come before. Even broadcasters knew that radio was both science and illusion and talked about reaching their audiences "through the magic of radio."

Even now, when people know that—like the wondrous facade of the Wizard of Oz—radio and television are made possible by somebody turning knobs and pulling levers behind the scene, you are still regarded with the timorous fascination that resulted in your regulatory confinement nearly 50 years ago. The evidence of this phenomenon is attested to by the bulky commission rules affecting your operation and the thousands of tons of paper filed with us each year by your industry.

While deregulation has caught up to almost all the major industries that were harnessed by the "alphabet agencies"—the FCC, the FTC, the CAB, and so on—broadcasting has remained a conspicuous exception. In the last few years we have seen the

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## FCC update

deregulation of airlines, oil and gas, and trucking industries. The FCC itself has substantially deregulated some common carrier services, and cable TV and even CB radio. But as for broadcasting, the FCC remains the last of the New Deal dinosaurs. There must come a time that the FCC catches up to the realities of your industry and eliminates regulations that no longer have valid purposes.

In my mind, it is time for fresh thinking, even radical thinking, when it comes to broadcasting. You in radio have seen the new approach. In radio deregulation, the commission prudently has begun to withdraw itself from areas that no longer require its attention. These efforts must continue. Moreover, I believe that we must now move on to television. Deregulation of television will be an important theme of my chairmanship. The technology bids us to pursue it, and the cost of continued regulation impels us as well.

At the heart of broadcast regulation is the public interest standard. The many coats of conceptual paint that have been slathered on the term down through the years have hampered our ability to see clearly what the public interest in broadcast regulation really is. Assumptions, programs and policies have grown thick over this basic concept.

A primary goal of the commission in the months to come will be to strip away the layers of rules, policies and programs that now encrust the basic public interest concept. The new age of alternative communications media—cable TV, MDS, STV, videodiscs and cassettes and perhaps DBS—clearly make some of these rules and policies as anachronistic as the vacuum radio tube. But our scrutiny of the broadcasting rules will not begin and end with those rendered obsolete by new technologies. Many rules have simply lost what usefulness they may have had because of the changes in American society that the passage of time has wrought. But many others, quite frankly, were ill-advised to begin with.

Top to bottom, we will take a look at each regulation imposed on broadcasters and ask, frankly, candidly, what would happen to the world if this regulation were eliminated? Does the regulation perform a function best undertaken by the regulators or by the industry? Do consumers really get enough back from this requirement to outweigh its costs on business and on the American public?

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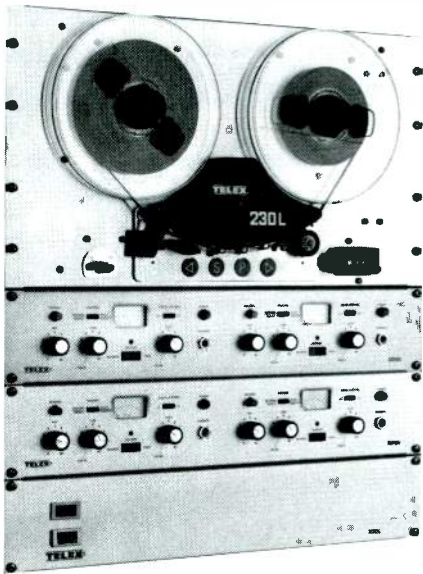
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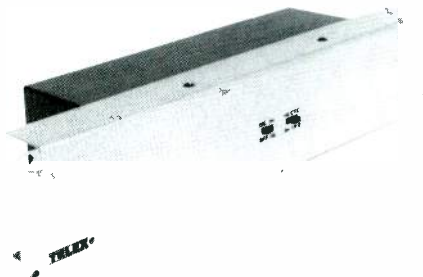
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**FCC update**

grand Pooh-Bah of the Potomac determining what kinds of programs a broadcaster must air, must change. And it will change. Technology has already undermined it. Neither logic nor experience any more supports it. And the American taxpayer should no longer have to pay for it.

To summarize what I have been saying, if regulation is truly to be in the public interest, the definition of public interest must change with the times, embrace the new realities and in the end be keyed to serving the public. I believe that the public has lost more than it has gained under the old regulatory pattern. The cost of regulation alone has been staggering. Not only has the taxpayer paid to keep the FCC enforcing a ton of outdated rules, the costs of compliance to the industries has been enormous. It is money that is taken from production or profits and wasted on unnecessary compliance with unneeded government rules.

Furthermore, when government undertakes to define—in concrete rules—the product that may be offered, consumer choice suffers; rigidity is substituted for diversity and creativity. The media must be allowed to find new ways to communicate without having to fit them into preconceived patterns drawn up in Washington. I think that newspapers, magazines, book publishers, the theater, and record companies provide fresh, innovative and diverse material without processing guidelines and government policy statements. The public always benefits from an atmosphere of freedom and the incentives provided by marketplace competition.

And finally, the public will know that the regulations that are retained are those considered *absolutely necessary* to protect the public interest and will be enforced firmly. I would rather do a good job of enforcing fewer regulations that are essential than a superficial job of enforcing thousands of regulations, many of which have a tenuous connection to the public interest. The public will benefit from a cost-effective use of enforcement resources; and in an era of declining budgets, it is imperative that no government effort is wasted.

I know we have work ahead of us. And I know that our promises must be matched by our performance. Many difficult legal and economic issues do await us. And a new environment awaits you. I believe you will have much to gain in this new environment. And I know you will have much to offer. □



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## **CBS Broadcast executives hail compatibility developments**

At the Videotex '81 conference in Toronto, CBS officials welcomed the compatibility standards being developed for the French Antiope broadcast teletext system, the Telidon system and the AT&T standard for videotext coding.

Speaking at the conference, Harry E. Smith, vice president, Technology, CBS Inc., said, "From an engineering standpoint, future systems will be able to talk to one another in the same computer language, making it possible for terminals designed for one system to display the text and graphics of another without excessive cost or complexity. The result may well provide a positive impetus toward the establishment of a single broadcast teletext/videotext technical standard in North America that will help stimulate speedy development of a diversity of competitive electronic textual communication services.

"This development," Smith said, "will allow viewers in Canada and the United States to receive on their home video terminals a greater variety of information from many different sources—broadcast, cable television and telephone, and hybrid combinations of the three. In addition, the systems will be able to deliver more sophisticated graphics and a greater selection of color."

Commenting on the breakthrough, Gene F. Jankowski, CBS/Broadcast Group president, said, "We welcome the compatibility between these three systems. Since we are already on the air in Los Angeles with a modified version of the French Antiope broadcast teletext system, we applaud the fact that there will not be an electronic barrier at the border with Canada. In adopting the Antiope system, we stressed that it could be made compatible with other systems and technologies. Therefore, we anticipate supporting what may well become a North American broadcast teletext/videotext standard."

CBS has been offering broadcast teletext over the facilities of KNXT, the CBS-owned station in Los Angeles, since April 8, 1981, in a cooperative effort with KCET, the public broadcasting station in Los Angeles, and the West Coast office of the Caption Center of WGBH-TV, Boston. CBS explores news, informational and commercial applications of broadcast teletext as well as its application for captioning for the hearing-impaired, while KCET tests

informational and educational uses.

RCA recently announced its decision to support the Antiope teletext system, and NBC plans to enter into teletext market tests at its station KNBC-TV in Los Angeles this fall. Smith said that the simultaneous testing by the three stations in Los Angeles would "go a long way toward demonstrating the public interest and benefits of teletext to other broadcasters, television set manufacturers, advertisers, the FCC and the general public."

John S. Suhler, president of the CBS/Publishing Group, which is involved in designing videotext products and systems, said he thought the development offered information and transaction providers something they had been waiting for.

"Now we can quit worrying about the problems of incompatibility and focus on the central issues that affect videotext's future—the creative, business and marketing aspects of providing information and services to the public through these new electronic channels," he said.

Smith said two developments led to the breakthrough. First, the use by all three systems of a common "presentation level protocol" defined the digital codes controlling the display of text or graphics on the screens of broadcast teletext and videotext terminals. Second, resolution of differences between transmission standards of the Antiope teletext system being proposed by CBS as a US broadcast standard and the Telidon teletext system being proposed for Canada made it possible for teletext broadcasts in either country to be received on standard teletext receivers in the other.

The difficult task of finding technical solutions to accommodate all three systems was made somewhat easier by the common software-based design approach, according to Smith.

Smith also said he expected intense competition in the making of teletext receivers and videotext terminals, and he had been assured by all parties that any applicable North American system patents pertaining to the compatible standards would be made available free of charge to all interested manufacturers.

## **Unitel production employs Ikegami color TV cameras**

A fleet of mobile TV production units has been put into operation by Unitel Production Services Inc., a New York City TV production facility. The system follows an unusual

modular concept that permits the user to rent only the equipment needed, whether it be a small system on a roll-around cart or two trucks carrying six Ikegami color cameras and related equipment.

There are seven units in the Unitel mobile system. Three are mounted on carts for indoor use. The four larger units are carried in vans and trucks. The principal units of the system are the Mobile II and Mobile IIP. The latter is a mobile control room installed in a truck. It incorporates a production switcher, character generator and communication connections with the field crew.

Mobile II is housed in a van with a custom-raised roof on which is mounted a camera platform. The van's equipment consists of four Ikegami HK-312E studio field cameras and two Ikegami HL-798 hand-held cameras, plus associated video and audio recorders and a communication system.

According to Ed Levine, Unitel vice president of technical operations, reliability was an important factor in the selection of the Ikegami cameras for Mobile II.

"Both performance and reliability are especially important for mobile operations," Levine said, "especially reliability when you consider the conditions under which mobile production can and does take place."

## **BBC broadcasts live stereo concert from China**

Listeners to BBC Radio 3, May 17, heard the first live digital stereo concert from China. New digital encoding equipment was used to relay the BBC Symphony Orchestra's concert from the City Hall in Shanghai to the Broadcasting House in London via the Intelsat satellite over the Indian Ocean.

The new equipment, the NICAM 3 (Near Instantaneously Companded Audio Multiplex), was developed by engineers in the BBC's Engineering Research and Designs Departments, and this was its first on-air use. The equipment was designed to convert stereo signals from analog to digital form and then to compress the signal so that up to three stereo pairs could pass over conventional 2048 kilobits digital telephony systems.

The digital signal passed over a mobile radio link from the Concert Hall to the Shanghai Broadcasting Center. It then went via a radio link 750 miles to the satellite ground station at Peking. The signal was beamed

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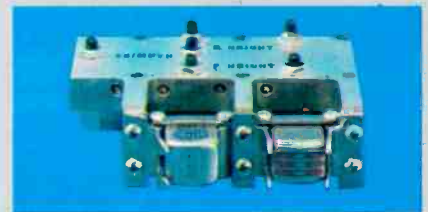
New Cart Hold Down



New Head Design



New Pressure Roller



New Removable Head Module

## Removable Head Module

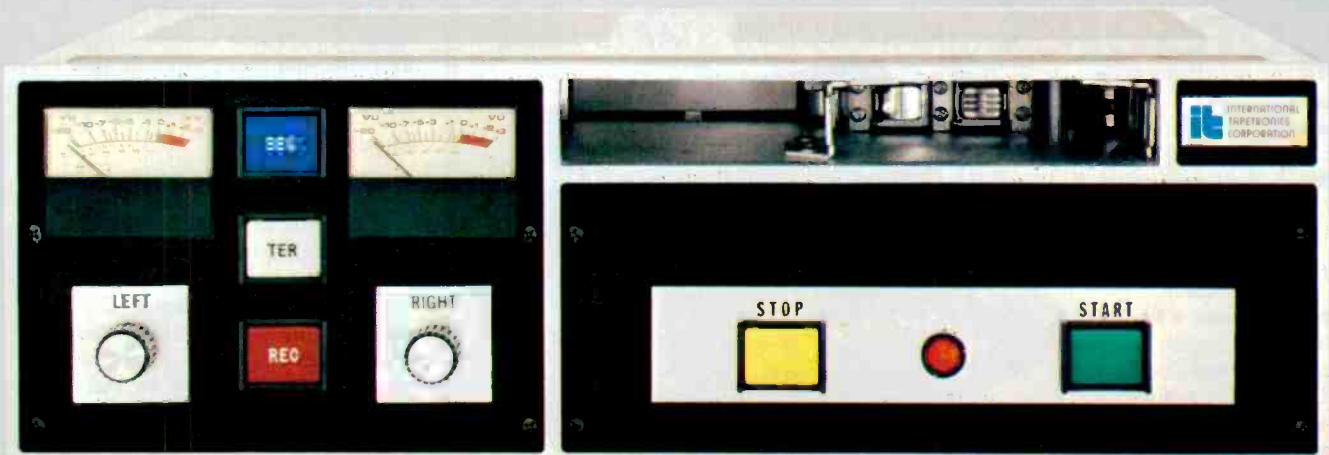
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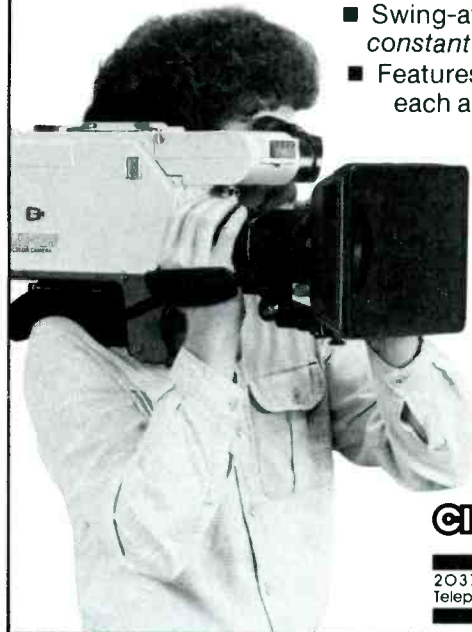
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## News

up to the Intelsat satellite, which is in geostationary orbit over the Indian Ocean, and was picked up by British Telecom at its satellite ground station at Madley in Herefordshire. From there it was fed via conventional circuits to Broadcasting House in London.

### Television becoming expanded information medium

Technological advances are transforming the home TV set into a vital medium of information and service that might change the way many Americans live, according to Stanley E. Basara, division vice president and general manager of RCA Broadcast Systems.

Services available on an experimental basis to some TV viewers—electronic shopping and billing, merchandise catalogs, fire and burglar alarms—should soon be available to many more. Teletext and viewdata are likely to become more widespread, Basara said.

Teletext experiments under way in several US cities and in Europe can provide printed information on such topics as weather, movie schedules and traffic reports. Viewdata, a system that links TV sets with information stored in a computer, can bring the library into the home or provide electronic shopping and billing.

Cable TV can provide 2-way interactive services. A growing number of cable TV systems offer burglar, fire and medical alarm signals that travel upstream on the 2-way cable to a central control point where the signal is monitored.

### NTIA funds satellite educational program

Two grants totalling \$168,559 have been awarded by the Commerce Department's National Telecommunications and Information Administration (NTIA) for a training program on the delivery of public services via communications satellites. The program is aimed at less developed countries and is entitled "Satellite Communications in a Developing World."

Representatives of less developed countries will attend seminars and workshops as part of their training. The number and identity of participating countries have yet to be determined. Others participating in the program include the State Department, Agency for International Development and Intelsat, an international communications organization. □

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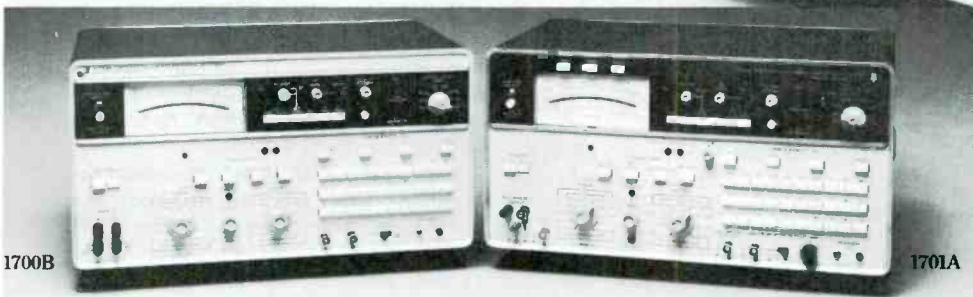
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SOUND TECHNOLOGY Department 3004104

## Master Digital formed

Master Digital Inc., Venice, CA, has been formed recently by Roger Pryor, formerly general manager of Digital Audio for Sony, and Arne Frager, owner and founder of Spectrum Studios in Los Angeles.

The company will provide services in a variety of areas including audiocassette duplication on a one-to-one basis from digital audio masters, digital audio transfer service and changing digital master tapes from format to format without any generation loss, thereby solving digital format problems.

Video music production will also be available, using digital audio soundtracks locked by SMPTE time code for television or cable simulcast and the videodisc/cassette markets.

Additional services will be provided in recording digital audio for video and film producers who desire soundtracks recorded either on location or in studios, and location digital audio recording services and equipment for music producers.

The list of clients currently ranges from companies using high quality audiocassettes duplicated directly from digital audio masters to use for artist approval, radio station or music review, to high end audiocassettes duplicated from major labels for the audiophile market and demonstration cassettes for equipment manufacturers.

A project completed in the last area provides high-end metal audiocassette tapes to be included with each Sony audiocassette player currently being installed in Saab cars.

For more information, contact Master Digital Inc. at (213) 399-1717.

## Harris Corporation wins Argentine contract

Harris Corporation has won an international competition to design and install one of the world's largest domestic satellite communications systems in Argentina. The initial contract is valued at approximately \$30 million.

The company will deliver 38 earth stations to help extend TV, radio, telex and telephone service to the corners of the 2300-mile-long country, which has an area about that of the United States east of the Mississippi.

The Harris Satellite Communications Division will install part of the system this year and complete it in 1982. Argentina's national telephone system, ENTEL, has committed itself to that country's "Project Sovereign-

ty," calling for extension of telecommunications to all border populaces. Twenty-four of the 38 Argentine earth stations will be located in small communities, ranging from the Andes in the northwest to Tierra del Fuego on the continent's southern tip. Three of them will be at Argentine bases in Antarctica.

Eight of the stations will link the remote satellite terminals to the existing microwave and coaxial cable network in the more populated areas of Argentina. Two of them are designated sub-master stations, because they will provide electronic maintenance and control service for all the other stations in their regions.

A master station near Buenos Aires, equipped with a powerful computer, will analyze outgoing calls from every earth station and assign frequency channels for use by the calling station and the destination station in less than a second. Argentina will use an INTELSAT satellite over the Atlantic Ocean to relay its communications traffic.

## Dynatech/U-Z expands product line

Dynatech/U-Z Inc., Culver City, CA, recently announced the expansion of its product line to include custom microwave components.

New products include filters, hybrids, multi-octave directional couplers, power dividers/combiners and variable attenuators.

U-Z has been supplying microwave switches to the industry since 1971.

## Lenco awarded Mexican contract

Televisa S.A. of Mexico has placed an estimated \$350,000 video equipment order with the Electronics Division of Lenco Inc., Jackson, MO. The order includes video test and switching equipment to be used in Televisa's 60 translator locations throughout Mexico.

## 3000 attend Video Forum '81

"Peirce-Phelps 1981 Video Forum was the best ever by numerical attendance; in terms of the professional status of our attendees and exhibitors, and in the industry leaders who spoke at our seminars," said Henry S. Grove III, vice president of Peirce-Phelps Video Systems Division.

Three thousand broadcasting, industry, business and government video professionals visited the 40 ex-

hibitors who were showing the latest equipment and attended the 12 seminars during the event. The 14th annual forum was held May 5-7, 1981 at Peirce-Phelps Corporate Center in Philadelphia, Pa, and May 12-14, 1981 at the Sheraton Inn/Washington-Northeast.

Hosted by Peirce-Phelps Video Systems, combined local meetings of the Society of Broadcast Engineers, the Society of Motion Picture and Television Engineers and the International Television Association were also held at the Forum.

Among the exhibitors were CMX Orrox, Eigen Video, Ikegami Electronics, ISI, JVC, 3M, Panasonic, Sharp, Shure, Sony and Zenith Data Systems.

Seminar speakers included Ken Winslow, Winslow Associates; Mark Heyer, Sony; Sue Miller Buske, National Federation of Local Cable Programmers; and Herbert Schnipper, Satellite Business Systems.

## RCA Americom adds Miami to satellite network

Construction of a \$5.1 million earth station and associated facilities to link the Miami area to its nationwide satellite communications network has been announced by RCA American Communications Inc.

The earth station, located in Medley, FL, will be linked via microwave to company central terminal offices and sales offices.

Other areas in the RCA Americom network include New York, Philadelphia, Chicago, San Francisco, Los Angeles, Houston, Dallas and Atlanta.

The Medley earth station is being constructed on a 10-acre parcel adjacent to the Palmetto Expressway. Initially, it will be composed of an 1800-square-foot building and two 13-meter antennas, each of which will access the company's SATCOM communications satellites positioned over the equator at an altitude of 22,300 miles.

## Bardwell & McAlister moves to larger quarters

Bardwell & McAlister has moved to larger quarters at 7051 Santa Monica Blvd., Hollywood, CA. The move signals an expansion from an area of 12,000 square feet to more than 23,000 square feet.

The new phone number is (213) 466-9361. □



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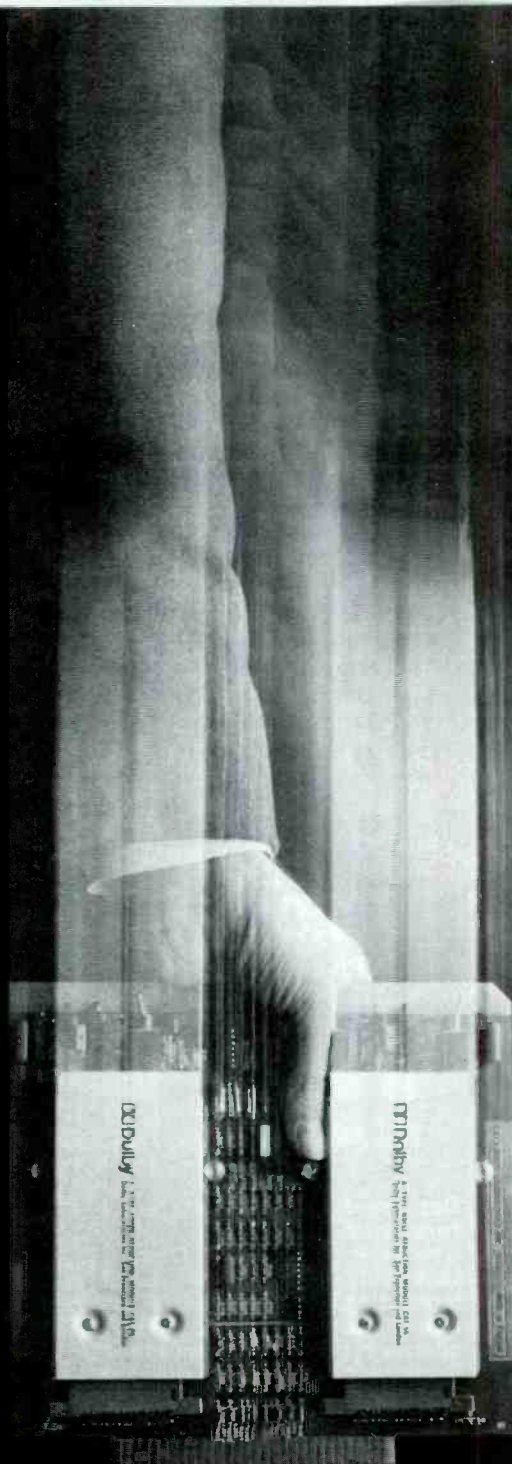
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**Dial changes not supported  
by Canada's private  
broadcasters**

Canada's private broadcasters have released the contents of a letter sent to all members of Parliament urging them not to back a proposal that would require virtually all AM radio stations in the western hemisphere to change dial positions.

The Canadian Association of Broadcasters (CAB) has spent more than two years examining a US government proposal calling for all radio stations to move closer together on the dial in order to make room for new stations. The study concluded that: such a scheme would produce few new stations for Canada in areas where they are needed; the total cost of changing dial positions would range from \$19 to \$36 million; the public would experience severe service disruptions in a changeover; the quality of AM radio would deteriorate and it would be difficult to add new services such as AM stereo.

According to the CAB, 95% of Canada's 400 AM stations would be required to change their dial positions if such a scheme were put into practice by a new international treaty, to be signed later this year, concerning the allotment of frequencies in the AM radio band.

**MST counters FCC's short-  
spaced VHF drop-in proposal**

The FCC's proposal to permit short-spaced VHF drop-ins on an unlimited basis threatens to undermine the system of TV broadcasting according to the Association of Maximum Service Telecasters Inc. One of the commission's primary assumptions is that growing demand for additional TV services—including new commercial networks—cannot be satisfied with the present system. Short-spaced VHF drop-ins are proposed to remedy this supposed deficiency.

MST said it believes that this assumption is wrong. The current system, providing for stations that meet minimum mileage separations and providing for UHF to develop side-by-side with VHF, still affords the best opportunity for additional TV stations. This system can provide the capacity for new networks, more diversity and competition and more ownership opportunities for minorities and public television, and it can do so without the destructive interference that short-spaced VHF drop-ins would cause to the public's VHF service and without their

adverse impact on existing and potential UHF service, MST said.

To emphasize its point, MST has undertaken a number of extensive computer studies and on this basis filed the following counterproposal with the FCC. The counterproposal urges the commission to:

- abandon the proposal for new short-spaced VHF allotments; and
- focus, instead, on the potential of the existing structure, especially for UHF television, to provide for additional full-spaced stations.

The counterproposal demonstrates that the current Table of Allotments, without change, provides for five or more regular full-spaced allotments—enough for four commercial network affiliates and a noncommercial TV station—in 95 out of the top 100 markets, and in 129 of the top 150 markets. It also shows that, if the FCC wishes to do so, it can add to the top 150 markets substantial numbers of new UHF allotments in full compliance with the mileage separation requirements.

**New officers elected for SBE**

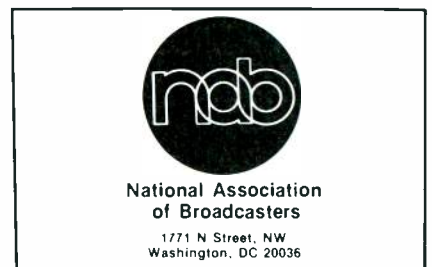
The Society of Broadcast Engineers has elected the following new officers to the Board of Directors.

**President**—Ronald L. Arendall  
Manager of Engineering, WTHR TV,  
Indianapolis, IN.

**Vice President**—Doyle D. Thompson  
Director of Engineering, WTKR TV,  
Norfolk, VA.

**Secretary**—Brad Dick  
Director of Engineering,  
KANU/KFKU, Lawrence, KS.

**Treasurer**—Edwin T. Karl  
Engineer in Charge, KMOX TV,  
St. Louis, MO.



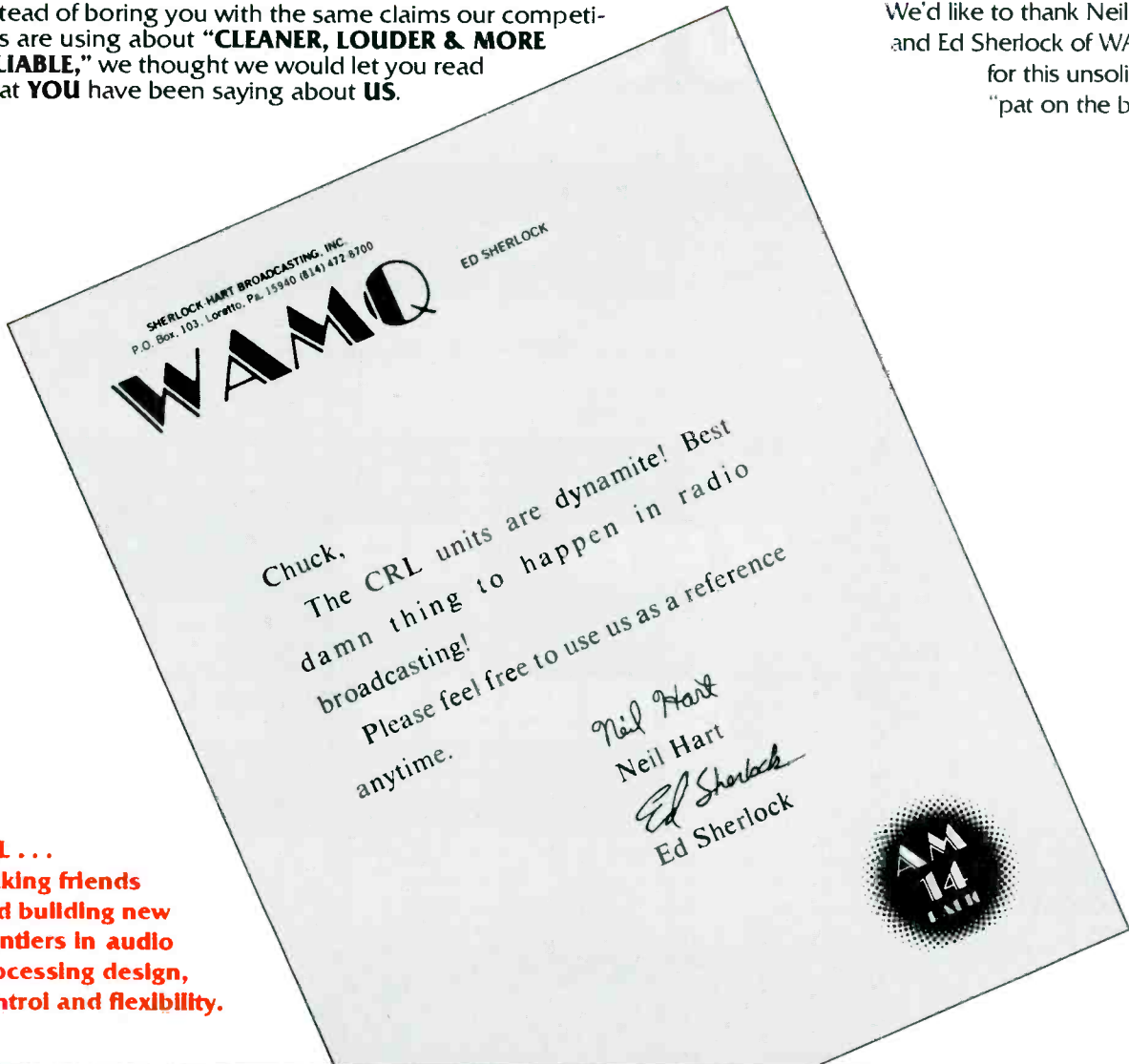
The annual Radio Programming Conference is scheduled for August 16-19, 1981, at the Hyatt Regency Hotel in Chicago, IL.

The agenda for the conference had not been set at press time, however more information may be obtained by contacting NAB, 1771 N St. NW, Washington, DC 20036; (202) 293-3570. □

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Broadway Video is both a production and post-production facility in New York City. Its recent credits

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"The BVE-5000 worked right out of the box and has been performing flawlessly ever since. With no problems of any kind. Unlike some other systems, whose manufacturers wait for customer complaints to get the bugs out, instead of thoroughly testing their equipment *before* it's sold.

"With its simplified keyboard, the BVE-5000 is

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*Randy Cohen, Broadway Video*



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Circle (15) on Reply Card

# State-of-the-art FM audio: A practical guide

by Robert Orban, chief engineer, Orban Associates Inc., San Francisco, CA

The simultaneous advent of modern audio processing and mass market FM receivers capable of high quality sound reproduction has severely escalated the audio quality requirements in FM plants. It is an unhappy fact that any audio processor degrades audio quality to achieve loudness, consistency and absolute peak control. If the processor is well-designed, it will still sound excellent on high quality receivers, provided that the quality of the audio at its input is immaculate. However, a distorted input signal will be further degraded by the processing and may well end up sounding offensive and unlistenable.

Computer people have long used the phrase: "garbage in/garbage out." This is especially true of audio processing, where the rule is: "garbage in/more garbage out."

The purpose of this article is to provide some hints on how to achieve immaculate audio at the processor input terminals. Such a discussion could easily fill a thick book. We can only hope in a limited space to cover the most important points.

## The systems approach

Processing will not be discussed specifically. However, experience in designing processors has clearly shown that it is difficult to obtain optimum results from a set of casually interconnected boxes from different manufacturers—or sometimes, from the same manufacturer. This writer's processing philosophy, therefore, leans strongly toward the system approach: All aspects of the processing are designed to work together harmoniously.

Achieving consistent, state-of-the-art audio quality in FM broadcast is a difficult task, requiring considerable skill, professionalism and great dedication. But, as certain stations with stand-out audio have shown, it is possible.

## DISC REPRODUCTION

Most radio programming still comes from phonograph records, either directly or through tape dubs. I will address the problems of tape later in this article; the current discussion centers on accurately retrieving as much information as possible from the grooves.

Orban is a recognized authority on the ultimate in high quality audio reproduction. In this article, he discusses a number of factors broadcasters and production people should consider in delivering a quality product. Although the author draws from a wealth of experience, the opinions expressed are *personal* and may or may not be shared by others in the industry or by **Broadcast Engineering**.

Disc is intrinsically a high quality medium and much effort has been expended by consumer manufacturers in developing audiophile cartridges, pickup arms, turntables and phono preamps of highest quality. Unfortunately, much of this equipment is not mechanically rugged enough to withstand the pounding that it typically receives in day-to-day broadcast operations. There are few reasonably high quality cartridges that are generally accepted to be sufficiently rugged to withstand professional use and abuse. None produce the same cleanliness and transparency as the best audiophile cartridges.

This phono cartridge dilemma is the prime argument for transferring all disc material to tape in the production studio and playing only tape on the air. In this way, it is possible (with care) to use state-of-the-art cartridges, arms and turntables in the dubbing process because requirements for mechanical ruggedness are relaxed. Also the problem of record wear is eliminated. However, maintaining tape equipment so that it causes no noticeable quality degradation is by no means easy, and the smaller station (particularly one without a full-time engineer) may well be able to achieve superior quality by playing discs directly on the air.

The following should be carefully considered when choosing and installing disc playback equipment:

1. The cartridge must be scrupulously aligned. When viewed from the front, the stylus must be absolutely perpendicular to the disc, or separation will suffer. The cartridge must be parallel to the headshell, or a fixed tracking error will be introduced. Overhang should be set as accurately as possible ( $\pm 1/16$  inch), and vertical tracking angle should be set at  $20^\circ$  (by adjusting arm height).

2. The tracking force must be correctly adjusted. Usually, better sound results from tracking close to the maximum force recommended by the cartridge manufacturer. If the cartridge has a built-in brush, do not forget to compensate for it by adding more tracking force according to manufacturer's recommendations.

3. Anti-skating force must be correctly adjusted. The accuracy of the anti-skating force calibration on many pickup arms is questionable. The best way to adjust anti-skating is to obtain a test record with an extremely high level lateral cut (some IM test records are suitable). Connect the left channel output of the turntable preamp to the horizontal input of an oscilloscope

and the right channel preamp output to the vertical input. Operate the scope in the "X/Y" mode, so that a straight line is visible at a  $45^\circ$  angle. If the cartridge mistracks asymmetrically (indicating incorrect anti-skating compensation), then the scope trace will be bent at its ends. If this happens, adjust the anti-skating until the trace is a straight line, indicating symmetrical clipping.

It is important to note that in live-disc operations, use of anti-skating may increase the incidence of the arm's sticking in damaged grooves instead of jumping over the bad spots. Increasing tracking force by approximately 15% has the same effect on distortion as applying anti-skating, and in live-disc operations, the former expedient may be preferred.

4. A modern, direct-drive turntable must be used. None of the older design professional broadcast turntables have low enough rumble to be inaudible on the air. These old puck-, belt- or gear-driven turntables might as well be thrown away. Don't even hand them down to an AM operation—modern multiband processing will cause the rumble to be audible even on automobile AM radios.

5. Proper turntable mounting is crucial to avoid picking up footsteps or other building vibrations and to avoid acoustic feedback from monitor speakers, which will cause muddiness and severe loss of definition. The turntable is best mounted on a vibration isolator, which in turn is placed on a non-resonant pedestal mounted as solidly as possible to the building (preferably to a concrete slab).

6. Until recently, most "professional" phono preamps were seriously deficient compared to the best "audiophile" preamps. Fortunately, this situation has recently changed, and a small number of high quality professional preamps are available (mostly from small manufacturers). A good preamp is characterized by extremely accurate RIAA equalization, high input overload point (better than 100mV at 1kHz), low noise (optimized for the reactive source impedance of a real cartridge), low distortion (particularly CCIF difference-frequency IM), load resistance and capacitance adjustable for a given cartridge and cable capacitance and effective RFI suppression.

After the preamp has been chosen and installed, the entire disc playback system should be checked with a reliable test record for compliance with the RIAA equalization curve.

(Special note: If you wish to equalize the station's air sound to produce a certain sound signature on the air, the phono preamp is not the place to do it.)

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**"The Originators"**

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## FM audio

Some of the better preamps have adjustable equalizers to compensate for frequency response aberrations in phono cartridges. Because deviations of 0.5 dB can be detected by critical listeners, ultra-accurate equalization of the entire cartridge/preamp system is important.

The load capacitance and resistance should be adjusted according to the cartridge manufacturer's recommendations, taking into account the capacitance of the cables. If a separate equalizer control is not available, load capacitance and resistance may be trimmed to obtain flattest frequency response. Failure to do this can result in frequency response errors as great as 10 dB in the 10-15 kHz region.

The final step in adjusting the preamp is to accurately set the channel balance on the basis of a test record, and finally, to set gain such that output clipping is avoided on any record. If you need to operate the preamp close to its maximum output level because of the system gain structure, put a scope on the output of the preamp and play a loud passage from an audiophile or direct-to-disc record. Set the gain so that at least 6 dB peak headroom is left between the loudest part of the record and peak clipping in the preamp.

7. It is my opinion that the single most significant cause of distorted on-air sound is worn phono styli. Styli deteriorate sonically before any degradation at all is visible under a microscope, because the cause of the degradation is usually deterioration of the mechanical damping and center-

ing system in the stylus (or actual bending of the stylus shank), rather than diamond wear. This deterioration is primarily caused by back-cueing, although rough handling will always make a stylus wear out before its time.

Styli used on-air in 24-hour service should be changed every two weeks as a matter of course. Disc jockeys and the engineering staff should listen constantly for audible deterioration of on-air quality, and should be particularly sensitive to distortion caused by defective styli. Such styli should immediately be replaced when problems are detected. One engineer I know destroys old styli upon replacing them so that he is not tempted to keep a stock of old, deteriorated, but usable-looking styli.

It is important to maintain a stock of new spare styli for emergencies or for routine periodic replacement. There is no better example of false economy than waiting until styli fail before ordering new ones or hanging onto worn-out styli until they literally collapse. Note also that smog- and smoke-laden air may seriously contaminate and damage shank mounting and damping material. Some care should be used to seal your stock of new styli to prevent such damage.

8. There are several impulse noise reduction systems currently available that effectively reduce the effects of "tics" and "pops" in disc reproduction without significantly veiling audio quality. They are particularly useful in live-disc operations where discs tend to become worn and damaged. The Burwen TNE-7000 is effective in removing small "tics"; the SAE 5000 works well on larger scratches. Both

devices can be connected in series at the output of the phono preamps to virtually eliminate the effects of disc damage. They must not be used elsewhere in the chain (such as in the program line), because the supersonic energy necessary to trigger their control circuitry will probably be rolled off.

9. Do not forget that records wear out, particularly when tracked at 3-gram forces. Live disc operations should save spare copies of promo records for use when the originals wear out, rather than giving them away to the production director's friends. Frequently played cuts should be transferred to tape or cart; although the copy will initially sound inferior to the original, 50 plays down the road the tape should sound about the same, whereas the disc would be seriously deteriorated.

## TAPE

Despite its undeniable convenience, the tape cartridge (even at the current state-of-the-art) is still inferior to reel-to-reel in almost every performance aspect. Unlike the sometimes mystical sonic differences attributed to preamps and amplifiers, performance differences between cart and reel are readily measured and include differences in frequency response, noise, high frequency headroom, wow and flutter and, particularly, azimuth and interchannel phasing stability.

### Sum-and-Difference Recording

Because it is vital in stereo FM broadcast to maintain mono compatibility, sum-and-difference recording is preferred in either reel or cart operations. This means that the mono sum signal (L + R) is recorded on one track, and the stereo difference signal (L-R) is recorded on the other track. A matrix circuit restores L and R upon playback. In this system, interchannel phase errors cause frequency-dependent stereo-field localization errors rather than deterioration of the frequency response of the mono sum.

Several manufacturers make external sum-and-difference matrix processors to be used in the cart machines' input and output lines; at least one manufacturer incorporates a compandor-type noise reduction system within the same package.

### Cheap Tape

Cheap tape, whether reel or cart, is a temptation to be avoided. Cheap tape may suffer from any or all of the following problems:

- Sloppy slitting, causing the tape to weave across the heads, or, if too wide, to slowly cut away the tape guides
- Poor signal-to-noise ratio

### Suggested Reel-to-Reel Recorder Maintenance

This maintenance schedule, suggested by ITC, is intended as a guide for maintaining a unit in optimum condition, and is for units in routine daily use. The schedule may be varied depending on a particular machine duty cycle. The intent is to develop a schedule to allow maximum use with minimum maintenance time. In most cases, this maintenance schedule will enable you to pinpoint potential trouble areas before they become problems that may potentially remove the machine from service. (Check the manual for your particular recorder for specific maintenance procedures and schedules.)

	DAILY	WEEKLY	MONTHLY	6 MONTHS
CLEAN HEADS, PRESSURE ROLLER, TAPE GUIDES, TAPE GUIDE POSTS, AND IDLER ARM	•			
CLEAN FRONT PANEL OVERLAY, HEAD COVER, AND ESCUTCHEON		•		
DEGAUSS ALL HEADS AND TAPE GUIDES			•	
CHECK HEAD AZIMUTH, ZENITH, HEIGHT			•	
CHECK FREQUENCY RESPONSE - EQUALIZATION			•	
CHECK BRAKE SLIP TORQUE				•
CHECK TORQUE MOTOR TORQUE				•
CHECK CAPSTAN MOTOR SPEED (HIGH AND LOW SPEED)				•
CHECK PRESSURE ROLLER PRESSURE				•
LUBRICATE CAPSTAN MOTOR				•
CHECK RECORDER BIAS AND EQUALIZATION			•	
CHECK RECORDER METER CALIBRATION				•
CHECK 25 H <sub>z</sub> TONE DETECTOR SENSITIVITY (IF APPLICABLE)				•
CHECK INPUT, OUTPUT LEVEL CALIBRATION				•

Courtesy of International Tapetronics Corporation



# DBX HELPS KMJQ WORK MAJIC.

Majic. It's a black format that's living up to its name in several markets across the country. And perhaps the biggest success story is Houston's KMJQ. Back in 1977, KMJQ adopted the Majic format and went from near bottom to #1 in just 2 short Arbitrons.



Yet KMJQ was the softest station on the dial.

"To achieve our goal," explains Chief Operator Leroy Dietrich, "we placed a lot of emphasis on the quality of the sound. By the day we started the Majic format, we had built a technical ability that we think is probably one of the best in the country.

"We hired an audio consultant to get us started," continues Dietrich. "He installed P 303 pre-amps and MC20 moving coil cartridges on SL-1100A turntables. Then he recommended dbx equipment for definition and dynamics."



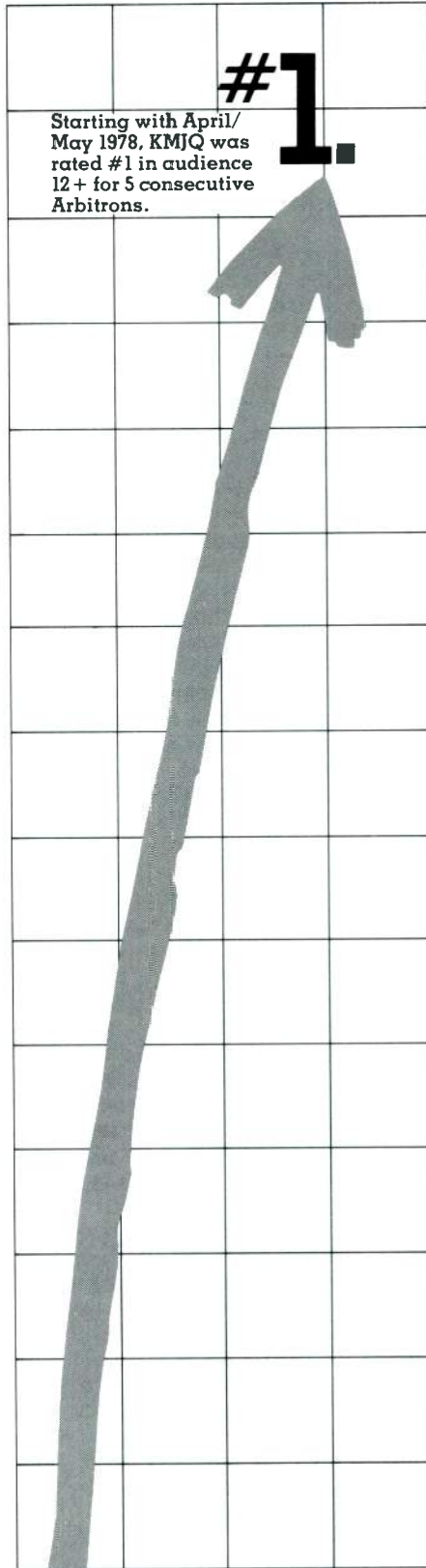
KMJQ installed dbx tape noise reduction on all their cart machines. Not just for their program material, but for their commercials, too. "That keeps our advertisers happy because their commercials sound as clean as our music," says Dietrich. "And



we use a dbx Model 500 subharmonic synthesizer to restore the low end.

It makes the station sound especially well balanced. Even at low listening levels."

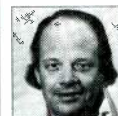
KMJQ also needed a compressor/limiter - but they didn't want to ruin the sound quality they had worked so



hard to get. "After hearing how smooth the dbx 165 compressor/limiter works, there is no doubt in my mind that it's the best limiter I've ever heard in my life. We use it on voices, and it gives us the control we need without sounding like we have any control."



As you'd expect, KMJQ has constantly been making subtle technical changes to maintain their leadership position. "Due to competitive forces in the market, we've had to crank our signal up louder. Without dbx tape noise reduction on our carts, the noise would have been cranked up, too. Now I'm happier than ever that we're fully dbx'ed," says Dietrich. "We not only get the sound we want, but the whole system is incredibly reliable - bulletproof."



Dietrich summarizes his feelings about KMJQ's technical product by saying, "A lot of this is subtle stuff, psychoacoustics. But people comment to us that our station sounds more like the record they bought than the other stations do. A psychological thing, agreed. But it all adds up when you start reading the Arbitrons."

For more information on dbx's complete line of equipment for the broadcast industry, write Professional Products Division, dbx, Incorporated, 71 Chapel St., Newton, Mass., 02195, USA. Tel. (617) 964-3210. Telex: 92-2522. Distributed in Canada by BSR (Canada) Ltd., Rexdale, Ontario.

Circle (17) on Reply Card

## FM audio

- Poor high frequency response and/or high frequency headroom
- Inconsistency in sensitivity, bias requirements or record EQ requirements from reel to reel, or even within a reel
- Splices within a reel
- Oxide shedding, causing severe tape machine cleaning and maintenance problems
- Squealing due to inadequate lubrication.

High-line, name-brand tape is a good investment. It provides initial high quality and guarantees that recordings will be resistant to wear and deterioration as they are played. Whatever the choice of tape, you should standardize on a single brand and type to assure consistency and to minimize tape machine alignment problems. Some of the most highly regarded tapes in current use (1980) include: Agfa PEM 468, Ampex 406, Ampex 456, BASF SPR-50 LHL, EMI 861, Fuji type FB, Maxell UD-XL, TDK GX, Scotch (3M) 206, Scotch 250, Scotch 226 and Sony SLHII.

It goes almost without saying that cheap carts are to be avoided, considering that even the best carts provide barely adequate quality. Because carts will interact with different transport designs in different ways, one of the best ways to choose a cartridge brand is to make extensive tests on the in-house cart machines, and to choose the brand exhibiting the best interchannel phase stability and lowest wow and flutter with the particular machines.

### Tape Speed

If all aspects of the disc-to-tape transfer receive scrupulous care, then the quality difference between 15 ips (38 cm/s) and 7.5 ips (19 cm/s) recording is easily audible; 15 ips has far superior high frequency headroom. The effects of dropouts and tape irregularity are also reduced, and the effects of interchannel phase shifts are halved. Also, a playback machine can deteriorate (due to oxide buildup on the heads or incorrect azimuth) far more severely at 15 ips than at 7.5 ips before an audible change occurs in audio quality.

Nevertheless, because of playback time limitations at 15 ips, most stations operate at 7.5 ips (Many carts will not operate reliably at 15 ips and are subject to jamming and other problems.) This seems to be the lowest that is practical for use in day-to-day broadcast practice. Although 3.75 ips can produce good results under carefully controlled conditions, there are few operations that can keep

playback machines maintained well enough to obtain consistent high quality 3.75 ips playback day in and day out. Also, use of 3.75 ips results in another jump in sensitivity to bad tape, high frequency saturation and interchannel phase shifts.

The use of cassettes as a serious broadcast program source is currently being promoted in some sectors. I feel that cassettes' low speed, tiny track width, sensitivity to dirt and tape defects and severe high frequency headroom problems demand careful engineering evaluation of such proposals to ascertain whether consistent quality is obtainable in real-world operations.

### Use Of Noise Reduction

In order to reduce or avoid tape hiss, I recommend use of a compandor-type (encode/decode) noise reduction system in all tape operations. The two well-accepted systems are Dolby and dbx. In general, the more noise reduction a compandor noise reduction system attempts to deliver, the greater the danger of such audible side effects as breathing and mistracking between encode and decode sections. The selection should be made by deciding which is more important to you: a high amount of noise reduction or freedom from side effects.

If you choose Dolby, bear in mind that to achieve accurate Dolby tracking, record and playback levels must be matched better than 2 dB (preferably 1 dB). The Dolby tone should faithfully be recorded at the head of all reel-to-reel tapes, and level matching should be checked frequently. There should be no problem with level matching if tape machines are aligned weekly, because level standardization is part of this procedure. If a different type of tape is put in service, record machines must immediately be aligned to the new tape before any recordings are made.

In my opinion, all single-ended (for example, dynamic noise filter) noise reduction systems cause totally unacceptable audible side-effects (principally program-dependent noise modulation) when used with music, and should never be used on-line. They may have their place in the production studio, but even there they must be used judiciously, with their operation constantly monitored by the station's "golden ears." Some possible applications include noise reduction of outside production work and, when placed after the microphone preamp, reduction of ambient noise in the control room or production studio.

### Tape Recorder Maintenance

Regular maintenance of magnetic

tape recorders is of vital importance in achieving consistently high quality sound. Maintenance of tape machines requires expertise and experience. Here are a few suggestions:

1. Heads and guides should be cleaned every four hours of operation.

2. Tradition has it that machines should be demagnetized every eight hours. In my experience, magnetization is usually not a problem in playback-only machines in fixed locations. A magnetometer with a  $\pm 5$  Gauss scale (R. B. Annis Co., Indianapolis, IN) should be used to periodically check for permanent magnetization of heads and guides. You will soon obtain experience on how long it takes for your machines in your environment to pick up enough permanent magnetization to be harmful. You may well find that this never happens with playback machines. Record machines must be watched much more carefully.

3. Deterioration of tape machine performance is usually gradual, not catastrophic. It is therefore necessary to measure the performance of an on-air machine weekly with standard test tapes, and to take whatever corrective action is necessary if the machine is not meeting specifications.

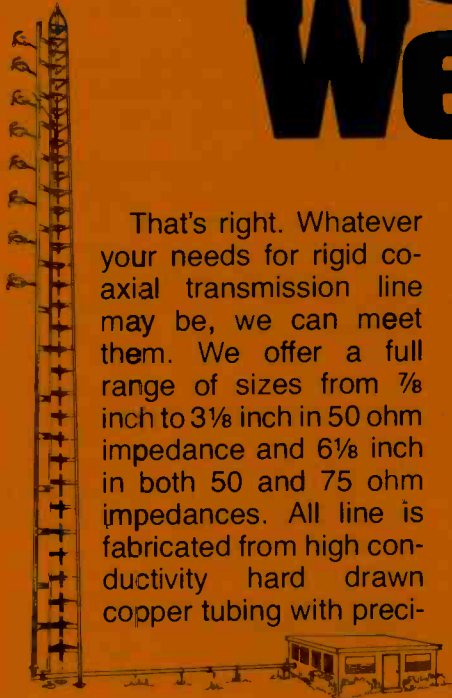
4. Weekly maintenance should include measurement of flutter, using a flutter meter and high quality test tape. Deterioration in flutter performance is often an early warning of impending mechanical failure. Spectrum analysis of the flutter can usually relate the flutter to a single rotating component. Deterioration in flutter performance can, at the very least, indicate that adjustment of reel tension, capstan tension, reel alignment or other mechanical parameter is required.

5. Weekly maintenance should also include measuring frequency response and interchannel phase shifts with a high quality alignment tape. These measurements, which are expedited by the use of special swept-frequency or pink noise tapes available from some manufacturers (such as MRL), provide an early indication of loss of correct head azimuth or of head wear. (The swept tapes are used with an oscilloscope; the pink noise tapes with a third-octave real-time analyzer.)

If a head becomes worn, do not try to compensate by adjusting the playback equalizer. This will increase noise unacceptably and will also introduce frequency response anomalies because the equalizer cannot accurately compensate for the shape of the roll-off caused by a worn head. Instead, the head must be replaced or lapped.

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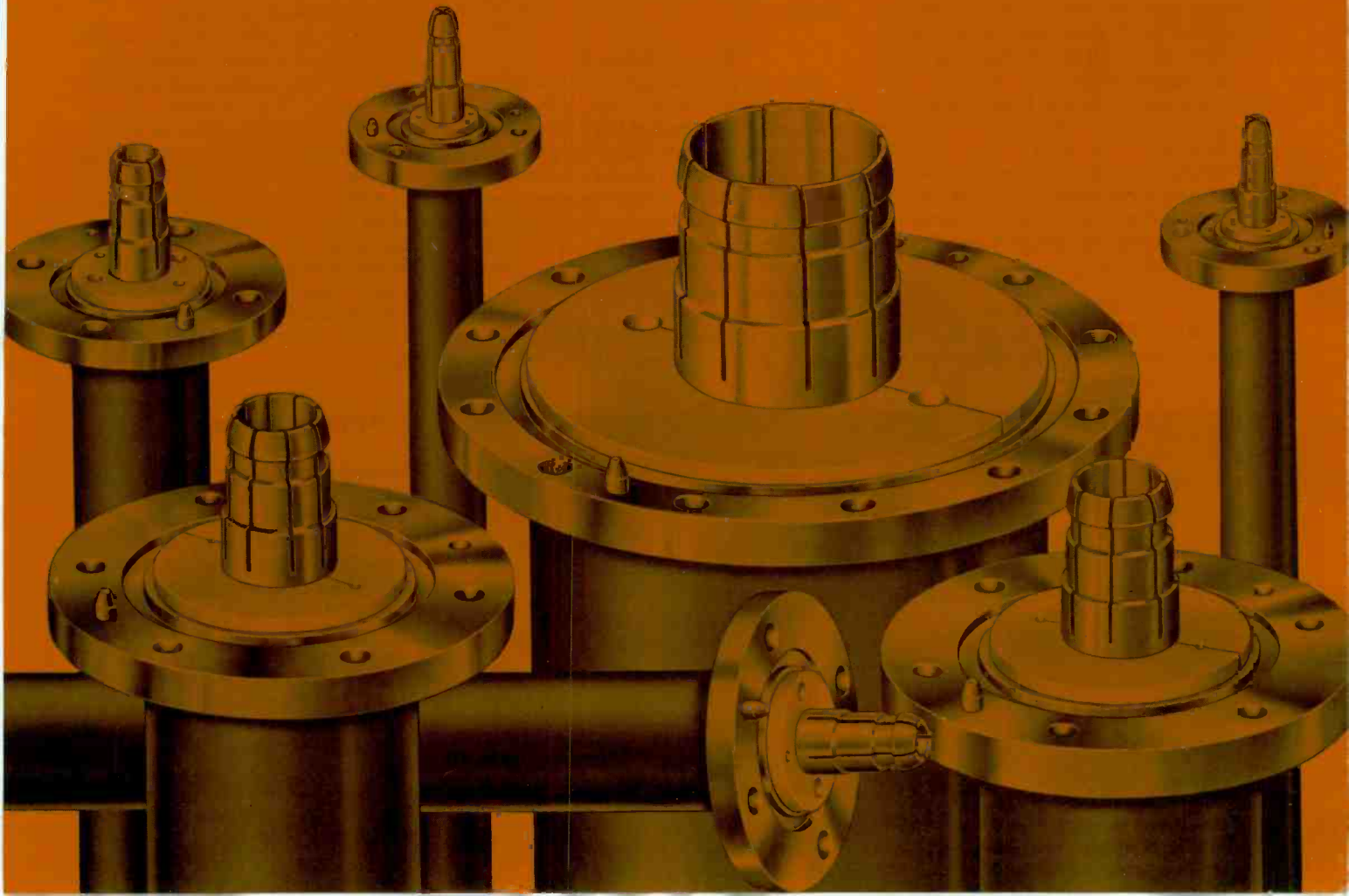
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## FM audio

aware that alignment tapes wear out. With wear, the output at 15 kHz may be reduced by several decibels. If you have many tape machines to maintain, it is usually more economical to make your own secondary standard alignment tapes to use for weekly maintenance, reserving your standard alignment tapes for reference use.

Do-it-yourself alignment tapes are best made with the traditional series of discrete tones. Begin by aligning the playback section of the master recorder on which the homemade alignment tape is to be recorded, using a fresh standard alignment tape.

### Coarse Azimuth

First obtain a coarse adjustment by peaking the level of the 15 kHz tone on the alignment tape, making sure that you have found the *major* peak. (There will be several minor peaks, many decibels down. You will not encounter these unless the head is totally out of adjustment.)

### Reproduce Equalization

Run the alignment tape and adjust the reproduce equalizers for flat high frequency response and for low frequency response which corresponds to the fringing table supplied with your alignment tape. The fringing effect appears below 500 Hz and ordinarily will result in an apparent bass boost of 2-3 dB at 100 Hz, because the alignment tape was recorded full-track and is being reproduced on a half-track head. (Fine azimuth adjustment will not work correctly if the playback equalizers are not set for identical frequency response, because non-identical frequency response will also result in non-identical phase response.)

### Fine Azimuth

This adjustment is ideally made with a full-track mono pink noise tape

and a real time analyzer. If this instrumentation is available, sum the two channels together, connect the sum to the real time analyzer, and adjust the azimuth for maximum high frequency response.

Other possibilities include observing the mono sum of a swept-frequency tape and maximizing its high frequency response, or aligning by ear by listening to the mono sum of the announcer's voice on the standard alignment tape and adjusting for crispest sound. (The azimuth on the announcer's voice will be just as accurate as the rest of the tape).

If the traditional Lissajous pattern is used, use several frequencies and adjust for minimum differential phase at *all* frequencies. Using just one frequency (for example 15 kHz) can give erroneous results.

### Calibration

After the azimuth has been carefully adjusted and the playback equalizer adjusted for maximally flat response from the standard alignment tape, write down the actual VU meter reading produced at each frequency on the spot-frequency standard alignment tape. Use the fringing table by *subtracting* the compensation from the readings you have made. You will use the *compensated* readings below when you are recording your tape, because you are recording in half-track stereo instead of full-track mono.

### Record Azimuth

Record your alignment tape using an audio oscillator. First, adjust the azimuth of the *record* head by observing the mono sum from the playback head and exciting the record amplifier with pink noise, swept tones or wide-range music (for by-ear adjustment). If you use a Lissajous pattern, be sure to use several frequencies, as was previously mentioned.

### Recording The Tape

You are now ready to record the

spot frequencies on tape. Set the VU meter to "playback" and observe the reading as each tone is recorded. Adjust the tape recorder Record Gain immediately after each frequency is switched until the VU meter reads the same as it did when you were playing the standard alignment tape. Your homemade tape should have an error of only 0.5dB or so if you follow these steps carefully.

Remember that your homemade tape will deteriorate with use; check it frequently against your standard reference tape.

The homemade tape is not suitable for critical azimuth adjustments. These should be made using the methods described previously, employing a test tape recorded with a full-track head. Even if you happen to have an old full-track mono machine around, getting the azimuth *exactly* right is not practical, and a standard commercial alignment tape should be used for azimuth adjustments. Because ordinary wear does not affect the azimuth properties of the tape, it should have a long life if properly stored.

Special note: All test tapes should be stored tails-out (under controlled tension) in a temperature- and humidity-controlled environment. Neither edge of the tape pack should touch the reel flanges. This cannot be achieved unless the tape is wound onto the storage reel in normal PLAY mode, not in fast forward or rewind.

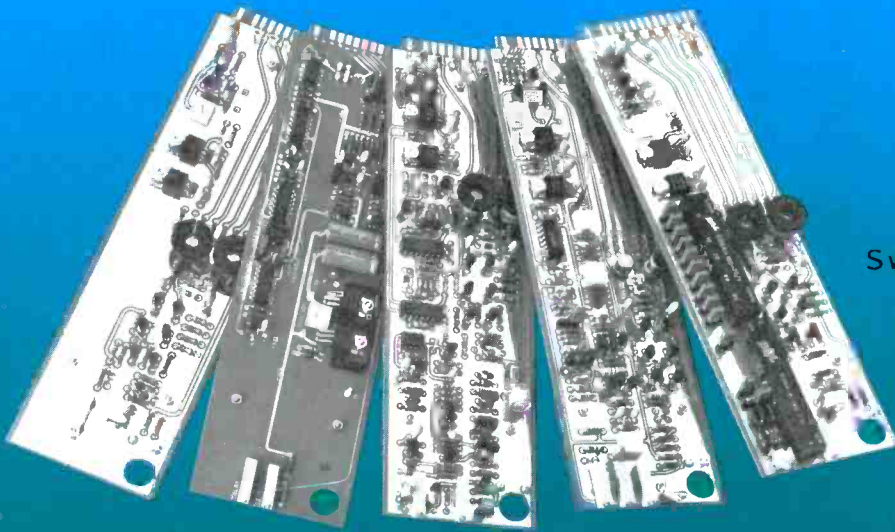
6. After the reproduce section of the tape machine is aligned, record alignment should be checked and adjusted as necessary. This involves setting record head azimuth, bias, equalization and meter calibrations according to manufacturer's recommendations. I recommend that tape machines be adjusted so that +4 dBm in and out corresponds to "0 VU" on the tape recorder's meter, and also to Dolby level and "Standard Operating Level." This is ordinarily 185nW/m for standard tape and 250nW/m for high output tape.

### KYA audio productions

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Circle (19) on Reply Card

## FM audio

Current practice calls for adjustment of bias by the "high-frequency overbias" method rather than by the "peak bias with 15mil wavelength" method, as was formerly standard practice. Briefly, bias is adjusted by recording a 1mil wavelength on tape (5kHz at 7.5ips) and increasing bias until maximum output is produced from the tape. Bias is then further increased until the output has decreased by a fixed amount, usually 1.5-3dB. The correct amount of decrease is a function of both tape formulation and

width of the gap in the record head. The tape manufacturer's datasheet should be consulted.

8. Last, but no means least, keep it clean. Dust is a great destroyer of precision mechanical parts (and cigarette smoke is not good either.) In addition to keeping dust away from the heads and guides, periodically clean the rest of the machine with a vacuum cleaner (suction mode) or soft clean paint brush.

### Cartridge Machine Maintenance

The general comments above apply to cart machines as well. However, these devices have their own set of

idiosyncracies, largely because much of the tape guidance system is in the cartridge and is thus subject to the vagaries of the construction of the individual carts.

1. Because the lubricated tape deposits lubricant on pressure rollers and guides, frequent cleaning is advisable to assure lowest wow and flutter and to prevent possible cart jams. Cleaning should be performed as often as experience proves necessary. (Interestingly, because of the nature of the tape lubricant, it does not tend to deposit on head, gaps, and head cleaning is rarely required.)

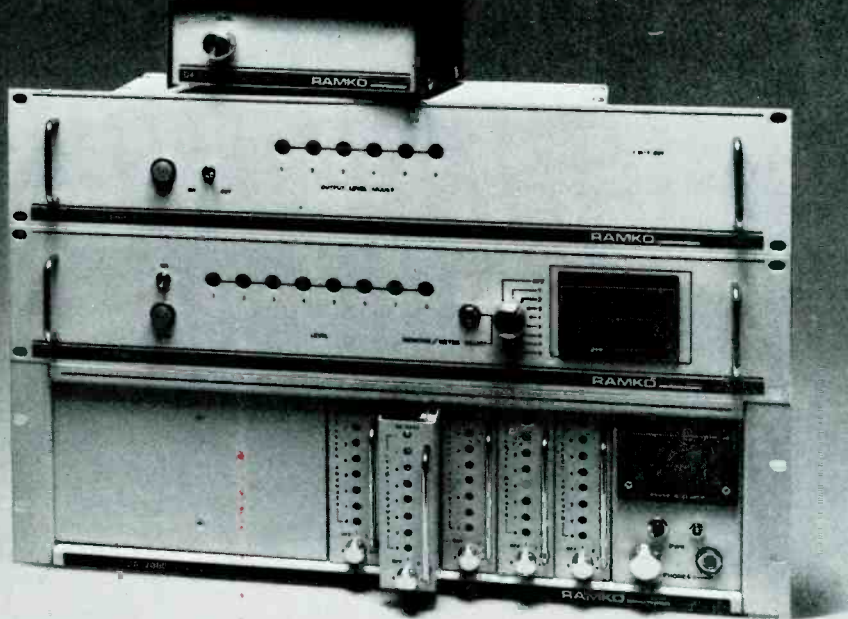
2. Even with the best maintenance, interchannel phase shifts in conventionally designed cart machines will usually prove troublesome. Check head alignment frequently. Also, different brands of cart will show significant differences in phase stability in a given brand of machine. Run tests on various brands of cart and standardize on the one offering best phase stability.

3. Because of the vast differences in design among manufacturers, it is difficult to provide much more specific advice. Precisely follow manufacturer's instructions regarding periodic maintenance, mechanical alignment, tensioning and lubrication.

4. Many early (and some not-so-early) cart machine designs were saddled with completely inadequate electronics. Considerable improvement can be achieved in some of these machines by electronics' modifications. Check electronics for record-amplifier headroom (be sure the amplifier can completely saturate the tape before it clips); record-amplifier noise and equalization (some record amplifiers can actually contribute enough noise to dominate the overall noise performance of the machine; playback preamp noise and compliance with NAB equalization; power supply regulation, noise and ripple; and line amplifier headroom. Check the alignment of the record level meter. (In order to improve apparent signal-to-noise ratio at the expense of distortion, some meters are calibrated so that "0" corresponds to significantly more than 1% third-harmonic distortion.)

Probably the most universal problem is inadequate record amplifier headroom. In many cases, it is possible to improve the situation by increasing the operating current in the final record-head driver transistor close to its power dissipation limits. This is usually done by decreasing the value of emitter (and sometimes collector) resistors while observing the collector voltage to make sure that it stays at roughly half the power supply voltage under quiescent conditions,

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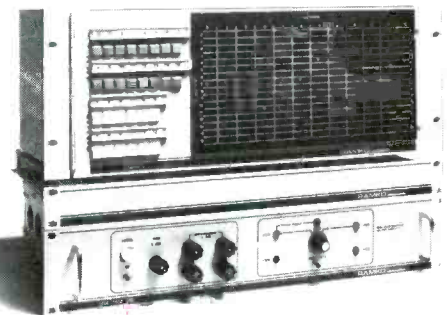
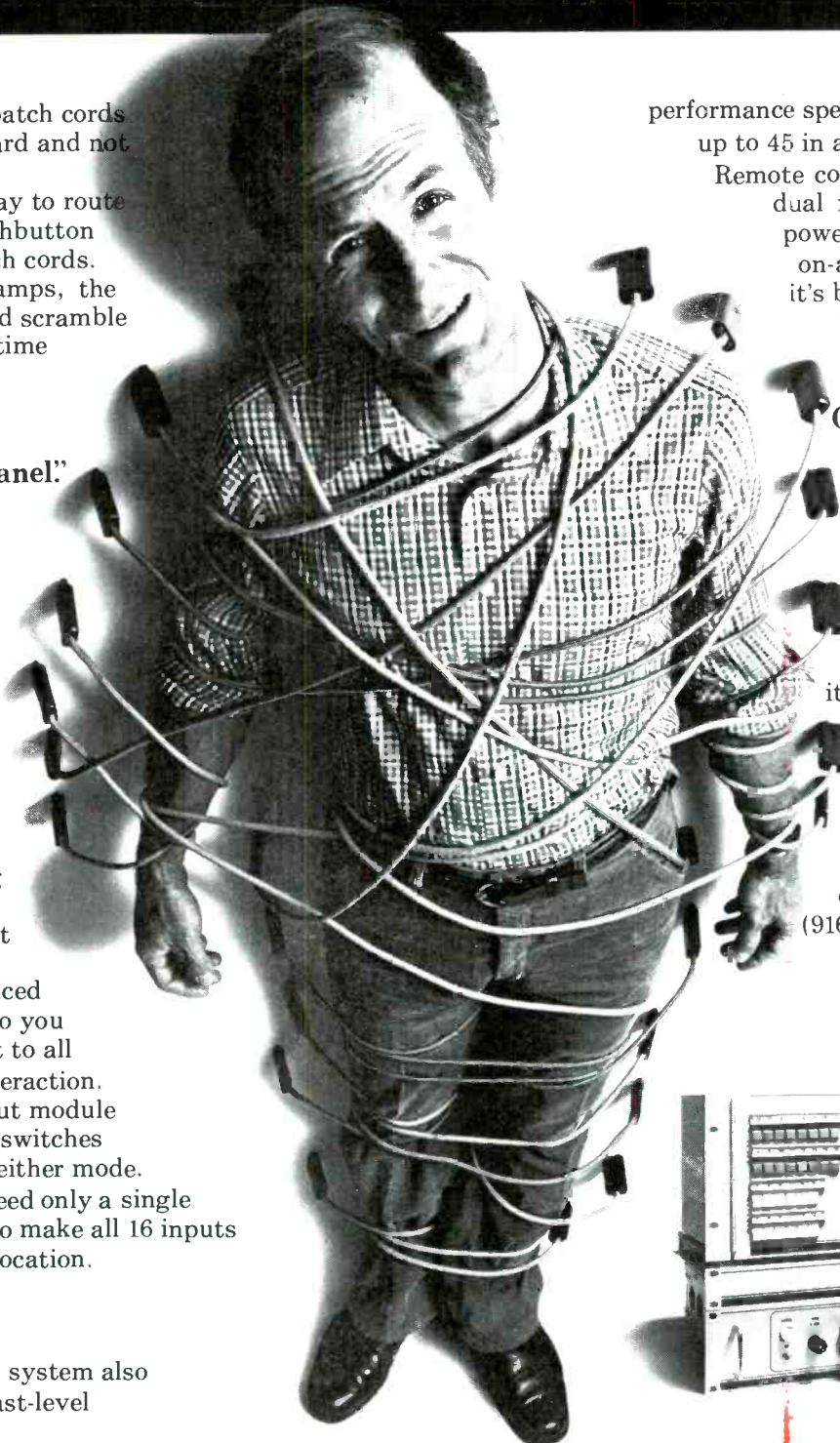
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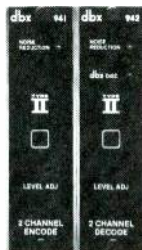
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## FM audio

and adjusting the bias network as necessary if it does not.

### SYSTEM CONSIDERATIONS

Other than bad styli, the single most common cause of distorted air sound is probably clipping. The gain and overload point of every electronic component in the station must be critically reviewed to make sure that components are not being operated so that they introduce clipping distortion or excessive noise.

VU meters are worthless for checking peak levels. Even Peak Program Meters are not fast enough to indicate clipping of momentary peaks, because their integration time is approximately 10 ms. Although the design of PPM's makes them excellent for monitoring operating levels in media with limited dynamic range (such as magnetic tape), in which small amounts of peak clipping are acceptable to achieve optimum signal-to-noise ratio, there is no excuse for any clipping at all in the purely electronic part of the signal path, because low noise and wide dynamic range are readily achieved with good design. For this reason, the peak levels should be monitored with a true peak-reading meter or with an oscilloscope, and gains should be adjusted so that peak clipping never occurs under any reasonable operating conditions (including sloppy disc jockey gain riding.)

In the case of older equipment with soft clipping characteristics, it may be impossible to see a well-defined clipping point on a scope. Worse, audible distortion may occur many decibels below the apparent clip point. In this case, the best thing to do is to determine the peak level producing 1% THD and to arbitrarily call this level the clipping level. The scope can be calibrated to this 1% THD point and headroom measurements can then be made.

The canny engineer will also be aware that certain system components (such as microphone or phono preamps) have absolute input overload points. Difficulties often arise when gain controls are placed after early active stages, because the input stages can be overloaded without clipping the output. Many broadcast mic preamps are notorious for low input overload points and can easily be clipped by high output mics and/or screaming disc jockeys. Similar problems can occur inside consoles if gain structures and operating points have been poorly chosen by the console designer or if master gain controls are operated

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## FM audio

with unusually large amounts of attenuation.

When operating with nominal line levels of +4 or +8dBm, the absolute clipping point of the line amplifier becomes critical. The headroom between nominal line level and the amplifier clipping point should be greater than 16dB. This implies that a line amplifier for a +4dBm line should clip at +20dBm or above, and that an amplifier for a +8dBm line should clip at +24dBm or above. In particular, it means that IC equipment (which almost always clips at +20 dBm or so unless transformer-coupled) is not suited for use with +8dBm lines. The +4dBm lines have become standard in the recording industry and are preferred for all studio construction (recording or broadcast) because of their compatibility with IC op-amp operating levels.

The following components of a typical FM audio plant should be checked for operating level and headroom:

- Phono preamps
- Tape and cart preamps
- Record amplifiers in tape machines
- Microphone preamps
- Console summing amplifiers
- Line amplifiers in consoles, tape recorders, etc.
- Distribution amplifiers (if used)
- Signal processing devices such as equalizers
- Specialized communications devices, including remote broadcast links and telephone interface devices
- STLs, whether land-line or microwave.

### Voice/Music Balance

The VU meter is deceptive in indicating voice/music balance. The most artistically pleasing balance between voice and music usually results from peaking voice 4-6dB lower than music on the console VU meter. If heavy processing is being used, this factor may have to be increased further.

Following this practice will also help to reduce the possibility of clipping voice (which is much more sensitive to clipping distortion than most music) in the electronics.

It is sometimes difficult to train operators to follow this practice. If the console has (or can be modified to have) separate summing amplifiers for live voice and music, then the correction factor is easily automated by building a separate summing amplifier (using a single IC op-amp) to drive the VU meter, and summing the output of the voice summing amplifier into the VU amplifier with greater

gain than the output of the music summing amplifier.

### Electronic Quality

FM has certain limitations that prevent it from ever becoming a transmission medium totally satisfying to the "golden-eared" audiophiles. These limitations must be considered when discussing the quality requirements for FM electronics. The problems in disc and tape reproduction that have been discussed are much more gross by comparison, and the subtle masking of basic FM transmission limitations is irrelevant to those discussions.

There are three fundamental limitations. The first is multipath distortion. In most locations, a certain amount of multipath is unavoidable, and this is exacerbated by the inability of many apartment-dwellers to use rotor-mounted directional antennas.

The second is the bandwidth limitation of the FM stereo multiplex system, which is theoretically 19kHz but is practically limited by the characteristics of real-world filters to between 15 and 17kHz.

The third is the IF bandwidth of receivers necessary to eliminate adjacent and alternate channel interference. This effect can be clearly heard by using a tuner with switch-selectable IF bandwidth. Most stations cannot be received in wide mode because of interference. But if the station is reasonably clean (well within the practical limitations of current broadcast practice) and free from multipath, then a clearly audible reduction in high frequency "grit" is heard when switching from normal to wide mode.

These limitations have considerable significance in gauging cost-effectiveness in current broadcast design practice. Most of the older design broadcast electronic equipment (whether tube or transistor) is measurably and audibly inferior to properly designed modern equipment. This is primarily due to a design philosophy that stressed ruggedness and RFI immunity over distortion and noise and to the excessive use of inferior transformers. Frequency response was purposely rolled off at the extremes of the audio range to make the equipment more RFI-immune. Cascading equipment of such design tends to increase both distortion and audible frequency response roll-offs to unacceptable levels.

Modern design practice emphasizes the use of high-slewrate, low-noise IC operational amplifiers such as the Signetics NE5534 family and the Texas Instruments TL070 family. Although some designers insist that

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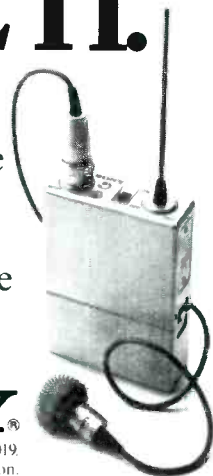
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## FM audio

only discrete designs can provide ultimate quality, the performance of the best of the current ICs is so good that discrete designs are just not cost effective for broadcast applications when the basic FM quality limitations are considered.

It has recently been discovered that capacitors have a subtle, but discernible effect upon sonic quality. Polar capacitors, such as tantalums and aluminum electrolytics, behave differently than ideal capacitors. In particular, their high dissipation fac-

tor and dielectric absorption can cause significant deterioration of complex musical waveforms. Ceramic capacitors have problems of similar severity. Polyester film capacitors can cause a similar, although less severe, effect when audio is passed through them.

For this reason, dc coupling between stages, which is easy with op-amps operated from dual positive and negative power supplies, is best. Coupling capacitors should be used only as absolutely necessary (to keep dc offsets out of faders, thus preventing scratchiness, for example). If capacitors must be used, film types

such as polystyrene, polypropylene or polycarbonate are preferred.

If it is impractical to eliminate capacitors or to change capacitor types, do not be too concerned. It is probable that other quality-limiting factors will largely mask the capacitor-induced degradations.

It goes almost without saying that the number of transformers in the audio path should be kept to an absolute minimum. Transformers are sometimes the only practical way to break ground loops and/or eliminate RFI. If a transformer is necessary, use a high quality device such as those designed by Deane Jensen and manufactured by Reichenbach Engineering, North Hollywood, CA.

In summary, the path to highest quality is that which is closest to a straight wire. More is *not* better: every device removed from the audio path will yield an improvement in clarity, transparency and fidelity. Use only the *minimum* number of amplifiers, capacitors and transformers. Never leave a line amplifier or compressor in "test" mode on line because it seems too much trouble to take it out. Small stations often sound dramatically superior on the air to their big-time rivals because the small station has a simple audio path, while the big-budget big-timer has thrown everything but the kitchen sink on line. The more equipment the station has (or can afford), the more restraint and self-discipline is required to keep the audio path simple and clean. Every amplifier, resistor, capacitor, transformer, switch contact, patchbay contact, etc., is a potential source of audio degradation. Corrosion of patch-bay contacts and switches can be particularly troublesome, and the distortion caused by these problems is by no means subtle.

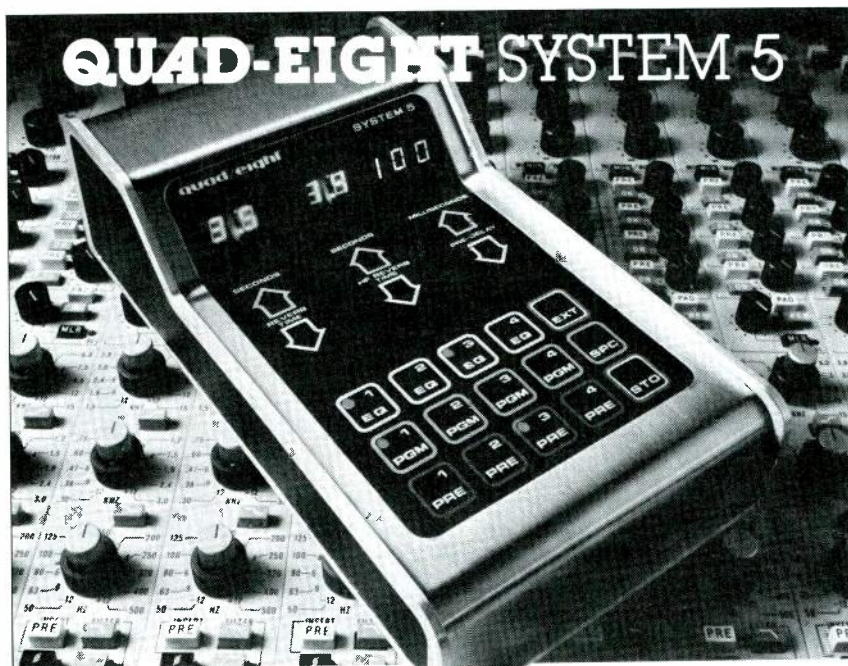
Any program director who boasts of his station's \$20,000 worth of "enhancement" equipment should first be taken to a physician who can clean the wax from his ears, then forced to swear that he is not under the influence of any suspicious substances, and finally placed gently but firmly in front of a high quality monitor system and shown exactly the sort of degradation that \$20,000 worth of "enhancement" causes.

There is no situation where an old '70s cliché is more valid: less is more. □

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This guide to state-of-the-art FM audio will be concluded in the September issue of BE.

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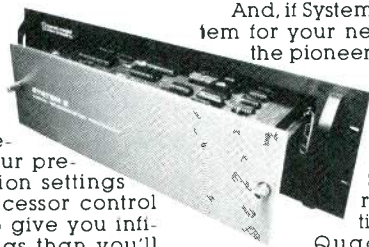
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# Audio processor roundup

by Gary Breed, consulting engineer, D. L. Markley & Associates, Peoria, IL

When a broadcast station wants to improve the quality of its transmitted signal, often the first step is to upgrade the audio processing equipment. No longer is just being loud good enough to catch listeners' attention as they tune across the dial. A station must sound clean as well. As technology improves across the board, the improvements that can be

made in a station's sound become smaller and more subtle. Some of the most subtle, yet powerful, components of broadcast audio occur as the audio is processed for presentation to the transmitter.

This audio processor roundup describes some of the available gain-control devices on the market. However, equalizers, reverbs or audio

special-effects units are not included. The portion of the broadcast audio chain being dealt with is the program audio, as it is processed before the transmitter to provide the maximum performance within the constraints of bandwidth and modulation. Manufacturers are listed alphabetically and reader service numbers are provided for obtaining additional information.

## ADM Technology Inc.

The 1326 *Limiter Amplifier Module* has up to 40dB of limiting with a 1ms attack time and a program-controlled release time (up to 8 seconds). A gain-reduction meter is included in the module. This is a single-function device, designed as an optional module for use with the ST Series II consoles.

Circle (203) on Reply Card

The 1320 *Limiter Amplifier Module* is designed for use in the ADM 800/1600/2400/3200 consoles, and has 30dB of gain control range with fast attack and program-controlled release times. A gain reduction meter is included.

Circle (204) on Reply Card

## Applied Technology Corporation

The *Discriminate Audio Processor III* is a 3-band processor, with variable crossover points. Each band has an RMS response leveling amplifier with adjustable input and output levels, giving the user control over the relative intensity and amount of com-



Audio Processor III and Maximod

pression in the various parts of the audio spectrum. The unit has a useful bar graph display indicating the amount of gain reduction and the out-

put level of each band. The unit also features a pot to equalize the unprocessed (proof) mode levels with the normal operating levels.

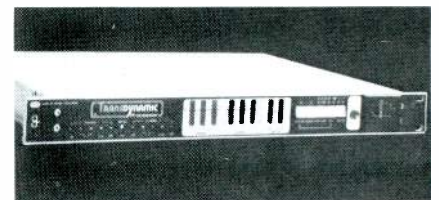
Circle (205) on Reply Card

The *Maximod* is the first production digital limiter, which was announced in March 1981. The digital circuitry in this peak limiting unit allows an instantaneous (or negative) attack and release time. If desired, a finite release time can be programmed into the unit. The unit does not have clipping or waveform overshoot, or the associated harsh sound. Control of the operating parameters is done via a front panel keyboard, designating the gain, positive and negative modulation limits, polarity, phase shifting, symmetrical or asymmetrical modulation, FM pre-emphasis, low and high pass filtering, release time and output level. A battery back-up is provided to maintain the operating settings for up to several days should a power failure occur.

Circle (206) on Reply Card

## Audio & Design Recording Inc.

The *Transdynamic Processor* is a 3-band processor with 6dB per octave (standard) or 12dB per octave (optional) skirts between adjacent bands. A 30Hz input filter is provided for the elimination of subaudible noise, and 12kHz or 15kHz low pass filters are provided to prevent passing these high frequencies to the transmitter. The three bands have independent AGC action with output levels indicated on LED bar graph meters. The recombined signal is passed through a wide-band limiter and a "constant-current" clipper. The output level can be maintained with 0.5dB of the desired maximum level. For FM, 25, 50 or 75 $\mu$ s pre-emphasis response can



Transdynamic Processor

be selected. Additional features include peak-reading LED bar graph input and output meters, an internal pink noise generator for setup and calibration, automatic bypassing in the event of a failure and a separate monitor output for making adjustments while the unit is in the bypass mode.

Circle (207) on Reply Card

The *F600 Broadcast Limiter* is an all-purpose feedback-type limiter with attack times adjustable from 10 $\mu$ s to 25ms, and release times adjustable from 25ms to 3.2s. Pre-emphasis of the processing response for FM use is optional. Control of the output level is within 2dB of the desired maximum. This basic limiter is used in combination with other units to make the following multifunction devices:

- *E560 Selective Limiter*. The F600 is combined with a single notch or peak equalizer section.
- *F690 Music-Voice Ratio Limiter*. In addition to normal operation, an added input is provided for a separate microphone feed with an adjustable sensitivity to override normal program material.

Circle (208) on Reply Card

The *Gemini Easy-Rider* is a straightforward, uncomplicated AGC unit with compression slopes of 2:1 to 20:1, attack times variable from 500 $\mu$ s

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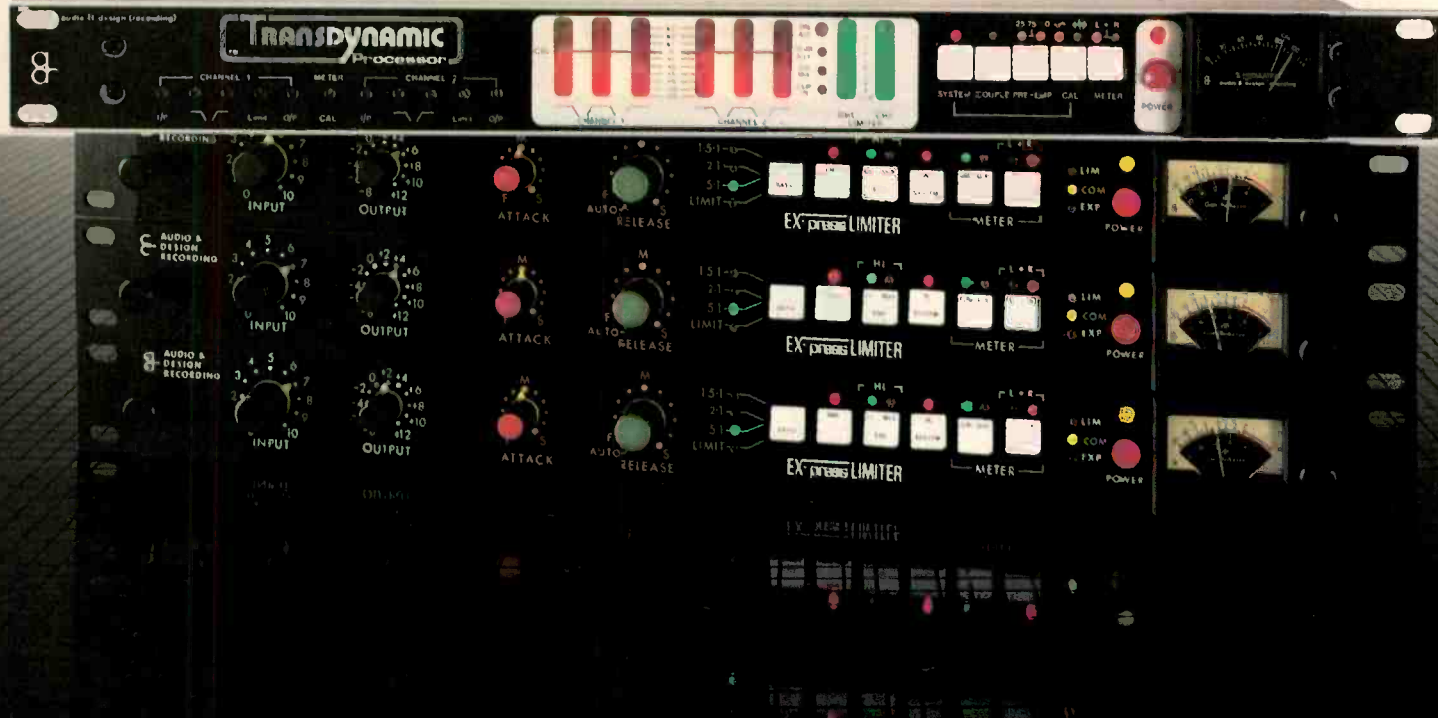
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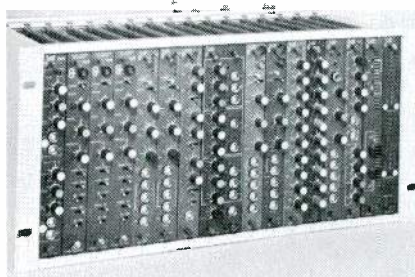
Gemini Easy-Rider

to 5ms, and release times adjustable from 4 ms to 4s. Two units can be coupled for stereo.

Circle (209) on Reply Card

The FM Stereo Ex-press Limiter is a compressor-limiter-expander in a single unit making this a 1-box FM audio processor. Variable attack or release time, or an automatic release time can be selected. Compression ratios of 1.5:1, 2:1 and 5:1 are selectable with a limiting slope of 20:1. After 10dB of compression, limiting occurs regardless of setting. There are three expander threshold settings. The single meter can be switched to read left, right or sum output, or gain reduction. A clipper is provided for maximum peak control. As an FM unit, the control circuits respond to selectable pre-emphasis of 25, 50 or 75µs.

Circle (210) on Reply Card



Scamp System

A number of the M600 and Scamp Modular Frames or similar units are available in modular formats for easy use of several processing functions.

Circle (211) on Reply Card

#### Audio Technologies Inc.

The *Emph'a Sizer* combines three functions in a single unit: input gate, compressor and equalizer. The input gate holds the gain control when the input level drops below the adjustable threshold level. This prevents the objectionable pumping that occurs when a compressor returns to full gain without gating. After the gating mode has been initiated, an adjustable delay

begins, after which the compression will release to full gain. The release time is also adjustable. The compressor function uses a voltage-controlled amplifier (VCA) in a normal mode of slow gain riding. However, if the input exceeds adjustable attack and release time



Emph'a Sizer

thresholds, fast-acting networks respond with attack time of 1 ms. Slope of compression is variable from 1:1 to about 20:1. The equalizer section is a 4-band parametric unit and may be inserted before or after the compressor.

Circle (212) on Reply Card

#### R. Barth KG

The *Dynaset U311* has the unique feature of dual-slope compression. Levels below an adjustable threshold and those above are processed with different adjustable parameters. Levels from -12 to +12dBm are controlled as upper-band levels, with adjustable threshold, compression ratios to 20:1, and a compression hold gate (The gate is referenced only to the high level processor.) The compression slope of the lower level processing is adjustable in the same range as the upper, and has a threshold adjustable from 0 to 30dB below the upper level threshold. The result is smooth control of a wide range of levels, without pumping effects. The unit is packaged for modular installation in consoles or in a rack-mount unit.

Circle (213) on Reply Card

#### Broadcast Electronics Inc.

The *AM-400 Compressor Limiter* is designed for AM use, offering compression ratios up to 30:1 with release time variable from 5 to 40s and limiting with 1µs attack time. Short peaks are clipped, but clipping is of short duration (one or two cycles) because the peak limiter will have reacted by then. Symmetrical or asym-





AM-400

metrical operation can be selected. The limiting functions may be disabled for compression only or in the "proof" mode the unit functions as an amplifier only.

Circle (214) on Reply Card

Nearly identical to the AM-400, the AM-500 Compressor Limiter Expander adds an expansion function: The unit operates with a fixed or centerline gain point, with compression reducing that gain and expansion increasing the gain to level off signals above



AM-500

the sensitivity threshold. When all audio drops below this threshold, the unit returns to centerline gain after about 17 seconds.

Circle (215) on Reply Card

As in the AM-500, the FM-601 Stereo AGC/Limiter has expansion and compression functions that operate as described for that unit, except that there are ganged stereo channels. The companion FM-600 is a mono version. A 10 $\mu$ s attack time limiter follows the AGC section, with selectable 75 $\mu$ s, 25 $\mu$ s, or flat frequency response. Modes of operation include the previously mentioned frequency response, plus limit only and test modes (flat response only). These modes are remotely selectable by simple switch closures. The unit automatically is bypassed in case of power interruption or internal failure, to prevent down time.

Circle (216) on Reply Card

#### Circuit Research Labs Inc.

The APP-400A Audio Preparation Processor is a 2-band AGC unit for

AM use. Following a transformerless balanced input, the audio is made symmetrical via a "Harmonic Phase Rotation Network." The audio is then band-split into parallel AGC circuits with a slow gain-leveling action. These two bands can be strapped to provide wide-band AGC action.

Circle (217) on Reply Card

The SPP-800 Stereo Preparation Processor is basically the stereo version of the APP-400A without the need for

two separate boxes. As with the 400A, this unit has 2-band AGC and gating circuitry to eliminate pumping. Attention has been given to the strapping method to reduce audible cross-modulation between channels.

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APP-400 System

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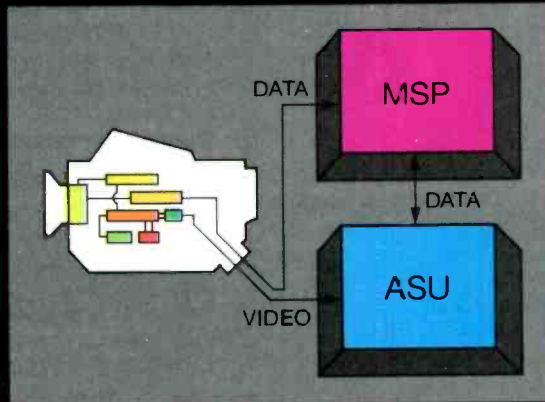
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BCC-20



BCC-21



ASU INTERFACE



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Circle (30) on Reply Card

## Audio processors

The *SEP-400A Spectral Energy Processor* is a 4-band processor, using proprietary control circuitry to automatically maintain consistent peak-to-average ratios. Input gating holds compression when audio drops below the threshold level and allows the user to determine the range of levels that activate the processor. Two units may be strapped for stereo.

Circle (219) on Reply Card

The *PMC-400A Peak Modulation Controller* is an AM limiter that uses multiband techniques and clipping to control peak levels. Controls are included for high and low frequency phasing, to compensate for transmitter responses, and for asymmetry. The asymmetry function has two controls for day and night operation, because a transmitter may have different modulation response at different power levels. A pre-emphasis circuit is available to compensate for the poor frequency response of the typical AM receiver and a loss pass filter is included to keep the spectral content of the output within FCC specifications

regarding energy content of transmitted sidebands.

Circle (220) on Reply Card

The *SMP-800 Stereo Modulation Processor* is an FM limiter that includes a wide-band AGC circuit to allow the unit to be used for single-box audio processing. A pre-emphasis response



SPP-800 and SMP-800

limiter and the capability for multiband peak limiting allow for maximum modulation levels. The pre-emphasis may be selected between 25, 50 or 75µs. A low pass filter is included to keep the audio energy out of the stereo pilot in the stereo generator.

Circle (221) on Reply Card

### dbx Inc.

The top of the dbx line of compressor/limiter products, the *165 Compressor/Limiter* uses "Over Easy" compression, characterized by smooth

operation with minimum audible effects. Attack and release times are adjustable from 1 to 400dB/ms and 10 to 4000dB/ms, respectively, or automatic operation may be used. Separate input level and compression level controls allow selection of calibrated compression slopes. Two units may be coupled for stereo operation.

Circle (222) on Reply Card

The 160 and 162 Compressor/Limiters are essentially the same, except that the 162 is a stereo version with two identical channels internally coupled for identical response, eliminating the need for separate channel adjustments and reducing the potential for errors. Time constants are factory preset and the only controls are input, output and overall compression level, plus metering selectors.

Circle (223) on Reply Card

Designed as part of the dbx 900 series mainframe and modules, the *903 Compressor* operates much like the 165 unit, but with an LED bargraph meter instead of a standard panel meter.

Circle (224) on Reply Card

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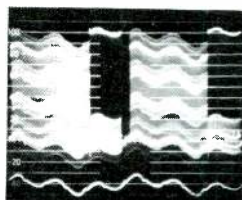
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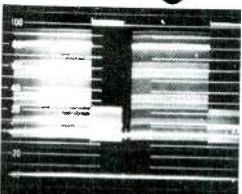
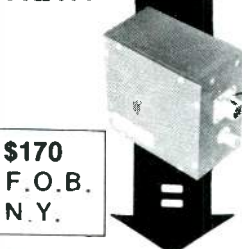
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## Dorrough Electronics

The Discriminate Audio Processor (DAP) is a 3-band unit with separately controlled expansion and compression on each band and gain control metering on the front panel for each band, as well as on the output level meter. All the controls for compression level and relative output from each band, the limiter circuit, and for AM, the symmetry control, are internal trimpots, making this a "set and forget" unit. Master input and output level controls, plus an output meter range and input level range switch are the front panel controls.

Circle (225) on Reply Card

## Gregg Laboratories

Gregg's 2530 Tri-band Audio Processing Amplifier is an FM/TV processing unit with 3-band AGC. The AGC control of each channel has adjustable attack and release times, wide or narrow range of levels, switchable interband level reference to prevent excessive gain control in any single band, and gated gain control. Audio inputs are balanced transformerless, as are the outputs, and are RF suppressed. Input conditioning filters prevent subaudible low frequency noise from affecting the processing functions. Pre-emphasis is applied

before processing, and de-emphasis afterward. Gregg recommends a peak limiter using clipping alone because the audio processing in the 2530 is pre-emphasis-based.

Circle (226) on Reply Card

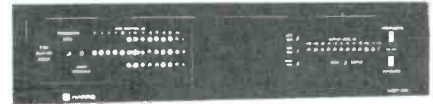
Gregg Laboratories also has the following units:

- 2561/2562 Mono/Stereo AM multi-band processor
- 2511/2512 Mono/Stereo Broadband Gain Controller
- 2650 FM Peak Limiter.

Circle (227) on Reply Card

## Harris Corporation

The AGC amplifier of the MSP-90 series is a 3-band unit with up to 24dB of compression and 12dB of expansion, each with selectable attack and release times. LED indicators show the gain reduction level and the output level. The AM limiter consists of a fast IC circuit, providing up to 15dB of limiting with less than 40µs attack time and selectable 1.3 to 7.5s release



MSP-90

times. Control of the asymmetry is included, as is a phase reversal network using zero-crossing switching for in-audible changes in polarity.

The FM limiter is a 2-band processor, splitting at 400Hz. The high frequency band is pre-emphasized and limited, then recombined with the low frequency portion. The final sum passes through a protective clipper to avoid peaks in the low frequency material or peaks from the combining process.

Circle (231) on Reply Card

The MSP-95 FM Audio CPU is a particular combination of the FM configuration of the MSP-90 processor and a stereo generator, for use in an STL system, or as replacement for the audio processing and stereo generator



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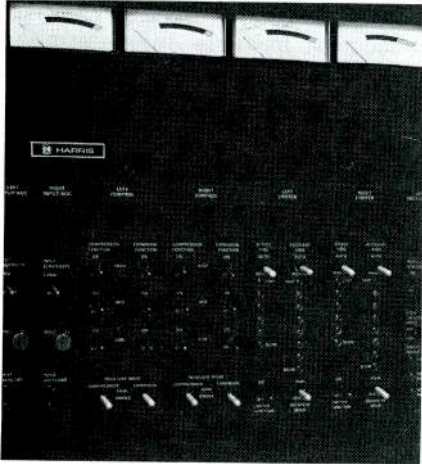
Circle (33) on Reply Card

## Audio processors

in either STL or same-site applications.

Circle (232) on Reply Card

One of the most complex units on the market is the MSP-100 Audio Processor combining 3-band AGC, limiter and "protection" or fast limiter/clipper circuitry, all with adjustable operating



MSP-100

parameters, automatic response or manual settings and a total of five meters to monitor operating functions. In the AGC portion, bandwidths, thresholds and attack/recovery times are user-adjustable. The limiter, a broadband peak type, reduces transient and summing error peaks. Fast or slow response times are switchable, or automatic program-controlled action may be selected. The AM protection module has zero-crossing polarity reversal, followed by a fast limiter and clippers, with symmetry adjustment. The type and amount of protection is adjustable. The FM protection circuit splits high and low frequencies, with the highs receiving processing from the limiter/clipper, then the recombined audio finally being checked for peaks by a broadband clipper.

Circle (233) on Reply Card

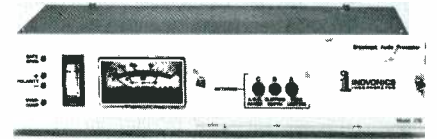
### Inovonics Inc.

The MAP-II is an 8-band audio processor for AM use. The input audio first encounters a high pass filter with cutoff frequency selectable at 50, 70 or 100Hz. Next is a slow, gain riding AGC with gating during program pauses, then the multiband compressor. Each band uses "open loop"

or feed-forward AGC, providing a gradual transition in gain levels. This, along with coupling between adjacent bands, keeps the processed result smooth with minimal phase errors between different bands. Following AGC, the recombined audio goes through phase rotation to keep the maximum peaks in the positive direction. The peak limiter is conventional, but is combined with a hard clipper to maintain as much control as desired. A selectable low pass filter ends the chain of audio signals through the unit. A pink noise generator is included for easy initial setup.

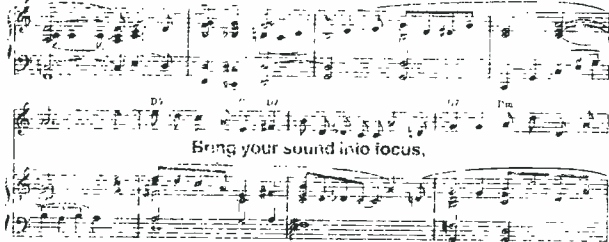
Circle (228) on Reply Card

The 215 is a multifunction broadcast audio processor with a gated AGC amplifier with selectable input high

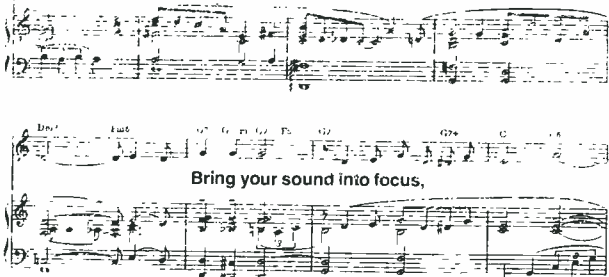


215

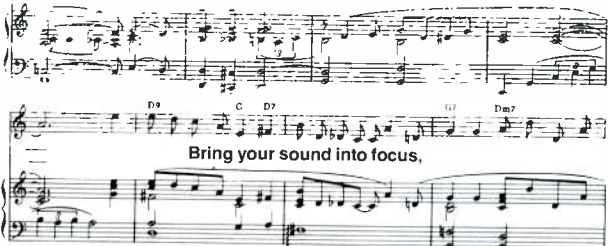
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# ARRI HMI® LIGHTS:

HMI is the first new light since quartz halogen. ARRI HMI lights are also new: specifically designed to make the most effective use of the HMI bulb's efficiency.

**B**y now it's common knowledge that a 4K HMI bulb puts out 102 lumens per watt at 5600 degrees Kelvin; whereas a tungsten bulb, filtered for daylight balance, puts out between 15 and 20 lumens per watt.

That's astounding efficiency. But that's the *bulb's* output. How much of that light gets onto the subject depends on the efficiency of the lamp-head. How many watts are drawn depends on the efficiency of the distribution system.

HMI bulb efficiency has made it worthwhile to overcome the draw-

backs — notably flicker. ARRI began on that early. We've been making motion-picture lighting equipment since the Thirties. In the Sixties, we began experimenting with HMI's fore-runner, Radium street lights. In 1972, we pioneered the use of HMI for filming, at the Olympic Games.

But at the Olympics we were still plugging the new HMI bulbs into conventional lamp-heads designed for tungsten point sources. (HMI, of course, is an arc.) As Osram perfected the HMI bulb, one thing became obvious: Since efficient output was the HMI bulb's claim to fame, the delivery system must, above all, be as efficient as possible. That meant *new* lighting designs.

ARRI's engineers didn't have to adapt. Their new lamp-head designs take maximum advantage of the HMI bulb's characteristics. The ARRI 4K, for example, has a 19.7 inch diameter Fresnel lens. Most other 4K HMIs use a 14 inch.

Peter Edwards is Supervising Lighting Director at CFTO-TV in Toronto; and he is Chairman of the Society of Television Lighting Direc-

Connectors and switches on ARRI HMI ballasts are recessed. A yellow ground test button lights up if you have a good ground.



ARRI HMI lights are available in the four standard AC configurations: 575W, 1200W, 2500W and 4000W, plus a 200W battery-powered unit. Shown here: the 4000W.



4000W light shown here has 19.7 inch Fresnel lens with wire safety grid.

Tube frame protects ignition during, acts as floor stand.

Yoke position is adjustable for altered center of gravity.

tors, Canada. He has won two Emmy Awards for lighting. He ran side-by-side tests for CFTO of the ARRI HMI 4K and two other brands of imported IIMI 4K lights. "At 40 feet and full flood position, the best of the other two measured 150 foot-candles; the ARRI measured 200 foot-candles," says Mr. Edwards.

## ARRI

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Circle (35) on Reply Card

## Audio processors

pass filter, a program-controlled RMS compressor and either an AM or FM peak limiter. The AM limiter has phase rotation circuitry and a feedback limiter/clipper combination. Adjustable asymmetry and selectable low pass filter roll-off are additional features. The FM peak controller has selectable flat, 25 $\mu$ s or 75 $\mu$ s pre-emphasis response functions and also uses a limiter/clipper combination.

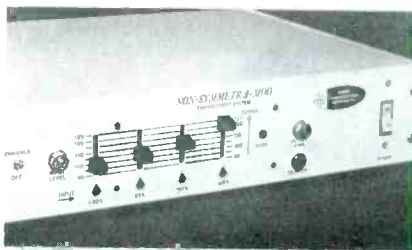
Circle (229) on Reply Card

The 201 Limiter has selectable attack and release times and contains an average-responding limiter, plus a peak "ceiling" limiter. This general-purpose gain controller may be used in studio recording as well as in program line applications.

Circle (230) on Reply Card

### Kahn Communications Inc.

Intended to be placed after AGC and limiting equipment and before the transmitter input, the Non-Symmetra-Mod enhances positive peaks to achieve 125% peak modulation. The device does not use clipping, but cir-



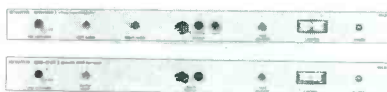
Non-Symmetra-Mod

cuit information is not available.

Circle (234) on Reply Card

### McMartin Industries Inc.

The monaural BFM-1515R and the stereo BFM-1514R processors are usable for FM or AM, depending on whether flat or pre-emphasis processing response is selected. In the flat mode or in the low frequency band of the pre-emphasis mode, the limiter has 20 $\mu$ s attack time and adjustable 20 to 25ms release time. The pre-emphasis limiter has 50  $\mu$ s attack time and



BFM-1514R and BFM-1515R

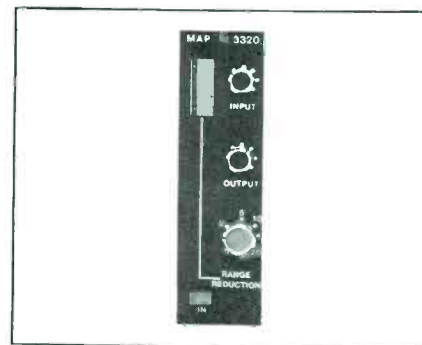
program-controlled dual time constants. (Only 75 $\mu$ s pre-emphasis is included.) A 15kHz low overshoot filter is included for FM stereo operation.

Circle (235) on Reply Card

### Modular Audio Products

Packaged as an optional plug-in unit in the console, the 3320 Compressor/Limiter is a general-purpose gain controller with a fixed 20 $\mu$ s attack time and an automatic variable release time for fast, but smooth response. Up to 30dB of compression may be used with a minimum threshold for the beginning of AGC action of -50dBm.

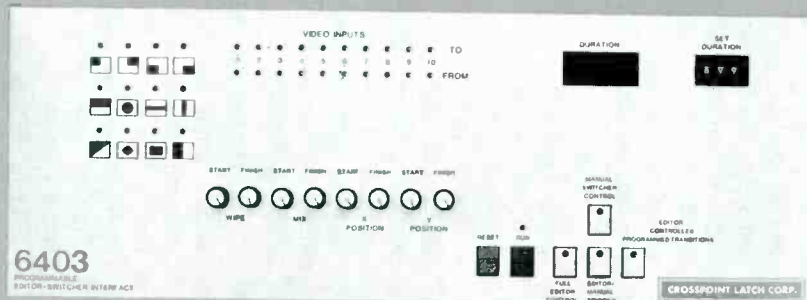
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3320

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Circle (36) on Reply Card



### Orban Associates Inc.

The *Optimod-AM (9000A)* is a 1-box unit for AM audio processing, containing eight signal processing blocks:

- Input filter passing 100–11kHz
- Broadband gain riding compressor
- Program equalizer to tailor frequency response
- A 6-band limiter
- A silent acting phasing circuit
- A "smart" clipper to limit peaks not caught by the 6-band limiter
- Transmitter equalizer, to compensate for inaccuracies in response of the transmitter, especially an older one
- An output filter to limit the occupied bandwidth of the transmitted signal. Gain reduction metering of the broadband AGC, the six bands of limiting and the peak clip-



Optimod-AM (9000A)

per is on the front panel, along with a multimeter measuring various system parameters.

Circle (237) on Reply Card

The *Optimod-FM (8100A)* contains a 2-band AGC circuit, in which the bass and higher frequencies are separated. Coupling between these two bands of AGC is adjustable, from complete independence to a single-action broadband AGC action. Input filters eliminate inaudible frequencies from affecting the gain control action. Following the recombining of the two bands, a pre-emphasis response limiter controls the high frequency levels and in turn is followed by a "smart" clipper and an overshoot compensating circuit. The audio section feeds a stereo generator.

Circle (238) on Reply Card

### RCA Broadcast Systems

The *BA-145 AGC Amplifier* for use in AM, FM and TV or recording studios uses an insulated gate FET for gain control, swish-up, eliminating thumps and pumping. A meter and LED indicators show compression (to 24dB), expansion (to 16dB) or level hold. Selectable compression attack times

from 0.2 to 30ms and release times from 10 to 40s are supplemented by expansion attack times from 5 to 30s with release of 4 to 10s. Frequency response of .5dB, 20Hz to 15kHz and less than 1% harmonic distortion for the range on input signals from -12 to +30dBm, develops an output level of +18dBm with compression or +26dBm amplifier maximum. The unit is field convertible for stereo: the BA-145S. Two of these units may be synchronized for use in quad installations.

Circle (246) on Reply Card

The *BA-146A Limiter Amplifier* for AM radio use features inaudible FET-controlled action. Limiting action occurs at 1 $\mu$ s per decibel of compression. Release time is selectable from 0.2 to 5s. Release time is variable in relation to program content within the selected time. Either symmetrical or asymmetrical action is possible. Noise rating is 70dB minimum for 20Hz to 20kHz spectrum with frequency response of  $\pm$  1dB. Harmonic distortion is 1%. Up to 50:1 compression ratio is available.

Circle (247) on Reply Card

The *BA-147 Limiter Amplifier* for FM and television differs only in inclusion of a 75 $\mu$ s pre-emphasis time constant from the B-146A.

Circle (248) on Reply Card

The *BA-150 Digital Overshoot Control Processor (DOC)*, for use with any FM exciter/stereo generator maintains 100% modulation without overshoot. Shaped, bi-level clipping provides control on high frequency peaks. The resultant ringing is controlled through a dc gated aperture control loop. Non-linear phase response is also handled by a 6-section active delay network. Signal-to-noise ratio greater than 75dB covers a response range of 20Hz to 15kHz. Attack time is 50 $\mu$ s; harmonic distortion is less than 1%. System crosstalk is rated at less than -46dB.

Circle (249) on Reply Card

### Thomson-CSF Broadcast Inc.

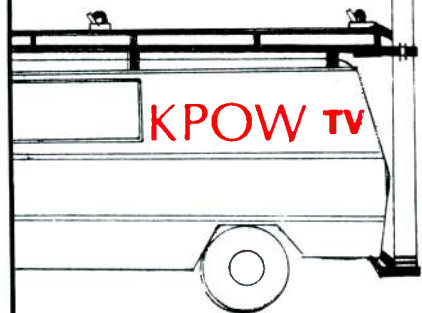
The *Monaural 4440A and Stereo 4450A Audimax* units are proven-design AGC amplifiers with  $\pm$  10dB of gain control about a center gain setting. Audio within the 20dB window is either boosted or attenuated to provide a constant output level. A gain holding gate reduces the pumping effect often found in AGC units and,

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Circle (37) on Reply Card

## Audio processors

after 10 seconds of silence, returns to the center gain level. The gate has an adjustable threshold for various formats' requirements. Front panel adjustments are input and output level controls, control and test switching, and gain control metering.

Circle (239) on Reply Card

The Volumax 4300 AM Limiter uses fast limiter and output clippers for modulation control and a silent-acting phase reversal circuit that actually fades between phases, during pauses in program material. The resulting output is free from clicks or thumps present in some phase reversal networks.

Circle (240) on Reply Card

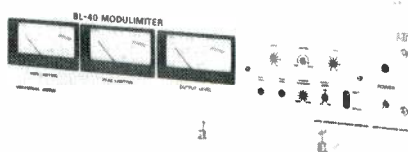
The FM Volumax is a stereo FM split-band peak limiter with frequency division above and below 5kHz. (The FM Volumax 4101 is mono.) Low frequencies are controlled by a moderately fast limiter, then the signals are split into two bands. Both bands are pre-emphasized for processing by the proprietary Dynamic Fre-

quency Compensator circuitry. Following recombination, a final safety clipper catches any peaks before de-emphasis and output to the transmitter/stereo generator.

Circle (241) on Reply Card

## UREI (United Recording Electronics Industries)

Designed for AM use, the BL-40 Modulimiter combines RMS limiting of medium speed with peak limiting in one unit. Attack and release times of the RMS limiter are program dependent. High average level material will cause the limiter to respond more slowly than will short duration peak levels. Phase optimization circuitry reverses phase for maximum modulation. Metering is provided for RMS



BL-40

limiting, peak limiting and the output level. Asymmetry and the RMS to peak limiting weighting controls are available with input and output level controls behind a front access panel.

Circle (242) on Reply Card

An AGC unit with up to a 20:1 compression ratio, the LA-4 Compressor Limiter uses optically coupled attenuators for smooth response. The response is RMS, another smoothness factor. The threshold of compression and the compression ratio are adjustable. Two units may be strapped for stereo.

Circle (243) on Reply Card

The 1176LN/1178 Peak Limiter features selectable 4:1 to 20:1 compression ratios, variable attack and release times of 20 to 800  $\mu$ s and 50ms to 1.1s, respectively. The front panel meter can be used for input or output level indication or to monitor gain reduction. Two units may be coupled for stereo (1176LN) or the 1178 stereo unit may be used.

Circle (244) on Reply Card

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CNN CABLE NEWS NETWORK



...Gene Wright, Vice President of Engineering, Turner Broadcast Systems

# 24 HOUR NEWS

## “Around-the-clock operation doesn't faze our TK-47 cameras”

Turner Broadcast Systems operate eight RCA TK-47 Automatic Color Cameras. Four of the cameras are live 24 hours a day at Cable News Network. They're never turned off. Four other TK-47's are used in the WTBS system.

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deliver all the news, all the time.”  
Find out how the TK-47 can give you a new “look” in cost saving, time-saving, and picture quality. TK-47—it's automatic, versatile and now available in Triax. Call your RCA Representative and ask for a showing of a tape in which six top engineering professionals tell how they are using TK-47's in their broadcast and teleproduction operations. You'll see why the TK-47 is first choice for savings and performance. RCA Broadcast Systems, Bldg. 2-2, Camden, NJ 08102.

# station- to-station

---

## Coax transmission line leak repaired

A. J. Martin  
Translator maintenance engineer  
KDLH-TV3  
Duluth, MN

Someone shot a rifle at the lower sidelights on a KDAL-TV\* translator tower and hit the 1-5/8-inch coax transmission line instead. By the time the leak was discovered, quite a bit of moisture had worked its way into the transmission line, even though it was constantly pressurized by an air dryer. The moisture resulted in breakdown within the line and this effect could be seen as flashing in the transmitted picture signal.

After the line was repaired, the lower coax connector was removed, the moisture shaken out of the lower

\*The KDAL-TV call letters have subsequently been changed to KDLH.

end of the coax and dry air was blown into the line until it appeared dry. By the next morning, flashing was again occurring in the picture, so the whole drying process was repeated. The line evidently had quite a bit of moisture in it, and this would migrate down and collect in the low end during the day. Because the translator site was about 30 miles away, it wasn't convenient to open the line each day, and I didn't want to have a tower man make climbs to open the line for purging. Just having the line filled with dry air wasn't enough. The dry air would saturate with moisture, and because there no longer was a leak in the line the moist air stayed in the line.

I decided to purge the line of moist air by letting it breathe. This was accomplished by drilling a small hole (#58 drill) in the lower end of the line. The moist air would slowly bleed out of the line, and when the pressure dropped suffi-

ciently, the air dryer would quickly refill it with dry air. The line was left this way for about a week, at which time the small hole was filled with silicone bathtub sealer, and it has been working fine ever since.

## Weather alert detector

James Lunacek  
Broadcast technician, KUOM  
University of Minnesota  
Minneapolis, MN

In our geographical area heavy thunderstorm and tornado activity is of great concern. To alert station personnel to potentially dangerous weather conditions, we use a business band FM receiver tuned to the local National Weather Service station. The output of the receiver feeds a signal splitter for monitoring and re-broadcast if conditions warrant. A tone decoder with delay is set up to detect the 1kHz NWS



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**Emergency Alert tone.**

The tone decoder portion of the system is shown in the accompanying schematic. The 567 tone decoder IC, two transistors, an SCR and an IC voltage regulator along with the required capacitors and resistors were assembled on a small circuit board and enclosed in an octal-based relay case. The only external components are the alarm relay and the reset push button. We found space for the decoder and relay on the FM receiver chassis.

When the 567 decoder detects a 1kHz signal its output goes low, causing Q1 to remove the short across C1. C1 charges in a short length of time (determined by R1), fires the UJT (Q2) and provides a pulse to turn on the SCR (Q3). In our system, Q3 operates an external relay that unmutes the control room speaker.

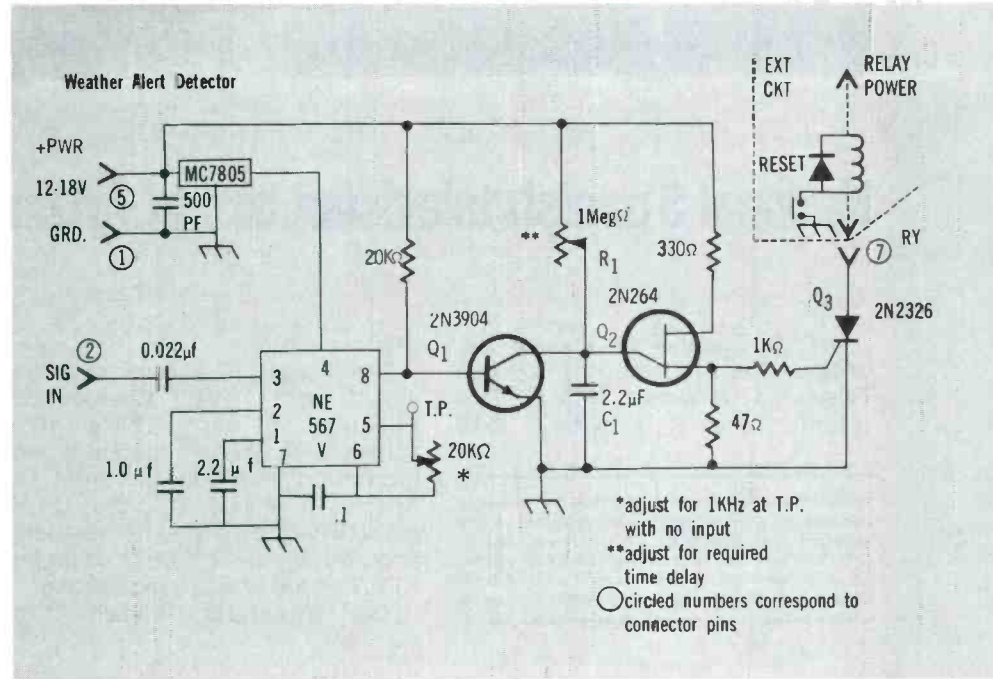
Because the decoder seemed to work reliably, we decided to extend the system to pre-empt all the normal monitor audio in the station.

The station monitor distribution system consists of three FM closed-circuit modulators feeding an existing CCTV house distribution system. Individual offices are equipped with home-type FM receivers.

This system was chosen because

of the physical separation of the station offices and because of the already installed CCTV system. The first modulator normally provides an off-air signal, the second provides the network program and the third provides weather information. When an alert is detected, the weather

receiver output is transferred to modulators 1 and 2 and continues on modulator 3. This increases the chances that station personnel within range of a monitor will become aware of the bulletin. The operator on duty resets the decoder circuit after the bulletin. □



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**Scotch Color Plus Video Tape**

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## National Spanish television airs in Arizona

K40AC, Channel 40, Tucson, AZ, became the SIN National Spanish Television Network's 79th affiliate recently when it installed a 1kW

UHF translator.

The Channel 40 system relays the signal from KTVW, Channel 33, Phoenix, to carry SIN's daily schedule of Spanish language programming throughout most of Arizona. It is estimated that Channel 40 will reach a Spanish-speaking population of 120,000, bringing KTVW's total coverage to 500,000.

The translator, installed by

helicopter, is operated off diesel generators because of its remote location. Total power consumption is less than 6 KVA during black picture conditions.

SIN currently reaches more than 3.5 million Hispanic households throughout the United States. SIN, which has been on the air for 20 years, began broadcasting 24 hours daily in April 1980. □

**Editor's Note:** For reference purposes, the translator selected by Channel 40 for its operation is the Acrodyne single-tube T-2400 V/U, which was introduced at NAB '80 in Las Vegas. It features a gain stabilized solid-state modular driver, plug-in wide-band RF circuits and status display for low maintenance costs.

# OPTIMOD-AM

## ROCK TO CLASSICAL...COAST TO COAST



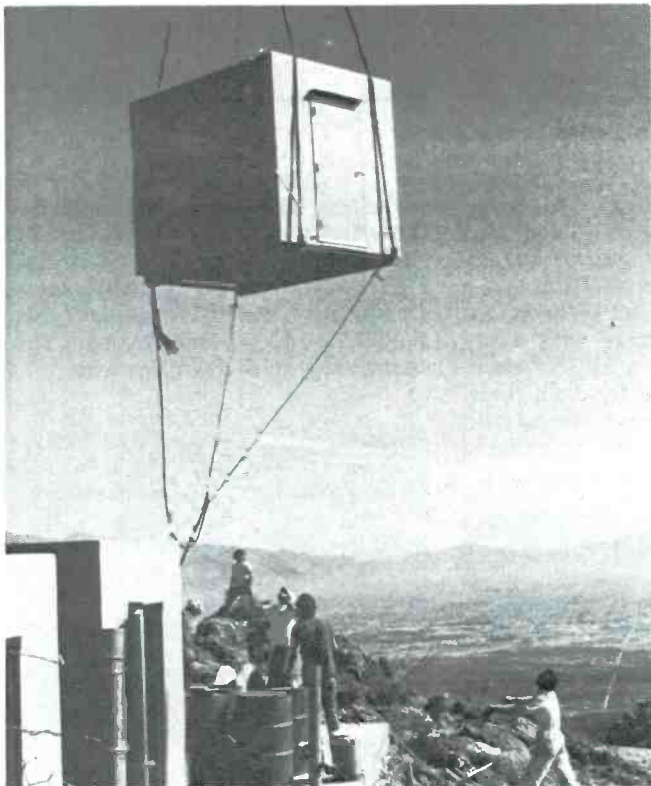
Hundreds of stations worldwide—in every format—now process with OPTIMOD-AM. An integrated system design makes OPTIMOD-AM ideal for all formats: it guarantees uniform audio quality and uncanny definition on typical AM radios—regardless of uneven operator gain riding or inconsistent source material. And our system stand-out—the "Smart Clipper"—listens to clipping distortion like a human ear to definitively solve the long-standing conflict between music loudness and voice distortion.

Regardless of format, you can adjust the field-proven, stereo-ready OPTIMOD-AM system to give you the sound you've always wanted. Call us Toll Free (800) 227-4498, in California (415) 957-1067 for the name of the Orban broadcast dealer nearest you.

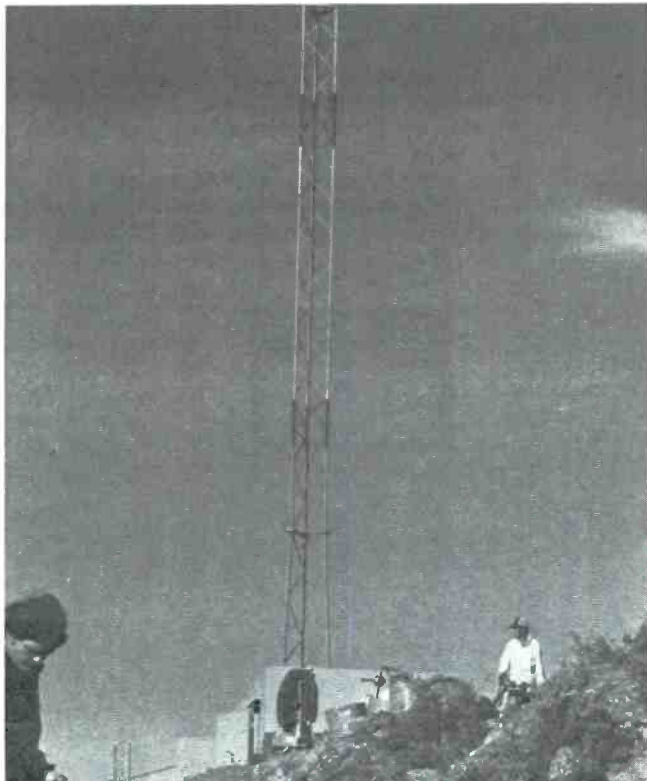
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Orban Associates Inc., 645 Bryant Street, San Francisco, CA 94107

Circle (41) on Reply Card

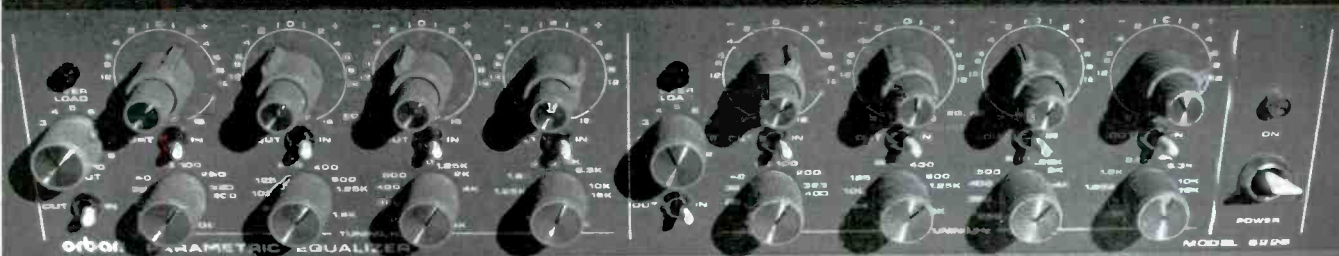


Because of its remote location, the translator was installed by helicopter.



The translator installation permits relays of the signal from KTVW Channel 33 Phoenix to carrying SIN's daily schedule of Spanish language programming to most of Arizona.

# World-Class Parametric EQ



If you're like most broadcasters, you're looking for an equalizer that's both an effective creative tool and a powerful problem-solver. The "constant-Q" Orban 622B Parametric offers the flexibility of stereo, four-band Parametric EQ and infinite-Q notch filtering all in one unit. The same equalizer can both "sweeten" program material and notch out hum or whistles in low-quality sources like remotes. It's this combination of functions which has made the 622B the world leader in Parametric EQ.

When the 622B is used on-line to tailor your broadcast to your exact requirements, switch-bypass ability makes proofs convenient. When it's used in the production studio it can make spots, promos, and effects really special!

For the demanding professional, the 622B offers excellent noise and distortion performance, rugged construction, extensive RFI-proofing, stability, and the reliability and support you've come to expect from Orban.

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## Friesen's credit omitted

In the March issue of **BE**, the story "KEYN Takes on a New Look," described the new facilities in Wichita, KS, under the ownership of Jim Long, former president of TM Productions, and Charley Pride, famous country singer.

In the course of preparing this article for publication, one of the authors, Orin Friesen, was inadvertently omitted from the credit lines. During the

preparation of the article, Friesen was chief engineer at KEYN and was responsible for the redesign of the station. He has since left KEYN to take a position with KFDI in Wichita, but keeps in close contact with Larry Waggoner and station KEYN, where he was chief engineer for eight years.

The authors are shown posing with Charley Pride during the remodeling of KEYN.



The authors, Orin Friesen (left) and Larry Waggoner (right), pose with Charley Pride during the remodeling of KEYN.

## Studio acoustics

The May 1981 issue of **BE** contained "The Basics of Studio Acoustics," by Robert Nissen of Hubert Wilke Inc. Figure 7 on page 54 was missing some dimensions and STC values that should have been printed in color. The corrected graphic is shown here.

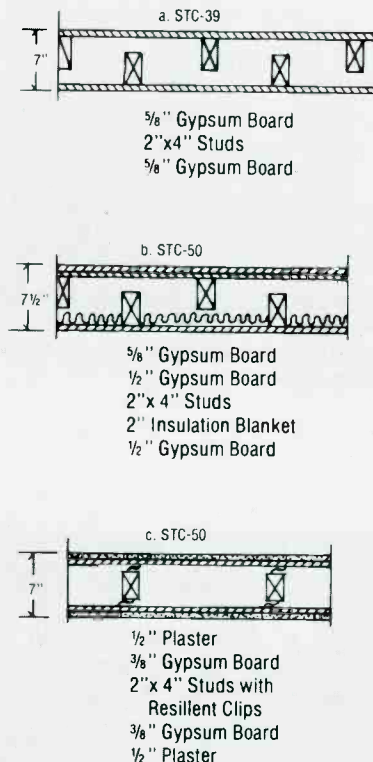


Figure 7. STC ratings of typical non-homogeneous multi-layer walls.

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**AG** A public service of this publication and The Advertising Council.

## Error in pricing

To the editor:

This is with reference to the description of our character generator and graphics system, the VISTA 80, given on page 77 of the May 1981 issue of your excellent magazine.

We appreciate your inclusion of our product in your listings, but would like to correct the error in pricing to read as follows:

VISTA 80/216—\$27,300

VISTA 80/116—\$22,950

Again, thanks for including our products in your survey.

F.G.R. Warren  
Vice President  
Digital Products & Technology  
MPB Technologies



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Outstanding electrical parameters include extremely low RF loss, smooth impedance co-efficient, and conservatively rated power handling capability.

Wellflex is available with either air or foam dielectric with copper corrugated outer conductor, solid and corrugated inner conductor (depending on size), and with a tough, durable, corrosion resistance polyethylene jacket suitable for burial and prolonged life.

Air Dielectric Wellflex in smaller diameters, ( $\frac{1}{2}$ " and  $\frac{7}{8}$ ") offer a field proven, fixed helix design called Spirafil II—a single, continuous extrusion which locks the center conductor coaxially within the outer conductor, resulting in a near perfect impedance coefficient throughout the entire length of line.

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# Preview of the NRBA Convention

The National Radio Broadcasters Association annual convention and exposition is scheduled for Sept. 13-16, at the Fountainebleau Hilton Hotel, Miami Beach, FL. NRBA '81 provides a chance to learn about the impact of new technologies (cable and satellite transmissions) and to find out how other stations are making and spending money.

Highlights of the convention include awards presentations and hospitality suite galas, as well as more than 30 workshops presented by industry leaders on subjects ranging from production and programming to management and sales roundtables. With more than 70 companies as confirmed exhibitors, the Exhibit Hall is bound to be an exciting showplace.

## Agenda highlights

### Sunday Sept. 13

Registration opens—10 a.m.  
Exhibit Hall opens—Noon  
Opening cocktail party—6:30 p.m.  
Hospitality suite gala—8 p.m.

Workshops—8:30 p.m.  
*Programming Format Rooms*

Free-form discussions and idea interchanges led by America's programming experts. Some formats discussed will be AOR/Cross-Rock, Adult Contemporary, Country, News/Talk, Urban/Black and Beautiful Music. The workshop also will include promotion by format. (Will be repeated Tuesday at 4:15 p.m.)

### TV Spot Producers Circus

The leading producers of TV commercials for radio stations will show how and why those commercials are made.

### Cable and Satellite Forum

Learn all there is to know about the changes in technology, systems and services that are reshaping the radio business.

### Engineering Career Forum

A discussion on the effects new technology and regulatory changes will have on professional radio engineers.

### Monday Sept. 14

Registration opens—7:30 a.m.  
Exhibit Hall opens—8 a.m.  
Opening session—9 a.m.

Keynote address by Cecil L. Heftel, Congressman from Hawaii and owner

of Heftel Broadcasting.  
Spouses Program—9:45 a.m.

Workshops—9:45 a.m.  
*Sales Motivation*

Solutions to one of the most important and complex management problems given by a nationally recognized expert.

### Financing Your First Acquisition

A panel of lenders, bankers and brokers will make it seem easy for prospective first-time owners.

### Promotion Roundtable

An informative and stimulating dialogue led by the radio broadcaster recognized by his peers as one of radio's outstanding promotional leaders.

### Programming Review

A panel of America's foremost programming experts will critique a variety of off-the-air tapes.

### Engineering

Audio processing. Where have all the listeners gone? A roundtable discussion led by experienced radio engineers.

Coffee break—11 a.m.

Workshops—11:30 a.m.

### Rate Card Revelations

The mysteries of rate card design and maintenance unraveled by a panel.

### Small Market Sales Personnel

Finding, training, motivating and keeping salespeople in a small market is a big problem. This dialogue will provide some new answers.

### Project Management

A case study that will detail and analyze the principles of good management. (Will be repeated Wednesday at 9 a.m.)

### Promotion Spotlight

A revealing dissection of a typical radio market's promotional universe by an outstanding station promoter.

### Audience Recruitment

### Age Group 25-49

The new and increasingly important target group. Analysis, techniques and systems covered in a roundtable discussion.

### Engineering

Coexistence—the impossible dream. Understanding managers, understanding engineers.

Luncheon—1 p.m.

NRBA's Golden Radio Award to radio's living legend: Gordon McLendon.

Open Afternoon—2:30 p.m.

Visit the Exhibit Hall and the hospitality suites.

Hospitality Suite Gala—6 p.m.

### Tuesday, Sept. 15

Exhibit Hall opens—8 a.m.

Spouses program—9 a.m.

Workshops—9 a.m.

### Sales Techniques Analyzed

Techniques reviewed by videotaping and playback of real-life sales situations.

### The New FCC

Is the new FCC a different FCC? What can radio broadcasters expect to come out of Washington and how will they be affected by the transition?

### Use My Medium

Representatives of outdoor, print and television will tell why you should use their particular medium to promote your station.

### Programming for Lifestyles

An in-depth study of the kaleidoscope of this country's present and future lifestyle trends and their effect on your potential audience.

### Engineering

Digital audio. The sound of the future.

Coffee break—10:15 a.m.

Workshops—10:45 a.m.

### Large Market Sales Personnel

Finding, training, motivating and keeping salespeople is a major problem in any size market. This dialogue will provide some new answers, especially for broadcasters in larger markets.

### Financial Overview

A panel of experts with radio station financing experience will answer questions about the intricacies of today's money markets and shed light on radio station prices today and tomorrow. Learn how to add to your group.

### Promotion Superstars

Small- and medium-market broadcasters will be especially interested in this roundtable featuring the promotion superstars of the industry.

### On-the-air Personnel

This roundtable discussion, led by top programming management ex-



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For the second year in a row, Scotch® 479 won the award for the best picture of the year in a test of one-inch video tapes.

We scored well in all of the twelve categories tested, but especially well in the categories that commonly represent picture quality: color dropouts, high frequency dropouts, chroma noise, signal-to-noise ratio and stop motion.

These were scientific, quantitative tests, conducted as you would conduct them yourself, with no room for brand bias. The meters didn't play favorites. The standards were the same for every brand tested. And we tested every brand.

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last. In fact, our sophisticated binder and oxide coating are more advanced than the binders and oxides on some quad tapes. They had to be advanced to meet the special durability demands of one-inch video production.

So choose Scotch 479 for your one-inch video production. You'll find it looks good from repeated mastering all the way through post production. And we've seen the test results to prove it.



---

**3M**

## NRBA Convention

ecutives, will focus on recruiting, training, motivating and keeping on-the-air talent.

### Engineering

Future trends—a look at supporting technology for new programming.

Luncheon—12:30 p.m.

Address by Mark H. Fowler, FCC chairman

Gabbert Award for Outstanding Service to the Radio Industry presented to Robert E. Lee, former chairman, FCC.

Workshops—2:30 p.m.

### Promotion Circus

A presentation of promotional devices and systems that build sales as well as audience, by the leading suppliers.

### Trade Press Symposium

A view from the trade press summit and how you can reach the trade press with your message.

### Small Market Idea Exchange

Exclusively for small-market broadcasters. A freestyle, informal, information-packed bull session that has become an NRBA tradition.

### Focus Groups

A programming pretesting technique that is gaining acceptance. A roundtable discussion led by authorities on the subject.

### Engineering

The Things Ma Bell Never Told You—Part II, 1981 Edition.

Coffee break—3:45 p.m.

Workshops—4:15 p.m.

### Sales Roundtables

Small groups classed by market size engage in idea and experience exchange. Voted last year's most popular and informative session.

### Management Roundtables

Same as above except the subject is every phase of management.

### Programming Format Rooms

Free-form discussion and idea interchange led by America's programming experts.

### Engineering

Satellite Transmission and Distribution. Satellite Radio.

Superstar Showtime—9 p.m.

Miami Beach Theater of The Performing Arts. Shuttle buses from

hotels will be provided.

### Wednesday, Sept. 16

Eye-opener—8 a.m.

Special roundtable—9 a.m.

The Cuban Problem.

### Workshops

#### Project Management

A case study that will detail and analyze the principles of good management.

#### Arbitron Advisory Council

An update on the rating service. Answers to your questions, solutions to your problems.

#### Engineering

Deregulation, regulation, unregulation, AM stereo and station proliferation to be discussed.

Reservations can be made through NRBA. It is recommended that you register early for preferred hotel accommodations. NRBA has arranged special low-cost air fares from many major cities. For more information or preregistration material contact: NRBA, 1705 De Sales St. NW, Suite 500, Washington, DC 20036; (202) 466-2030. □

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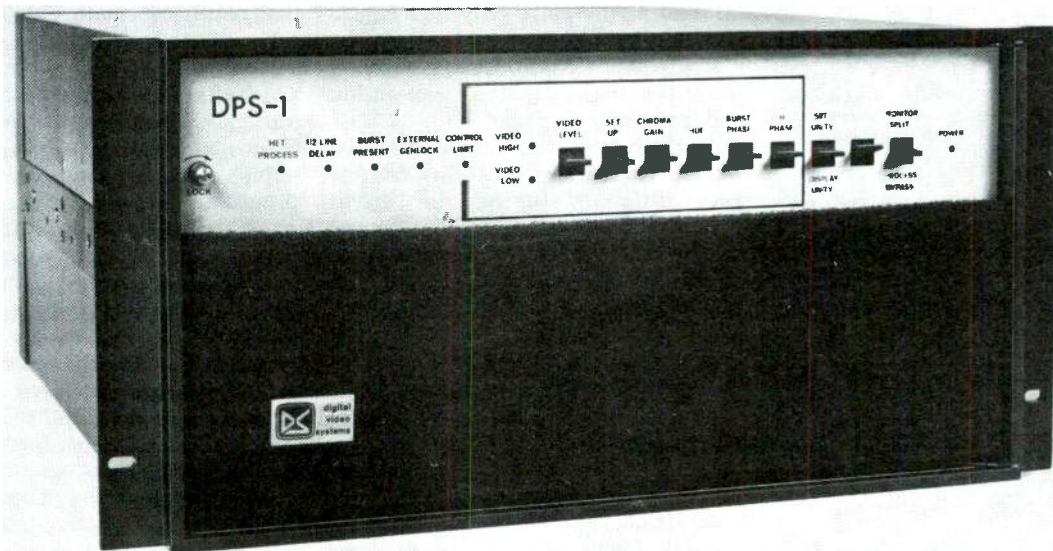
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A fixed window is used instead of a floating window which results in faster lockup without vertical hunting

**Digital burst processing.**

Used to provide line by line clock phase correction accuracy to 0.5 nanoseconds.

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Eliminates horizontal cycle hopping.

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Corrects velocity errors on a line by line look ahead basis to provide highest quality color pictures.

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## Part II

# PRC '81: A conference replay

By Brad Dick, chief engineer, KANU, Lawrence, KS

The second third of the seminar on FM transmission was addressed by Charlie Goodrich of McMartin In-

**Editor's note:** This second part concludes our coverage of PRC '81. The July BE included a summary of Bob Gonsett's discussion of intermodulation interference, which was presented at the FM performance seminar.

Table 1. Dynamic range

System	Total dynamic range, (dB)	Usable dynamic range, (dB)
		(Total-20 dB)
Microphone	120	100
Disc reproducer (with average disc)	65	45
Tape recorder (with tape ref. 3% dist.)	60	40
Cartridge machine (with tape ref. 3% dist.)	55	35
Console	80	60
Distribution amplifier	80	60
Bell telephone link (STL)	78	58
Microwave link cross country	74	54
TV aural transmitter	60	40
FM transmitter	65	45
AM transmitter	60	40
Satellite system	70	50

Table 2. Noise levels vs. environment

Environment	Approximate average noise level (dB above threshold of hearing, A-weighted)	
Home	Quiet suburban evening	30
	Average	45
	Downtown (windows open)	60
Automobile (Quiet model)	Windows closed on highway	60
	Heater or air conditioner	70
	In traffic, windows open	80
Office	Quiet office	55
	Noisy office	75
Factory	Depending on type	65-90
Studio	Average good studio	30

A large orchestra playing a loud passage can produce levels in the concert hall in excess of 110 dB. The smallest musical sound that same orchestra might generate could be as low as 30 dB, and its audibility would be limited by the ambient noise in the concert hall. Thus, the *dynamic range* of this orchestra is in excess of 80 dB.

dustries. Goodrich prepared a videotape showing the actual tuning of a McMartin transmitter to optimize performance in the stereo and SCA modes.

Goodrich said that tuning a transmitter for minimum AM noise was the most beneficial method to the total system performance. He began by tuning the transmitter for minimum AM noise and then checking various specifications of the system, such as SCA crosstalk to and from the main channel, separation and frequency response.

By mistuning the transmitter final amplifier, the specifications change very little. Mistuning the driver caused noticeable effects on separation and crosstalk to the SCA channel. Mistuning the exciter even caused a slight increase in distortion from 0.15% to 0.25%. The effects of detuning the transmitter on frequency response was not measurable. Tests have shown that the IPA is the most critical in terms of obtaining maximum performance from the transmitter.

Goodrich said that engineers continually check the tuning of their transmitters, as an increase in incidental noise can cause a high level of picket fencing. Also, an antenna with a narrow bandwidth can make the tuning even more critical. Station engineers should know the bandwidth of their antennas and take steps to broaden them if necessary.

The engineers can easily check the AM noise of their systems during normal programming. The AM noise should not increase with modulation, so adjustments can take place during the day, avoiding the midnight maintenance routine.

The final portion of the seminar on FM transmission performance was presented by Rick Knowles, senior technical officer for audio, Canadian Broadcasting Corporation (CBC). Knowles began by outlining the basic size of the CBC, which includes more than 1000 owned-and-operated transmitters and 38 production houses across Canada. The network has adopted guidelines and standards for much of the audio field after many years of research. Knowles said he felt that these standards had resulted in a vast improvement in the sound of the total system and provided the producers with a tool most US producers

of programming did not have. That tool is the *predictability* of the audio processing to be used at the final broadcast station.

As Knowles said, "Anyone who owns a 4-inch speaker immediately becomes an audio expert," and several magazines are directed to audio topics. Even so, Knowles said that the audio industry was putting out a great deal of misinformation about audio.

Knowles made three major points. First, he said that broadcasting is entertainment. Therefore, if it is entertainment, it is not work, and the listener should not have to continually adjust the volume control to hear the program. This means that the station must produce a program in which the listener has to do no work. He said that the constant volume used by popular music stations was one reason for their success.

Second, he said that there was not an audio processing box that did a perfect job. No matter what the manufacturer claims, there is simply no way a single box can provide all of the audio processing necessary or the amount of aesthetic treatment required to perfectly correct audio problems.

Finally, he said if the above two statements are truisms, then perhaps, as an industry, we are attempting to tackle the problem in the wrong way by attempting to make all adjustments in audio processing at the final output (the transmitter).

The CBC has closely studied the problems surrounding audio processing and listener environment. From that research, Tables 1 and 2 were developed, showing that the usable dynamic range may vary from 35 to 100 dB. The reason for the 20 dB reduction in dynamic range is based on the fact that a minimum of 20 dB is needed to retain intelligibility of low level signals. The reduced figure could be called *usable dynamic range*. Therefore, instead of having an FM transmission with a signal-to-noise ratio of 65 dB, we really have only 45 dB of usable S/N. And an AM transmission system that supposedly has a signal-to-noise ratio of 60 dB has only 40 dB.

Table 2 shows the average noise levels for several typical listening environments and these noise levels become important to the broadcaster.

Using the two tables, one can see

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Table 3. Maximum acceptable dynamic ranges

Service	Period	Time of Day	Maximum Dynamic Range (dB)
FM Stereo	Monday-Friday	7 a.m.—9 a.m.*	20
		4 p.m.—7 p.m.	20
		other times	35
AM	Monday-Friday	7 a.m.—9 a.m.*	15
		4 p.m.—7 p.m.**	15
		other times	25
TV Sound		5 p.m.—7 p.m.**	20
		other times	30

\*Most listening done in automobiles or at home during meals.

\*\*Television being listened to during supper.

## PRC '81

that a maximum dynamic range of 45 dB could be transmitted on FM for those people listening in a good environment. A more realistic figure would be about 35 dB. Therefore, if one were to play an orchestra piece to listeners in an automobile in rush hour traffic with the car windows down, the dynamic range would have to be reduced to only 15 dB in order to retain the listener.

Table 3 shows the *Maximum acceptable dynamic ranges* to be used by the CBC stations. For many broadcasters, the figures may seem like music heresy, but the data are based on a great deal of research by the CBC.

Knowles said that if broadcasters were not willing to make the necessary reductions in the dynamic range, then the listener had only two alternatives: make his own volume corrections or change stations. Neither alternative is in the best interests of the broadcaster.

### SCA/Stereo Laboratory

The SCA/Stereo Laboratory seminar was of interest to those stations currently engaged in SCA operations. The program was presented by John Kean of National Public Radio. Kean received a grant from the Corporation for Public Broadcasting to assemble a test lab to test and adjust FM transmission systems for maximum performance to benefit SCA systems.

The portable equipment that is taken to stations for use includes a QEI modulation monitor, Hewlett-Packard 141T mainframe, low frequency and high frequency spectrum analyzer modules, X-Y plotter and a Boonton 102D FM Signal Generator. Also available are a Moseley SCA Generator and FM limiter.

The equipment allows Kean to test stations to determine nonlinearities of the transmission system that would affect the proper performance of a stereo and SCA system. For example, one useful test is to look at the VSWR of the antenna system vs. frequency. The combination of the Boonton generator and a VSWR bridge allows an easy plot of the VSWR, or, in effect, the antenna bandwidth. Most engineers do not know how their VSWR changes in relation to frequency because their only method of measurement is the transmitter meter.

One of the lingering problems with stereo and SCA transmission is that of "birdies" in the stereo signal. Kean addressed the problem by showing the output of several types of receivers on a spectrum analyzer with stereo and SCA signals applied. The reference

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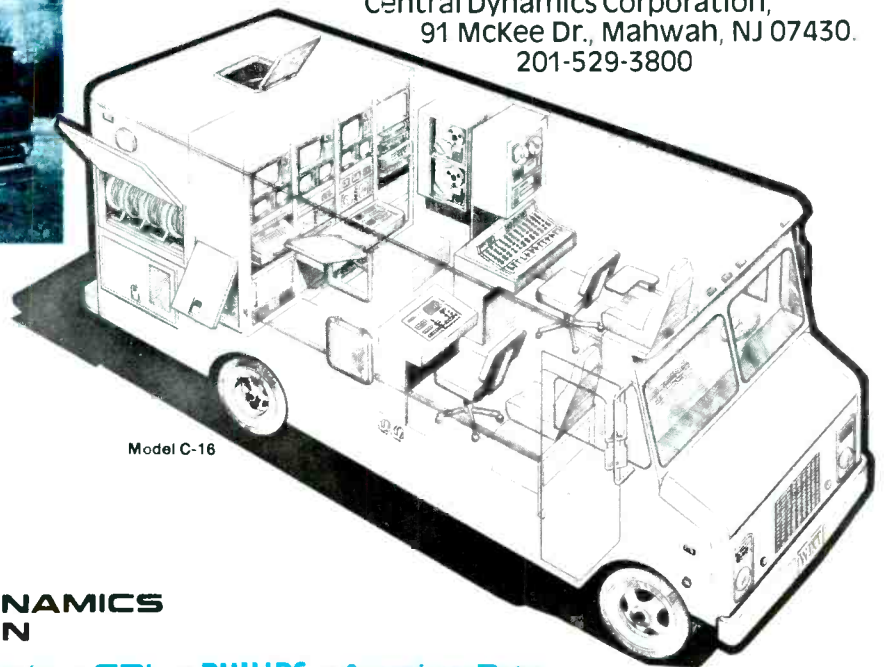
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Model C-16

**A-10:** 10-11' production area, 1-2 cameras, 1 portable VTR, audio mixer, video switcher, audio cart recorder, and ancillary equipment.

**B-14:** 12-14' production area, 2-3 cameras, 1 studio VTR, audio console, production switcher, audio cart and reel/reel recorder, intercom, and ancillary equipment.

**C-16:** See illustration to right. 16-18' production area, 2-4 cameras, 1-2 studio VTR's, other equipment similar to B-14.

**D-22:** 18-24' production area, 3-6 cameras, 1-3 studio VTR's, A/V routing switcher, 2 audio cart recorders, telephone system, other equipment similar to B-14.



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Circle (48) on Reply Card

## PRC '81

circuit was from an older receiver using a discrete stereo decoder.

The ratio detector of the receiver had outputs filtered by series resonant traps at 67kHz to prevent the SCA signal from being coupled to the stereo decoder. This circuit was compared to the phase-locked loop decoder of a more modern receiver, one usually having no coils or tuned circuits. The circuit relies on RC time constants to control the operation. The output of the PLL is fed to a stereo decoder similar to the stereo decoder used in the older receiver.

By feeding a 19kHz pilot signal and a 67kHz SCA signal into both stereo decoders, it was possible to compare their performance. The PLL stereo decoder always had a cleaner output than the discrete decoder, and the interference level was about 25 dB less. When modulation was added to the SCA signal, the sidebands caused the 9kHz "birdie" to twitter, or create the familiar sound from older receivers.

Kean then moved the SCA to 76kHz. Tests show that using the same decoders as before, the interference could be even worse. This is caused by the resulting audio birdie being lowered in frequency (from 0Hz to the peak deviation of the SCA channel), plus the fact that the benefit of de-emphasis is lost. Furthermore, some older receivers have traps at 67kHz, and moving the SCA to 76kHz would make those traps useless. This resulting interference signal can be characterized as an audio "buzz."

The next step was to move the SCA to 84kHz. This did not reduce the interference because 84kHz is about the same distance from 76kHz as 67kHz and the resulting "buzz" is the same. Also, by moving the SCA higher into the baseband, the old tuner traps at 67kHz are useless.

The SCA was then moved to 92kHz

and the test repeated. The resulting beat frequency was now 16kHz, much higher than before. Because this beat tone is so high in frequency, the ear is less sensitive to it. In practice, the interference signal can be measured, but it is not audible.

Kean suggested the following performance specifications for a 67kHz SCA system: **frequency tolerance**,  $\pm 500$  Hz; **injection tolerance**,  $9\% \pm 1\%$ ; **modulation**,  $\pm 5$ kHz for 100%; **audio response**,  $\pm 1.5$  dB 50 Hz to 7kHz measured at 50% modulation; **audio distortion**, 2% maximum for 50% modulation; **hum and noise**, 50 dB below 100% modulation using 150 microsecond deemphasis; **crosstalk**, from main or stereo to SCA, 47 dB below 100% SCA modulation; and **subaudible telemetry**, maximum of 40 Hz tones used, no less than 18 dB below 100% modulation. Harmonic distortion of tones should be -35 dB.

Kean said that these specifications were important to the proper operation of a good SCA system, but that most transmitters were not capable of meeting the 47 dB crosstalk specification. In his experience, grounded grid transmitters were better at meeting the crosstalk specifications than others. Parallel transmitters were even more difficult to tune to meet the SCA specifications, and he suggested that stations not operate in parallel but, rather, alternate the operation of the two transmitters.

Kean is currently conducting experiments on WETA by operating an SCA at 95kHz along with the regular 67kHz SCA. The 95kHz SCA is in addition to the modulation of the main channel and the 67kHz SCA, so a total modulation of about 110% is being used. No reduction in main channel modulation or SCA injection was done to accommodate the new SCA carrier. So far no problems have been noted by the local golden ears. However, in one case, a particular model of Yamaha receiver interpreted



The FM Transmission Seminar (John Kean is at the podium.)

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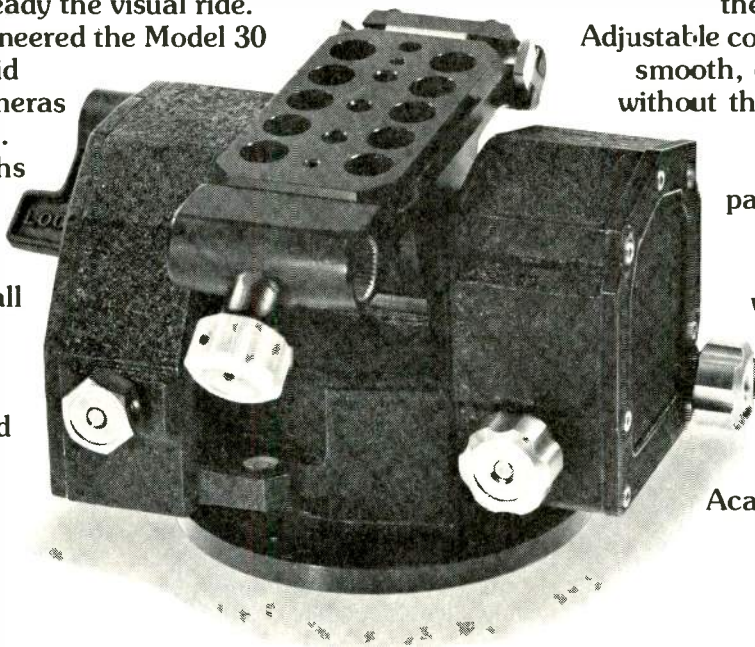
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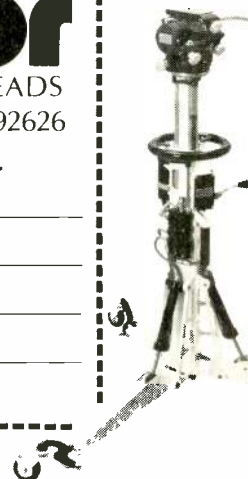
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## PRC '81

the additional SCA as a reduction in field strength and showed the station to be operating at about half power. Apparently the field strength meter looked at the signal in the upper part of the base-band and misinterpreted the 95kHz signal as a reduction in signal strength.

### Satellite Operating System (SOS)

For several years, NPR has been in the process of designing an operating device referred to as *Satellite Operating System (SOS)*. This system would interconnect with a data channel on the NPR transponder and provide NPR stations with various control and information functions.

The SOS is composed of two sub-systems, DACS (Data Access Communication System) and Machine Control. The DACS system allows NPR to transmit printed information to stations on an immediate basis and permits the grouping of stations so messages can be targeted. Advisory alarms are a part of the system, and any of four alarms can be activated at all stations—including EBS, Engineering, Programming or Management. The feature provides a method whereby the appropriate department can be alerted to important upcoming messages.

The second part of the SOS system, Machine Control, is even more complicated. The machine control aspect of the system provides the capability for a station to record programs from the network without relying on operators to start recorders. The control portion of the system will tune the satellite demods to the proper channel at the correct time, and start the recorder. The station operator enters a code identifying the desired pro-

gram and loads a tape on the recorder. The SOS will monitor the data channel from NPR and determine when to activate the necessary steps to tune the demods and start the recorder. The unit continually checks itself and its program to ensure that no faults exist, and it has the capability to completely reload its resident computer program from the satellite at any time, automatically.

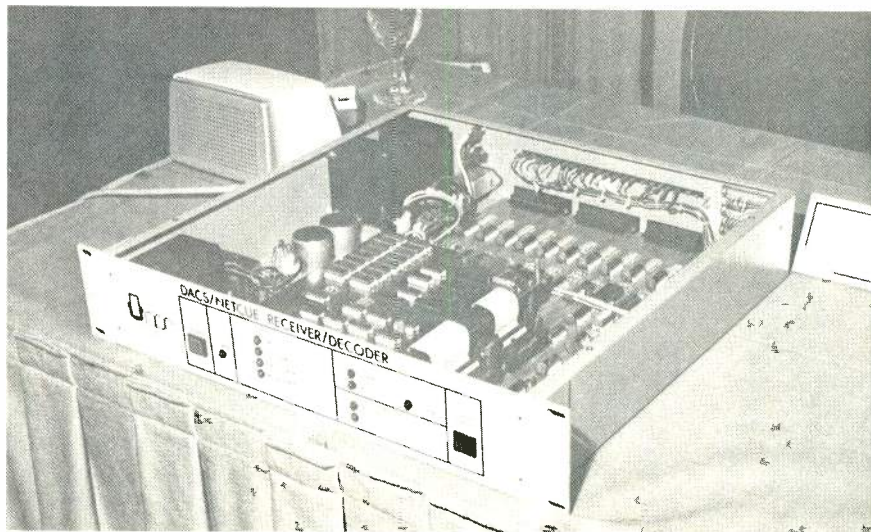
Options may include the capability of having the SOS control station routing switchers, matrix control for demodulator interfacing, and CRT data entry. Some stations have expressed the desire to interface the SOS to their own in-house computer systems. This feature would allow them to enter the desired record schedule into their computer and have the computer direct the SOS system to perform the necessary steps to record the programs, print out a schedule and tell the operator when and where to load tapes.

When finally installed, it will represent a giant step into the world of automated control and operation for many public radio stations. As far as is known, no commercial network has attempted such a sophisticated station-related project, and NPR stations are looking forward to its completion.

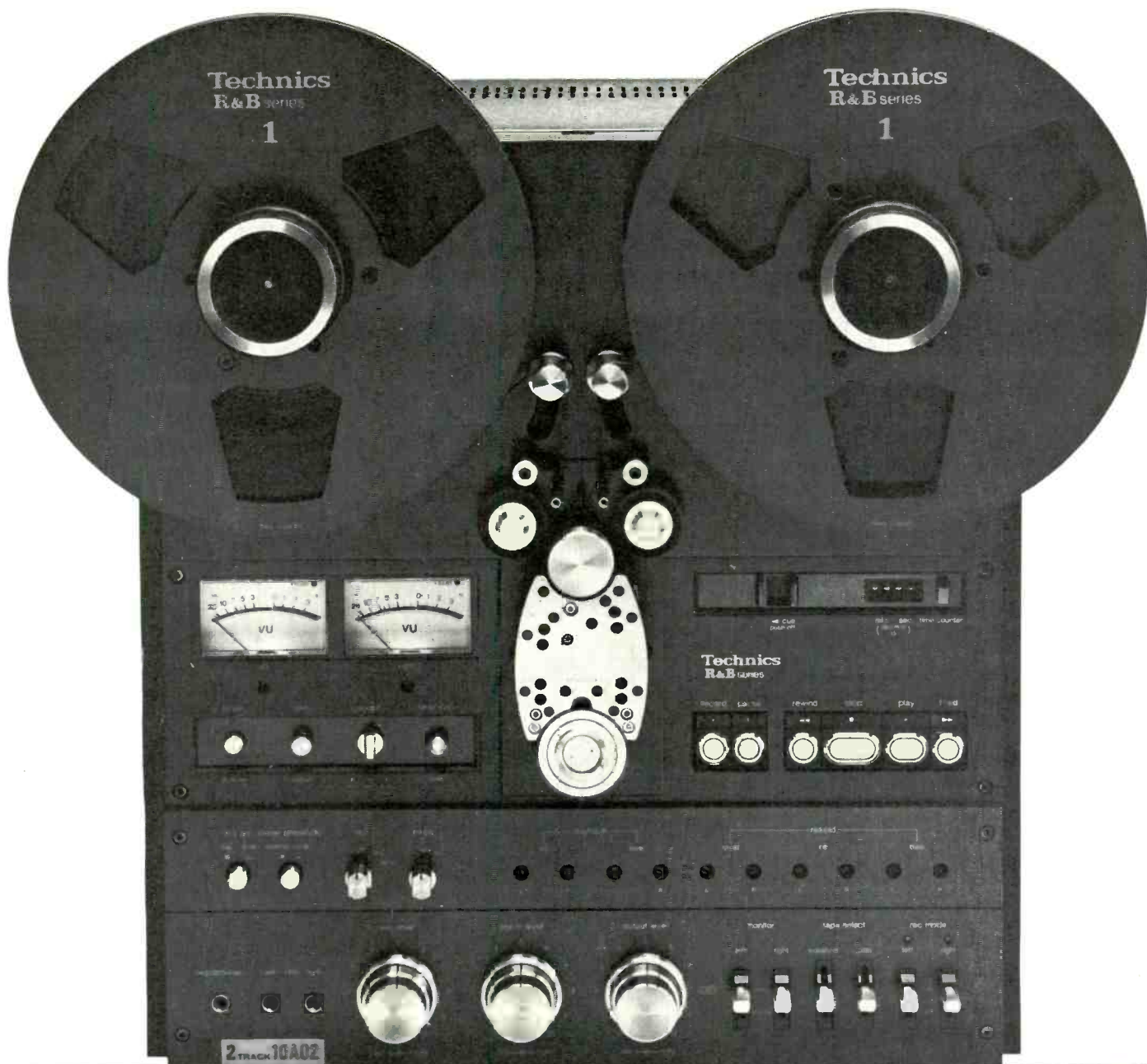
### Final Comments

The Public Radio Conference had more seminars than can be included in this report. The topics were timely and particularly of interest to public radio stations. The information gathered by those attending will not only help make the participants better engineers, but will also allow the stations to present better quality radio to the listening public.

Next year's conference is tentatively scheduled for April 18-22 at the Hyatt Regency Hotel in Washington, DC. □



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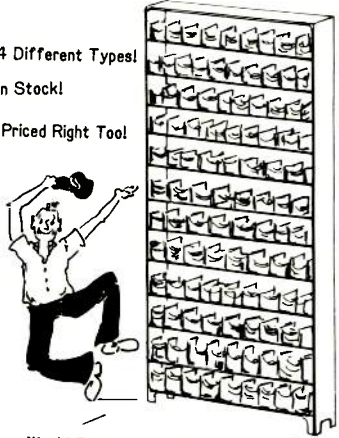
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## Broadcast mixer, amplifiers

Broadcast Audio Corporation has introduced four new products.

The Series II System 20 is an expandable modular broadcast mixer, which joins the previous systems 8, 12 and 16. Dc switching allows quiet control of one of three inputs to each mixer. System 20 accepts different types of mixer modules to include panpots and equalizers. Output levels, to +26dBm maximum, are within 1dB from 20Hz to 20kHz. Noise is rated at -68dB or better, below a +8dBm output. THD is 0.25% or less; IM is less than 0.05% SMPTE-rated.

FET Monitor Amplifiers BA-235 and BA-435 provide two or four 35W output channels. Response of  $\pm 0.1$ dB from 20Hz to 20kHz with THD and IM distortion of less than 0.05% complements a noise figure of -100dB. Phase shift is  $\pm 10\%$  over audio spectrum. Current limiting provides output protection.

The BA-205 phono amplifier includes passive equalization networks, yet yields a +8dBm rated output with a 7mV input RIAA and IEC response of  $\pm 0.2$ dB (20Hz to 20kHz). THD is 0.01% with an IM distortion of 0.006% SMPTE-rated enhancing a signal-to-noise ratio of 85dB. Rumble filtering is centered at 40Hz. A maximum of +28dBm across 600 $\Omega$  is available.

Circle (202) on Reply Card

## Modular broadcast color camera

CEI has introduced the CEI 330, a compact high performance video EFP color camera, which is capable of operating 2400 feet from its electronics unit. It is possible to operate the system at distances of 4400 feet by using the CEI remote control package.

In developing the 330, CEI consolidated many of the electronics of the 310 into a digital transmission system package that attaches to the 310. The CEI 330 weighs less than 20 pounds.

CEI 330's signal transmission is via interconnect, full bandwidth RGB microcable. The CEI 330 may be connected to TV 81 cable. The 330 is also available in a studio package.

Circle (176) on Reply Card

## Modular character generator

A microprocessor-controlled modular character generator, the Scriptel "P," has been announced by Unitel.

The Scriptel "P" includes these features: hardware programmed character generator (EPROM), single

keyboard for editing and control, coaxial wires from keyboard to electronic unit, preview and broadcast pictures, 16 rows of 32 characters each page, internal memory of 16 to 32 pages, optional floppy disc (250 pages per disc), static transfer from preview to broadcast—complete, part, subtitle, character by character; and dynamic transfer—3-speed roll and crawl.

Several of the options available for the Scriptel "P" include disc memory, time counter, computer connection, multi-graphism (both PROM and RAM), automatic "Subtel" subtitler and "Graphlet" font composer.

Circle (177) on Reply Card

## Teletext system

Logica has introduced CONTEXT, a comprehensive range of teletext systems based on the BBC CEEFAX system.

Each CONTEXT system provides full facilities for the preparation, editing and transmission of pages of information to TV viewers.

Each CONTEXT system is supplied as a complete working package, including all hardware and software and training in its use.

CONTEXT's capabilities include the simple creation of text and graphics, in color, for news stories, magazine features, advertisements or entertainment; and parallel editing and transmission.

CONTEXT also has a flexible subtitling facility. In addition, CONTEXT has a comprehensive library that can hold several thousand pages of information, not currently being transmitted.

Circle (185) on Reply Card

## M-16 console

Tascam has announced the availability of the M-16, a new 16-track console. The new mixer can be configured with 16 or 24 input positions. There are eight main program mixing buses with submaster faders, eight main board outputs, two independent stereo mixing buses, four auxiliary mixing buses, 16 meters switchable to read bus or external source, and 16 x 2 monitoring with eight assignable effects returns. The M-16 has stereo solo in-place for input, monitor, and effects returns. All inputs have pre-fader-listen capability. During remix, the solo logic permits instant comparisons between effects send/receive. The M-16 also

features 4-band 8-knob parametric (sweep type) equalizers that may be switch bypassed and three filters (two high pass, one low pass). Faders are conductive plastic with a 100mm throw.

Circle (191) on Reply Card

#### Display monitor

TSD Display Products Inc. is offering a 9-inch display monitor that provides a high-definition, sharp image presentation.

Features of the display include a wide video bandwidth of 25MHz, uniform focus characteristics across the screen, and horizontal retrace time that is typically less than 7 ms. Separate horizontal drive, vertical drive and video signal inputs, as well as a composite video, have made it possible to provide simple interface circuitry.

Circle (192) on Reply Card

#### Tracking vibration recorder

Scientific-Atlanta Inc. has introduced a tracking vibration recorder, model 2521, which is a predictive maintenance tool for measuring vibration responses of rotating machinery. A self-contained recorder provides permanent records analysis and fault identification. The tracking feature records transitory effects and, when used with a strobe light, allows the user to observe a particular vibratory motion of the machine under test. This unit will perform laboratory measurements on engines, motors and turbine under field conditions.

Circle (193) on Reply Card

#### Portable generator

Victor Duncan Inc. has introduced a 70kW portable generator that is packaged in a conventional Chevrolet van. The generator has a 600A capacity that can be used to power conventional ac lights, HMI lights or arc lights. Control and monitoring functions are automated, and attention has been given to noise attenuation and cooling requirements.

Circle (194) on Reply Card

#### Studio lamp

A high-output energy-saving Sylvania fill-light for film, theatrical and TV studio use has been introduced by GTE. Called the Brite-Arc studio lamp, the 4000W light source provides about 102lm/W; which is ap-

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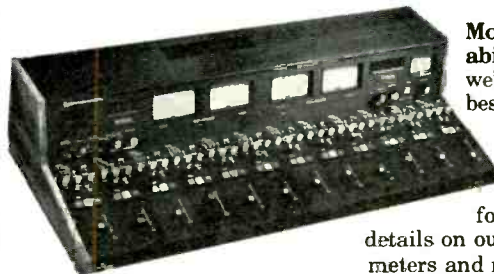
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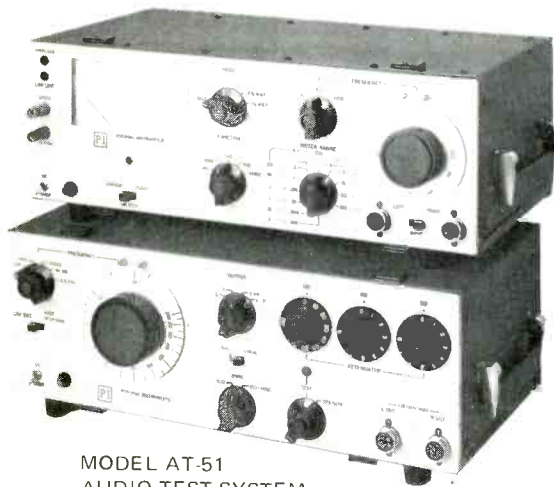
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## New products

proximately four times more efficient than incandescent or tungsten-halogen studio lamps. A medium-arc-length light source, the lamp provides a 370% higher level of daylight illumination than a 10,000W tungsten-halogen lamp adjusted for daylight with standard theatrical filters at a balance color temperature of 5600°K. The lamp has an average rated life of 500 hours compared to 300 hours for 10,000W tungsten-halogen lamps.

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### Digital generator

Siemens has announced the DAK digital audio indicative generator, which allows digital storage of short, repeated audio programs such as signature tunes, chimes and brief announcements. Audio programs are stored via digital signals in long-life semiconductor memories.

The indicative generator has a modular construction. It can be adapted to customer requirements and may be modified subsequently.

Two systems are available. The simpler system with non-linear 8-bit resolution is better suited for intercom and electro-acoustic systems and the elaborate non-linear 12-bit system is for high-grade studio recordings.

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### Set-up charts

AaRLO Enterprises has introduced a book of set-up charts called Flip Charts, intended for ENG location use and CCTV Systems. There are five 9"x12" charts: an EIA resolution chart graded to 800 lines; an EIA-type color camera registration chart for 3-tube cameras; an RS-170 9-step logarithmic reflectance chart; an EIA-type linearity (Ball) chart; and a color-bar chart for subjective in-field color reference. All charts, except the logarithmic reflectance, are laminated.

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### Digital stereo generator

C. N. Rood B. V. of the Netherlands has announced the immediate availability of its new 200 Series stereo generators and ancillary equipment. The SC-200 series stereo generator uses a patent pending sinusoidal switching system.

Typical specifications of the SC-200 stereo generator are 70dB channel separation; 0.01% harmonic distortion; 95dB signal-to-noise ratio; and 5-50°C temperature stability. Complete built-in test equipment is available.

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But convenience and versatility are just two of the advantages of the new ATM models. All-new electronics provide plenty of headroom inside the microphone with no more than 1% THD even when used in acoustic fields of 141 dB SPL. Which sets new standards for clean sound even close-up to big brass or inside a powerful drum kit.

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## **Bentz named technical editor for Intertec's Broadcast Engineering/Spec Book**

**Carl Bentz** has been named technical editor for Intertec Publishing Corporation's **Broadcast Engineering** magazine and **Spec Book**. The announcement was made by Cameron Bishop, publisher of the Electronics Group.

Bentz holds an FCC 1st class license and joins the company with a solid background in TV engineering technology and cable engineering. He previously served as a staff engineer with KCPT-TV, Kansas City, MO, and performed functions including engineering maintenance, design and on-air programming.

As technical editor, Bentz will coordinate and advise all technical aspects of **Broadcast Engineering** magazine. Bentz makes **BE** the only publication in the field with an FCC 1st class licensed engineer on staff.



Bentz has also performed engineering operations and maintenance functions for five tower directional station KUDL-AM (now KCNW) and KUDL-FM. Bentz also directed engineering operations, productions and cable system maintenance for Telecable of Overland Park, KS, and served as a technical writer for aviation navigation electronics instruction manuals.

His background includes extensive tracking of FCC issues, record keeping for both the KCPT and KUDL stations, and editing and rewriting of sections of the FCC rule book pertaining to engineering.

Bentz is a graduate of the University of Kansas and Capital Radio Engineering Institute.

**Mark Raduziner** has been hired as marketing coordinator for Intertec Publishing Corporation's Electronics Group which includes **Broadcast Engineering**, **Radio y Television**, **Electronic Servicing** and **Video Systems**. Raduziner joins the company with a strong background in publications, having previously served as a communications associate with McMartin Industries, a broadcast equipment manufacturer in Omaha, NE. As marketing coordinator, Raduziner will work on improving advertiser services and will coordinate marketing, sales activities and sales promotion functions for the Electronics Group. A graduate of the University of Nebraska, Raduziner holds degrees in journalism, speech and broadcasting.

3M has announced the appointment of **Robert J. Youngquist** as corporate scientist in its Professional Audio/Video Equipment Project. Youngquist is responsible for further advancement of digital audio and high-density digital recording technologies. He was research manager of the former Mincom Division, where he spearheaded development of the first commercially available digital multi-track recorder.

**Rodger Winchell** has been named national manager of federal government marketing for Sony Video Products Company. Winchell will coordinate sales of all products from the Sony Video Communications and Broadcast Divisions to the federal government and federally funded accounts.

The International Radio and Television Society Inc. "Broadcaster of the Year" award was presented to **Phil Donahue** during the 1981 IRTS Convention held in May in New York. Ave Butensky, IRTS president, presented the award.

During the 36th Annual International Conference of the Radio Television News Directors Association to be held September 10-12 in New Orleans, LA, **Walter Cronkite** will be presented with the 1981 Paul White Memorial Award. Cronkite previously received the award, a memorial to journalist Paul White, in 1970.

**Michael C. Rau** has been appointed to the newly created position of staff engineer for the National Association of Broadcasters. Rau, a graduate of Clarkson College, has served as a consulting engineer with Jules Cohen & Associates, was director of engineering for Rau Radio Stations, and has worked in the radio broadcasting industry in many positions from announcer and music director to chief engineer.

**Skip Finley**, president of Sheridan Broadcasting Network, Arlington, VA, replaces Thomas E. McKinney on the NAB Radio Board of Directors. Starting as a floor director in 1971, Finley moved through various broadcasting capacities before joining Sheridan Broadcasting as vice president and general manager of the Radio Division in 1979.

**David Zandan** has been appointed eastern regional sales manager for Edutron Inc. Before joining Edutron, Zandan was vice president of Fortel Inc., a distributor of Faroudja Laboratories products.

**Arnold Taylor** has joined Compact Video Systems as president of Compact Video Sales and also as group vice president of manufacturing. As group vice president, Taylor is responsible for Compact's three manufacturing divisions, Skirpan Lighting, RTS Systems and Compact Video Sales.

**Charles P. Covert** has been appointed general manager of the audio products group for the Ampex Audio-Video Systems Division. Covert will be responsible for the development, manufacturing and marketing of all Ampex audio products.

Alpha Wire Corporation named the following district managers: **Karl Rankin**, **Tom Sawyer**, **Charles Sims**,

**Bradford Coleman, Kevin McClure, Daniel Delavie, Wayne Eisel, Don Paton and Sean O'Callaghan.** They are responsible for electronic sales in their districts.

BGW Systems Inc. has announced that two new regional sales managers have been hired by the firm. **Jim Edwards** is the new BGW regional sales manager for the Central region (based in the Chicago area). **Gordon Hawks** is BGW's new regional sales manager for the South-Central region (based in the Dayton, OH area).

**Richard J. (Dick) Lutz**, former executive producer with WQED Pittsburgh, and special assistant to the president of Metropolitan Pittsburgh Public Broadcasting Inc., has joined Logica Inc. as US database manager for Prestel International. Lutz will select and support American providers of information for Prestel worldwide.

McMartin Industries has announced the appointment of three new Audio/SCA managers: **James Starkloff**, manager for the eastern region; **Jay McMartin**, manager for the western region; and **Joseph Krier** for the central region. Each manager is responsible for coordinating the efforts of McMartin's Engineered and Commercial Sound representatives in his area.

**William Park**, to vice president, Marketing, Sony Broadcast, from national sales manager; **Frank Brown**, to vice president, Engineering, Sony Broadcast, from general manager, Engineering.

HM Electronics Inc. has appointed **Robert W. Carr** as marketing manager. Coming to HME with more than 30 years background in engineering and marketing functions at Shure Bros. Inc., Carr will be responsible for the expansion of marketing and product planning activities. **R. Dale Scott** will continue as national sales manager and **John F. Kenyon** has been promoted to assistant sales manager.

**Sandra Palmer** has been named general manager of Transportable Earth Stations Inc. Palmer will oversee the scheduling of the TES fleet of portable uplink earth stations and satellite broadcast facilities as well as supervise an aggressive sales and marketing plan, among other duties. Before joining the Burbank based firm, she served as president for a Vail, Colorado land development concern and also served for several years as an executive at Compact Video Trucks.

Effective early this year, **John Walter** is vice-president and general manager, Leitch Video Ltd. At the same time, **Don Jackson** was appointed vice-president, engineering.

Jerrold division of General Instrument announced appointment of **Anthony J. Aukstikalnis** as vice president, engineering, Subscriber Terminal Systems. Aukstikalnis was most recently manager of the advanced development program at RCA's Astro electronics division and has held management positions in the defense meteorological satellite program and the missile satellite program. □



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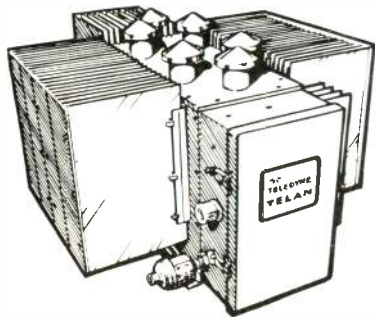
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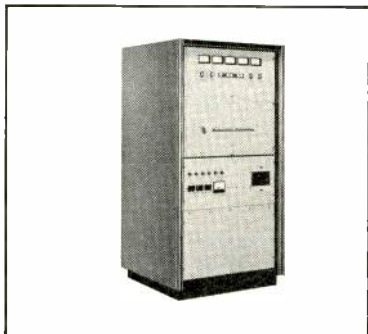


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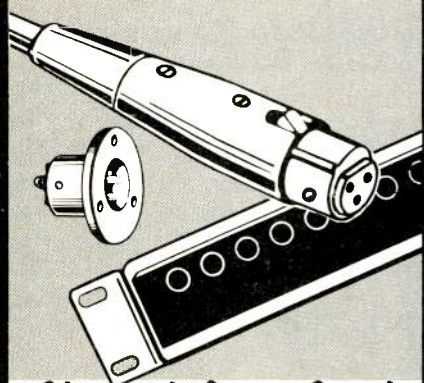
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**Solid-state emitters**

A 24-page product guide providing tabulated data and outline configurations for RCA's line of solid-state emitters has been released by *RCA Electro-Optics and Devices*, Lancaster, PA. The product guide, SSE-100, features an applications section depicting schematics of typical drive circuits for IR emitting diodes and injection lasers. Selection guides are also included. Copies may be obtained by writing to RCA, Box 3200, Somerville, NJ 08876.

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**Television technology**

A new book, "Television Technology in the 80s," has been published by the *Society of Motion Picture and Television Engineers (SMPTE)*. The 240-page book costs \$30, less a 20% discount to SMPTE members, and is available from SMPTE Books, 862 Scarsdale Ave., Scarsdale, NY 10583. The new book contains 22 papers plus a panel discussion that were presented at the SMPTE Television Conference in February 1981 in San Francisco. It covers many areas of TV's developing technologies, including digital video recording, digital techniques, the completely digital studio, new camera technology and high definition television.

Circle (251) on Reply Card

**Capacitors**

A 10-page, tab-indexed catalog of capacitors, published by *KD Components Inc.*, contains information for the prospective user of KD's 125° to 300°C high and low voltage ceramic, chip and mica capacitors. The booklet is illustrated by photos, diagrams and a variety of size/capacitance/voltage tables.

For a copy of the Capacitor's Catalog 181, contact: *KD Components Inc.*, 3016 S. Orange Ave., Santa Ana, CA 92707; (714) 545-7108.

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**Coaxial and RF switching relays**

The revised "Coaxial & RF Switching Relays" catalog released by *Magnecraft Electric Company* contains information about various types of coaxial relays designed for minimum size and weight, ac or dc operation, with time delay, auxiliary contacts and mechanical latching and unshielded RF switching relays are

also included. For a free copy or more information, contact: *Al Cooper*, *Magnecraft Electric Co.*, 5575 North Lynch Ave., Chicago, IL 60630; (312) 282-5500 Ext. 422.

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**Engineering products**

An engineering handbook from *Kerrigan-Lewis Wire Products* describes their film-insulated and yarn-covered magnet, litz and resistance wires. Also included are valuable tables covering resistance corrosion factors, temperature conversions and decimal equivalents. For more information contact: *Kerrigan-Lewis Wire Products*, 4421 W. Rice St., Chicago, IL 60651; (312) 772-7208.

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**Technical books**

More than 300 technical books are described in the "1981 Catalog of Sams Technical Books." The catalog, which includes 23 new titles, covers these areas: audio and hi-fi; communications; computers; electronics; industry; motors, engines, electrical appliances; radio and television; reference and mathematics; and servicing and troubleshooting.

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**3M products**

About 150 3M products, grouped by major segments of the communications industry, are described in a multipage, 4-color brochure. The products range from abrasives to videotape recorders.

Free copies of the brochure, "Products for Voice, Video and Data Communication," are available from Department 1599/3M, P.O. Box 4039, St. Paul, MN 55133.

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**Low-noise amplifier**

A release by the *International Microwave Corporation*, titled "Low Noise Amplifier Bulletin," describes an amplifier designed for earth terminal use. The bulletin provides general information, a list of key features, a photograph of the amplifier system and complete specifications for different models. For more information, contact: *International Microwave Corporation*, 33 River Road, Cos Cob, CT 06807.

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### TRAINING

**ELECTRONICS DEGREE** by correspondence. Earn A.S.E.T., then B.S.E.T. Free brochure. Grantham College, 2550 South La Cienega, Los Angeles, California 90034. 2-79-tfn

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### SERVICES

**WE REBUILD TAPE MACHINES!** Sebago Broadcasting Service rebuilds Broadcast Quality tape and cartridge machines. Harris-Ampex-Spotmaster-Magnecord-etc. All work done on hourly rates, plus parts. Call for **FREE** over the phone **EVALUATION Today!** Sebago Broadcasting Service, 705 West Hickory, Edna, Texas 77957, (512) 782-6720. 8-81-tf

**ONE STOP FOR ALL YOUR PROFESSIONAL AUDIO REQUIREMENTS.** Bottom line oriented. F.T.C. Brewer Company, P.O. Box 8057, Pensacola, Florida 32506. 7-71-tf

**HELIX-STYROFLEX.** Large stock — bargain prices — tested and certified. Write for price and stock lists. Sierra Western Electric, Box 23872, Oakland, Calif. 94623. Telephone (415) 832-3527. 1-73-tf

**BROADCAST ENGINEERING SERVICE COMPANY:** TV-FM-AM field engineering emergency maintenance — turnkey installation system design — survey and critique interim maintenance or chief engineer. B E S Company, New Port Richey, Fla. 33553, (813) 868-2989. 7-81-tf

**TRANSMITTER TUBES REPROCESSED** — Save 40 to 50%. 3CX2500, 4CX5000, 4CX15000 and many others. Write for details. FREELAND PRODUCTS CO., 3233 Conti St. N.O., La. 70119. (504) 822-9222. 6-79-tfn

**BROADCAST CRYSTALS:** for AM, FM or TV transmitters, frequency change, repair or replacement of oven types. Also vacuum types for RCA, Gates, Collins, CCA, etc. transmitters. High quality products, reasonable prices and better delivery! Don't be without a spare crystal. Frequency change for FM and AM nomitors. Over 30 years in this business. Eldson Electronic Co., Box 3751, Temple, Texas 76501. Phone (817) 773-3901. 4-81-tfn

### EQUIPMENT FOR SALE

**VHF TV TRANSMITTERS (2)** General Electric 35kw just removed from service. Tuned for channel 9 plus 10 kc. Can be seen operating into dummy load. Other miscellaneous equipment also available including Collins 13 ghz dual STL. For further information and inspection contact Robert E. Leach, WOR-TV, 1481 Broadway, New York, N.Y. 10036 or call (212) 764-6984. 8-81-tf

## EQUIPMENT FOR SALE (CONT.)

**RCA-TK-76** camera with lense. Excellent condition, low hours. \$24,000.00. 206-392-3011. 6-81-61

**LATE MODEL SATICON** equipped Hitachi SK-90 color camera with 12-1 Fujinon/AC/batteries/high speed charger/case. One owner. (412) 765-2910 days, (412) 231-7573 nights. \$20,500. 7-81-21

**TWO AMPEX AVR-2's** each equipped with editor/editec, digital dropout compensator, autotracking audio monitor stack, B&G air compressor, Tektronix 529, monitor switching panel, color monitor and spare head. Also for sale: two Tektronix R146 sync/color bar generators; one Tektronix service scope/spectrum analyzer system which includes 7504 90 mhz 4-slot mainframe w/CRT readout, 7A18 dual trace horizontal amplifier, 7B40 time base amplifier, 7B41 delaying time base amplifier, 7L5/L1 5mhz spectrum analyzer, 204-2 scopemobile: one Sylvania rack mount flying spot scanner slide chain. All equipment has been excellently maintained. Available immediately. Call John Switzer, (303) 455-1514. 8-81-11

### USED VIDEO EQUIPMENT FOR SALE

Ampex	VPR-1C	"C" format 1" VTR	\$22,500
Ikegami	HL77	Color Camera	16,000
Phillips	LDK-14	Color Camera	25,500
Gates	201E	Color Camera (Studio)	2,500
O'Connor	100C	Fluid Head	1,100
CDL	VS14	Production Switcher	4,500
Telescript		Lensline	1,850
		Teleprompter	
Lenco	PMM910/1200	Monitor/Waveform	1,750
Ianero	1000W	Cyc Lights (w/gel holders)	95

All Equipment in Good Operating Condition!

Call For Information and Listing of Other Sale Items

TRI•COMM Productions - Hilton Head Island, SC  
(803) 785-5920

**USED EQUIPMENT BARGAINS:** RCA TT-10AL 11KW VHF Transmitter \$5,000; Complete GE Film Island \$18,000; RCA TR-70 VTR, Cavac & D.O.C., \$17,000; Ampex 1200B VTR, AFA Rebuild, Editor, \$16,000; Norelco PC-70 Color Camera \$8,000; IVC 500 Color Camera \$2,500; CVS 504B T.B.C., \$5,000; Microtime 2020 T.B.C. \$9,500; Envirozone Air Filters, \$500; Hundreds of other items. 30 Brands new equipment. Call Bill Kitchen or Jim Herring, Quality Media Corporation, 404-324-1271. **Remote Production Cruiser:** Beautiful condition, full air-conditioning, camera platform on top, new diesel engine— and drive train. Equipment includes: (5) GE PE—350 cameras (can upgrade), minicam, motorized cable reels, full monitoring, full audio and video switching. Quad VTR and 3/4" editing system. \$130,000 takes it all. Call Bill Kitchen, or Jim Herring, Quality Media Corporation, (404) 324-1271. **New 5 KW Hi-Band VHF Transmitter:** Never used, in factory crates. Standard electronics model No.'s AH653, TH652, TH613. Tuned to channel 10, can be tuned to any hi-band channel. \$30,000. Bill Kitchen or Jim Herring, Quality Media Corporation, (404) 324-1271. **Used ENG Equipment:** Sony DXC 1600 Cameras, 4 avail. \$1,200 ea.; Sony RM-400 Editor \$800; Convergence ESC-1 Joystick Editor \$2,500; Sony VO 3800 3/4" VTR \$1,500; Sparta A15 Audio Console \$400. Call Bill Kitchen or Jim Herring, Quality Media Corporation, (404) 324-1271. **ENG-Production Van:** Like new with (2) Hitachi SK-70 Cameras, JVC 3/4" Editing Package, Portable VCR, CVSS04B T.B.C. with Noise Reduction, 3M1114 Switcher, Character Generator, Elaborate Audio, Patching, and Monitoring, Custom Ford Truck with Camera Platform and Generator. Cost over \$200,000 new plus labor. Everything you need to go to work today. Make offer! Call Bill Kitchen or Jim Herring, Quality Media Corporation, (404) 324-1271. 8-81-11

**AM OPTIMOD** like new, best offer—5 year old Gates AM modulation monitor, \$295. K-RAM, 925 E. Desert Inn Rd., Las Vegas, NV 89109, (702) 732-1363. 8-81-31

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## MISCELLANEOUS FOR SALE

**VIDEO T-SHIRTS. TV DESIGNED,** preshrunk T-Shirts. Our four designs are; "ENG" and Reg. Chart, "GLITCH", "RESOLUTION" and chart, and "VIDEO PEOPLE DO IT IN SYNC". \$8.50 each and \$2 handling. Send check and size to: AaRLO ENTERPRISES, 105 MINNA ST., SUITE 254, SAN FRANCISCO, CA 94105. 8-81-61

## HELP WANTED

### Field Service Engineers

The Grass Valley Group, Inc., a leading manufacturer of television broadcast equipment, is looking for people who want challenging professional positions. Openings exist in California, Indiana, New Jersey, and Georgia.

These challenging positions combine chances for U.S. travel plus marketing and engineering career opportunities. Individuals with experience designing and/or maintaining television broadcast systems are required to provide after-sales support for our wide variety of complex systems.

Interested and qualified candidates are invited to send a resume in confidence to Sylvia Smith, The Grass Valley Group, Inc., P.O. Box 1114, Grass Valley, CA 95945. An Equal Opportunity Employer M/F/H.

**The Grass Valley Group, Inc.**  
A Tektronix Company

**TOP COLOR CORRECTOR**—East coast midtown video studio. Good personality-following-incentives-engineering know-how- executive privileges-excellent benefits-ideal surroundings-good working conditions-resume kept in strict confidence. Write P.O. Box 1701, Grand Central Station, New York, N.Y. 10163. 8-81-11

**PHOENIX, ARIZONA,** CBS affiliate has engineering department openings for experienced operating and maintenance personnel. Require minimum 2 years experience and technical/college graduate or equivalent. Send resume or call Al Hillstrom VP/Engineering, 511 W. Adams, Phoenix, AZ 85003, (602) 257-1234. Equal Opportunity Employer. 8-81-11

#### Help Wanted Technical

If you are an energetic, self-motivated, communicative Chief Engineer who has a minimum of five years broadcast experience, we have a challenging opportunity for you in Boston. Please send a complete resume to:

Mr. Dennis R. Ciapura  
Greater Media Inc.  
Turnpike Plaza  
197 Highway 18  
East Brunswick, NJ 08816

Also, Assistant Chief Engineer opportunity in Detroit. Must have strong audio background. Send complete resume to:

Mr. Chuck Borchard  
General Manager  
WMJG/WHND Radio  
1 Radio Plaza  
Detroit, MI 48220 8-81-11

 **GREATER MEDIA, INC.**  
EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER

## HELP WANTED

**WJBF-TV IS LOOKING FOR AN EXPERIENCED** broadcast engineer. Applicants must have ENG maintenance experience and some transmitter experience would be helpful. Duties will include studio maintenance on RCA and Ampex equipment. An excellent opportunity to be with the markets leading station. Excellent salary and benefits. Send resumes to: Doug Moore, WJBF-TV, P.O. Box 1404, Augusta, GA 30903. An equal opportunity employer. 7-81-21

### MAINTENANCE ENGINEER GO FOR GROWTH IN EAST TEXAS

If you have an FCC radio telephone 1st Class license, demonstrate your expertise with a growth-oriented TV broadcast facility in Lufkin, Texas. You'll maintain the station's electronic equipment in accordance with mfr.'s specifications, the station's high standards policy and FCC regulations. ENG equipment and transmitter experience a definite plus. Starting salary commensurate with experience and ability. Send your resume or letter to:

Personnel Dept.  
**KTRE**  
P.O. Box 729  
Lufkin, TX 75901

An Equal Opportunity Employer M/F

**3M VIDEO EQUIPMENT:** Direct close out—new, full warranty. Model 710 pulse distribution amplifier, \$200 each. Model 730 sub carrier distribution amplifier, \$200 each. Model 1114 production switcher, \$4,500 each. Call 1-800-328-1008. 8-81-11

**FOR SALE AMPEX 1200 VTR,** full blown tape machine with Datametric's time code display/reader and C.V.S. 520 Sync generator. Redesigned dimensions of machine are 3'6" x 3'2". Excellent condition. 914-359-2936, VIDEO REMOTES. 8-81-11

**2-AMPEX AG-500** full track audio recorders. Good condition. \$750 each or \$1400 for Pair. Contact: Frank Torbert or Joe Gates (305) 293-2750. 8-81-11

**TELEVISION HELP WANTED—TECHNICAL:** \$40,000 + FIRST YEAR GUARANTEED. Our company has grown so quickly in the past 5 years, we are in desperate need of a very special person who knows broadcast equipment intimately and has aggressive sales ability. We are diversifying into other areas and need someone to take over the equipment sales division. Responsibilities include sales of new and used broadcast equipment and further development of equipment sales division as business demands. We are a first rate company and believe in paying top dollar for the right person. Call Bill Kitchen, Quality Media Corp., (800) 241-7878. 9-80-TFN

**ENGINEERS, TV Systems Engineers, Electronic Technicians, Technical Supervisors, Maintenance.** Immediate openings. Experienced. Full time. Full benefits, plus Pension. Excellent salary plus commissions. Send resume to Technical Operations, Inc., P.O. Box 840, New Hyde Park, N.Y. 11040, or call Personnel Mgr. (516) 352-2238. 9-80-tfn



## HELP WANTED (CONT.)

**TV STUDIO MAINTENANCE TECHNICIAN:** Independent commercial VHF station in 14th market seeks Maintenance Technician with valid FCC 1st class Radio/TV Operator's License, familiarity with latest broadcast equipment, minimum 2 years experience. Send resumes to: Dept. BE, KCPQ Channel 13, P.O. Box 98828, Tacoma, WA 98499. EOE. 8-81-1t

**VIDEO DESIGN ENGINEER:** One of the largest manufacturers in video industry seeking aggressive persons with strong background in circuit design. Excellent salary and fringe benefits, including profit sharing. Send resume to: Dept. 542, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 8-81-1t

### Room At The Top

WGBH Boston has an immediate opening for an **Assistant Chief Engineer—Maintenance and Design.** Candidates for this management position must have a thorough understanding of TV and FM state-of-the-art broadcast equipment, five years experience as a maintenance engineer and the proven ability to supervise maintenance engineers. Top salary and benefits. Send resume to: WGBH, Personnel (A-95), 125 Western Ave., Boston, MA 02134, Deadline: August 15, 1981.



WGBH is an equal opportunity employer.

**WXCL AM/WKQA FM** in Peoria, Illinois is looking for a dedicated Chief Engineer. WXCL is a 1 KW 4 Tower, and WKQA is a "class A" FM. If you're a dedicated number two man who knows good sound, the day to day operations of directional antennas, have working knowledge of studio equipment, both new and old, state of the art transmitters, and the managerial ability to head our two man engineering department, contact Bill Yordy, Director of Engineering, Manship Stations, in care of WBRZ TV, Box 2906, Baton Rouge, Louisiana 70821, or phone (504) 387-2222. WXCL/WKQA is an Equal Opportunity Employer. 8-81-1t

## INTERNATIONAL OPPORTUNITIES FOR AUDIOVISUAL SPECIALISTS

The King Faisal Specialist Hospital and Research Centre has current openings in its Audiovisual Department. The Hospital is a 250-bed specialty referral facility with a rapidly expanding Audiovisual Department. The following positions are available:

**Television Engineer—B.S.** degree in Electronic Engineering with five years practical experience in maintenance and repair of television and video systems. Thorough understanding of system set-ups and use of test equipment.

**Television Technician—A.S.** degree in Electronics or two years trade school with five years experience maintaining and repairing television and video systems. Both positions offer good salaries, 30-day annual paid vacation, transportation, furnished housing, bonus pay, and more. Interested candidates should send a resume to: Linda Hogin, Senior International Representative, Hospital Corporation International, One Park Plaza, Nashville, Tennessee 37202.

An Equal Opportunity Employer 8-81-1t



## ARABIAN GULF OPPORTUNITIES



**HAMAD GENERAL HOSPITAL**—in the center of health care for the people of Qatar—

Qatar is an independent State, located adjacent to Saudi Arabia on a peninsula surrounded by the Arabian Gulf. In the capital city of Doha, the new 660 bed HAMAD GENERAL HOSPITAL offers the following opportunities for experienced professionals:

**CREATIVE WRITER\*** (Print and AV materials knowledge of medical terminology and arabic culture and language helpful but not necessary)

**VC PRODUCER/DIRECTOR\*** will develop videotaped productions for public information and staff training

**CHIEF GRAPHIC ARTIST/GRAPHIC ARTISTS\*** Design and Production of printed material; graphics, titles and illustrations for audio-visual and TV productions.

**TV MAINTENANCE ENGINEER (P.A.L. System)** must be able to set up, troubleshoot and maintain state-of-the-art TV cameras, switches and all related equipment; general AV maintenance also necessary.

\*PORTFOLIOS REQUIRED AT TIME OF INTERVIEW

Enjoy uncrowded beaches and the clear turquoise waters of the Arabian Gulf, explore life in a different culture, and advance in your health services career at HAMAD GENERAL HOSPITAL. Salaries are attractive, and benefits are excellent. Interviews will be held in the U.S. during the summer of 1981.

If interested, send complete resume with telephone numbers to: Mr. Richard Schripsema, Chief Executive Officer, HAMAD GENERAL HOSPITAL, c/o U.A.I.H. (B), 398A Brookline Avenue, Boston, MA 02215.

## DIRECTOR OF ENGINEERING BROADCAST ELECTRONICS, INC.

Outstanding opportunity for a high technology oriented take charge professional with proven management skills to direct the engineering activities of rapidly growing equipment manufacturer. The ideal candidate will have a BSEE or MSEE with broad knowledge and recent experience in managing new product programs in radio or television broadcast products such as audio, digital and RF transmitters.

In addition to an excellent remuneration package, the overall benefit program includes a Profit Sharing Plan. Located in a pleasant mid-western city of 50,000 population, Broadcast Electronics offers an exceptional working environment in a modern headquarters engineering/manufacturing complex.

Please send resume in full confidence to: President, Broadcast Electronics, Inc.



BROADCAST ELECTRONICS INC.

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## Broadcast Engineers

• Camera • Transmitter

### Bored With Your Job Or Career?

If you feel confined in your present job, sitting behind a desk or trapped in a day-to-day routine with no future in sight, then a career with RCA Service Company may be your ticket out.

RCA Service Company's Broadcast Engineers travel all over the world to install, maintain and service television cameras, television tape recording equipment, and/or transmitting systems. A digital background, and experience in the maintenance of television broadcast and related equipment are necessary. RCA equipment experience is a real plus.

We are looking for a few of the best Broadcast Specialists, who are able to work without close supervision and who would enjoy working from home to travel throughout the U.S. and occasionally to many foreign countries.

Naturally we provide excellent salaries and Company paid benefits including medical and life insurance, vacations, holidays, and income savings, dental and retirement plans.

For immediate consideration, call collect, or send a letter or resume to: John Thayer, (609) 778-0770. RCA Service Company, 102 Galther Drive, Mt. Laurel, NJ 08054.

Equal Opportunity Employer



A Tradition On The Move!

## HELP WANTED (CONT.)

**SENIOR RADIO AND ELECTRONIC TECHNICIAN:** \$1,719-\$1,896 beginning salary. To install, maintain, and repair a variety of radio and TV electronic equipment. Minimum of 3 years of experience in design and repair of solid state and tube type electronic circuits or combination of education and experience. **TELEVISION ELECTRONICS TECHNICIAN:** \$1,522-\$1,679 beginning salary. Experience in the installation, adjustment and repair of color and black and white television equipment, including repair of studio equipment. Closing date to file District application is September 11, 1981. Pasadena Area Community College District, 1570 East Colorado Blvd., Pasadena, CA 91106, Telephone: (213) 578-7388. EOE/AA. 8-81-11

### DESIGN ENGINEERS BROADCAST ELECTRONICS, INC.

Excellent career opportunities are immediately available with Broadcast Electronics, a fast growing radio equipment manufacturer. You will find state of the art design tasks exceptionally challenging and the working environment in a 50,000 square foot headquarters complex pleasant and stimulating. Excellent company benefits, including Profit Sharing Plan.

#### AUDIO ENGINEER

This key position requires at least 2 years of experience designing audio circuitry, tape recorder electronics or audio consoles. A BSEE or equivalent experience will be considered. Individual will be responsible for challenging original design and product development projects.

#### MECHANICAL ENGINEERS

Candidates should possess broad mechanical design experience or, specialized skills in electro-mechanical linkage systems, cartridge machines, reel to reel tape recorders, heat-flow systems and innovative packaging for new products. These positions provide design challenges for new product development projects. Candidates with BSME preferred.

#### MICROPROCESSOR ENGINEER

Here is a challenging opportunity to help accelerate utilization of microprocessor technology to a variety of new broadcast products. A BSEE combined with strong interest in microprocessors is required.

Candidates are invited to send resume, in strict confidence, to Personnel Department, Broadcast Electronics, Inc., P.O. Box 3606, Quincy, Illinois 62305. An Equal Opportunity Employer



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ELECTRONICS INC.**

4100 NORTH 24TH STREET, P.O. BOX 3606  
QUINCY, IL 62305. PHONE (217) 224-9600

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We specialize in the placement of **Technical Engineers with Television Stations, Cable TV, Satellite Programmers & Networks, Pay TV, Manufacturers, Industrial TV, CCTV, Production Houses & Dealers. Also, technical sales with Manufacturers & Dealers. All levels, positions & locations nationwide. Employers pay all fees - confidential, professional. Over \$3,000,000.00 in Salaried Positions Placed. Employee & Employer inquiries invited.**

PHONE/RESUME - Alan Kornish (717)287-9635

### KEY SYSTEMS

106 new bridge center, kingston, pa. 18704

**TV BROADCAST TECHNICIANS.** Two new positions for FCC First Class licensed persons with two year minimum hands-on maintenance of studio and/or transmitter equipment. Write Mr. Egoft, WENY, P.O. Box 208, Elmira, NY 14092. 8-81-11

**TELEVISION BROADCAST TECHNICIAN** - Washington, D.C. - Federal Agency is accepting applications from individuals with a minimum of six (6) years operations and maintenance experience in video, audio, camera, lighting, quad and one-inch videotape for positions in color television studio and mini-cam production facilities. Beginning salary depending upon qualifications. Normal working hours from 8:45 a.m. to 5:30 p.m., Mon.-Fri., with periodic overtime. Moving expenses to Washington, D.C. must be provided by applicant. Interested applicants are requested to send a standard Federal application form SF-171, obtainable at most Federal offices, to Employment Branch (293-81), International Communication Agency, 1776 Pennsylvania Avenue, N.W., Washington, D.C. 20547. Questions, contact Dottie Flaak (202) 724-9468. An Equal Opportunity Employer. 8-81-11

### The future of TV is in good hands.

WGBH Boston—one of the country's outstanding production facilities—has immediate full-time openings for **operating engineers**. Top pay and benefits. If you're experienced, versatile and eager to link up with the best, send your resume to: WGBH

Personnel (A-92)  
125 Western Avenue  
Boston, MA 02134



WGBH is an equal opportunity employer.

**TV MAINTENANCE ENGINEER.** Central California NBC affiliate is looking for an engineer to fill a vacancy on a 6-person maintenance staff. Prefer computer experience and first phone. State-of-the-art equipment, good hours and top pay in an area with a low cost of living. Send complete resume to Personnel Manager or call Bob Hess, Chief Engineer, KSEE, P.O. Box 12907, Fresno, CA 93779, (209) 237-2424. An Equal Opportunity Employer. 7-81-2t

**MAINTENANCE ENGINEER:** Growing independent in Atlant offers competitive compensation to a person with maintenance experience and with RCA equipment; digital experience/education desirable. Send resume and salary requirements to Manuel Marquez, WANX-TV, P.O. Box 98087, Atlanta, Georgia 30029. EEO/AA Employer. 7-81-2t

**TELEVISION MAINTENANCE ENGINEERS:** First-Class FCC License. Strong Background in all phases of TV maintenance required. Famous year around Colorado recreational area. Contact A. L. Ladage, DOE, XYZ Television, Inc., P.O. Box 789, Grand Junction, CO 81502. 303/242-5000. 5-81-4t

**CHICAGO BASED** religious production company needs video maintenance engineer for 4-camera remote unit. Entry level considered. Contact: Bob Billman, H. S. Productions, Inc., 137 Kingston Rd., Bolingbrook, IL 60439, (312) 972-0078. 7-81-2t

**TV MAINTENANCE ENGINEERS:** Need 2 good engineers with 2-3 years maintenance experience on TR-600's, TK-28's, TK-45's, and/or TT30FL. Mid-west location, good benefits and pay. Send resume to Dept. 541, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 7-81-3t

## SITUATION WANTED

**SEEKING ENTRY LEVEL POSITION** in broadcast engineering. Have experience operating SMC automation, First Phone, and degree in broadcasting. Bob (714) 873-5413. 8-81-11

## FOR LEASE

**COMPLETE AIR PAC SYSTEM:** 2 Hitachi SK 90's, Ross Switcher, RTS, Sony BVH 500, Full Monitoring, All Accessories. Lease to Own. O.W.C. Call (213) 541-9488. 5-81-6t

## WANTED TO BUY

**WANTED;** Pre-1928 radio equipment and tubes. August J. Link, Surcom Associates, 305 Wisconsin Ave., Oceanside, CA 92054, (714) 722-6162. 3-76-1f

**HIGHEST PRICES PAID** for 112 Phase Monitors and for clean, 12 year old or less, 1 KW and 10 KW AM Transmitters. All duty and transportation paid. Surplus Equipment Sales, 2 Thorncliffe Park Dr., Unit 28, Toronto, Ontario, Canada. M4H 1H2, 416-421-5631. 2-79-tfn

**INSTANT CASH FOR TV EQUIPMENT:** Urgently need transmitters, antennas, towers, cameras, vtrs, color studio equipment. Call toll free 800-241-7878. Bill Kitchen, Quality Media Corporation (in Georgia call 404-324-1271). 6-79-tfn

**PRIVATE COMPANY** would like to purchase a used RCA TK-76B or Ikegami HL-79A. Contact Glenn Przyborski (412) 765-3910 or (412) 231-7573 after 5 P.M. Eastern Standard Time. 7-81-2t

**NEED PARTS FOR SPARTA AS-40B** audio board; Sparta Cart player #4610; Recorder #4710; Tone Arm #St-220; Motor #2100. Call days (312) 530-1530. 8-81-11

**INSTANT CASH FOR BROADCAST EQUIPMENT:** Urgently need UHF Transmitters, Microwaves, Towers, Weather Radar, Color Studio Equipment, AM & FM Transmitters. Call Bill Kitchen, Quality Media. (404) 324-1271. **REWARD FOR UHF TRANSMITTERS.** Quality Media will pay a \$500 reward for information which leads to our purchase of any UHF television transmitter. One reward per transmitter. Call Bill Kitchen (404) 324-1271. 8-81-11

**NEUMANN, TELEFUNKEN, AKG** tube microphones, all models, functioning or not, wanted; some transistor models. Also RCA ribbon microphones; Pultec Equalizers; EMT reverber plates; Teletronix, Fairchild, Universal Audio, Urei Limiters. J. MANDEL, TRITON PRODUCTIONS, 38 BROOKS ST., BRIGHTON, MA 02135, (617) 787-2220. 8-81-2t

**CHRISTIAN BROADCASTER** needs used equipment for AM, FM, SW stations. Send condition, location, price, data. Tax deductible donations accepted. Simkin, Box 9, Enterprise, KS 67441. 8-81-11

**WANTED:** Radio Transcriptions 16" E.T.'s, any Eddy Arnold, or other Country 15" or 12" Transcriptions. Will consider others. Interested in Radio Station Libraries to purchase, all speeds of records. Boyd Robeson, 2425 W. Maple, Wichita, Kansas 67213, (316) 942-3673, 722-7765 Eve. 9-80-tfn

**WISH TO PURCHASE** Thomson CSF Micro Camera MC 602, NTSC. May be second hand/good condition. Please contact Zane Bair, 10100 Santa Monica Blvd., Suite 1075, Los Angeles, CA. 90067. Telephone 213-553-3345. 8-81-11

**WANTED: USED RECORDING EQUIPMENT OF ALL AGES AND VARIETIES. MICS, OUTBOARD, ETC. DAN ALEXANDER, (415) 441-8936. 6-81-12t**

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## The MTR-10 Series

Bridging the gap between the new technology and old reliability, they're the logical extension of the innovative technology built into our multichannel MTR-90. The new MTR-10 Series gives the professional unprecedented control.

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