

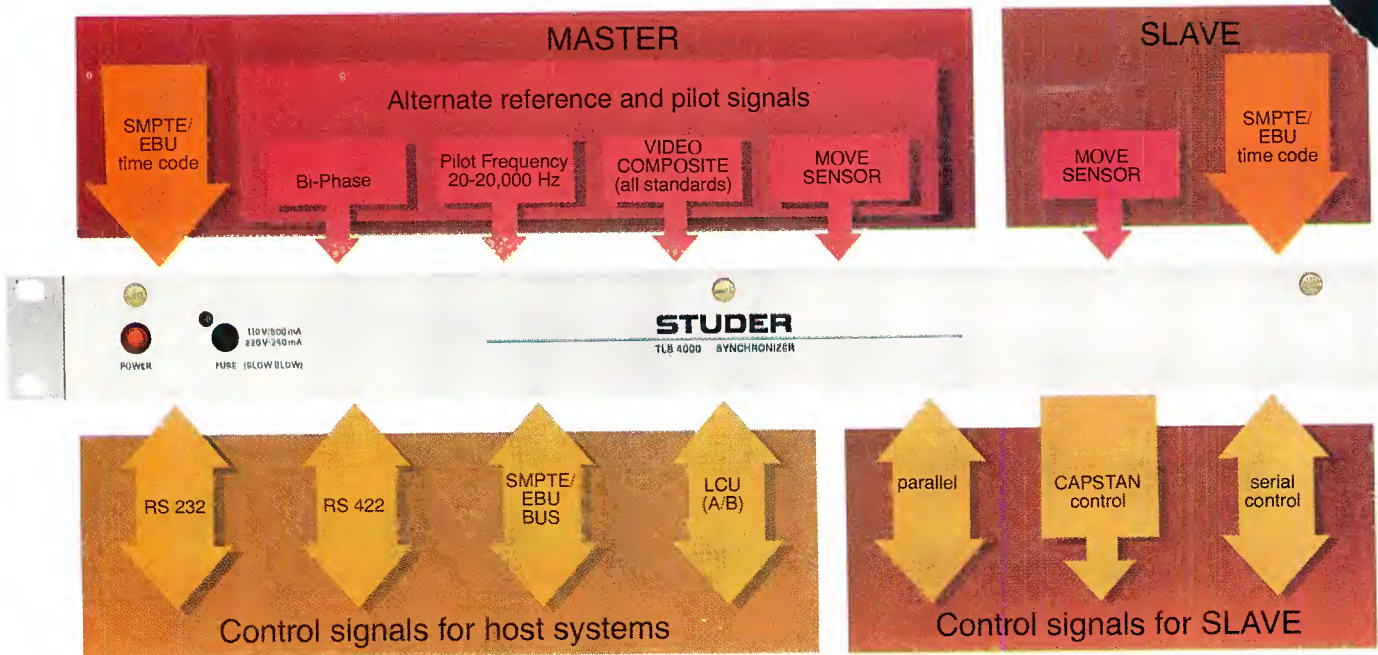
BROADCAST ENGINEERING

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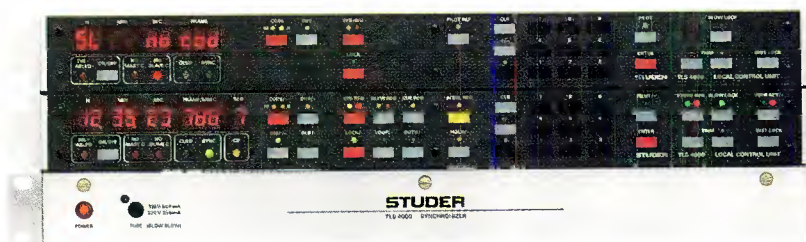
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Top to bottom: Type B LCU, Type A LCU, "black box."

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BROADCAST[®] engineering

The journal of broadcast technology

April 1985 • Volume 27 • No. 4

SPECIAL REPORT: AUTOMATION IN BROADCASTING

Computers are changing the way radio and TV stations operate. Advancements in technology and reductions in cost have brought the power of the computer to virtually every area of a broadcast facility. This month we assess where our industry is, and where automation may take us.

22 TV Automation: Integration is the Key

By Terry Kelly, ColorGraphic Systems; and Dale Buzan, Utah Scientific of Florida

Linking the computerized equipment at a broadcast station is the next major hurdle facing our industry. This article examines how automation gear can be designed to meet a station's present and future needs.

26 Automating Master Control

By Carl Bentz, technical editor

New developments in machine control systems for TV facilities. Related articles include:

- The Basics of Push-Button Dialing
- The Local Bus

36 Time Code: TV's Sprocket Holes

By Carl Bentz, technical editor

A look at what time code is, why we use it and what it can do in an automated facility.

38 Program Automation for Radio

By Jerry Whitaker, editor

How radio automation equipment is changing to meet new marketplace needs.

52 What to Expect in Transmitter Control Systems

By Whit Smith, Harris Corporation

A report on advancements in transmission system automation, and predictions on what the future may hold. Also examined:

- Relaxed Remote Control Rules

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70 Studio Acoustics, Part 2

By Eric Neil Angevine, broadcast acoustics consultant

Applying basic rules of acoustic isolation to keep outside sounds out and inside sounds in.

80 AM Radio: Looking Toward the Future

By Michael Rau, NAB office of Science and Technology

What AM broadcasters can — and should — do to effectively compete with FM stations.

90 Field Report: Shure FP31 Mixer

By Richard Rudman, KFWB Radio, Los Angeles

How this new, portable 3-channel ENG/EFP audio mixer performed in the field.



About the cover

Automation is playing an increasing role in the on-air operation of radio and TV stations. Our issue this month examines the options available to broadcasters seeking to automate their facilities. Shown is the newly installed computer-controlled master control room of WTAE, Pittsburgh, PA. (Photo by Rich Wilson.)

Coming events

May 7-11

American Women in Radio & Television, Hilton, New York

May 12-15

Broadcast Financial Management, Chicago

May 14-15

LPTV, Western Bonaventure, Los Angeles

May 15-18

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

May 19-23

National Public Radio, Marriott City Center, Denver

May 29-June 1

ITVA Conference, Marriott, New Orleans

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FCC adopts RF radiation standards

The Federal Communications Commission (FCC) has amended its environmental rules effective Oct. 1, 1985, to provide provisions addressing human exposure to RF radiation.

FCC actions granting construction permits, licenses or authorizing modifications in existing facilities, will be treated as major environmental actions if the facility or operation in question would expose workers or the general public to levels of RF radiation exceeding the safety guidelines issued by the American National Standards Institute.

Under the new rules, designation of an action as major would require an applicant to submit a narrative statement describing the environmental effect, if any, of the excessive radiation. The commission's staff then would determine whether to prepare an environmental impact statement, which would have to be considered in deciding whether to grant the application.

The new rules will apply to radio and TV stations, experimental broadcast and LPTV stations, satellite uplink stations and experimental radio

stations authorized under Part 5 of the rules. Guidelines on evaluating compliance with the rules will be provided in a technical bulletin now being developed by the commission's Office of Science and Technology. This bulletin will be available in August or September of this year.

Japan links to European satellite

A new transatlantic satellite link has been established to allow Japan's six major TV networks to receive TV news programming from Europe at less cost and with greater flexibility.

The link, provided by BrightStar, transatlantic carrier of TV programming, transmits the European programming from Great Britain to the United States where it is picked up and carried to the networks by the Japanese international satellite system. Previously, the networks had to use another, totally independent system via an Indian Ocean region satellite.

John Milman, BrightStar's general manager, said that adding a European link to the Japanese networks' existing 24-hour service from the United States has increased access to European

television while reducing their satellite costs.

Another factor in the Japanese networks' decision to use BrightStar was the quality of transmissions.

Japanese networks using the new BrightStar link include Nippon Hoso Kyokai (NHK Channel 1 & 3), Nippon Television Network Corporation (NTV Channel 4), Tokyo Broadcasting System (TBS Channel 6), FUJI Television Network (FUJI TV Channel 8), ASAHI National Broadcasting Company (ANB Channel 10), and Television Tokyo (TV Tokyo Channel 12).

BrightStar, a joint venture of Western Union and London-based Visnews Ltd., transmits via an advanced land and satellite network, incorporating dedicated circuits on the Westar and Intelsat satellites, and associated earth stations and microwave facilities in the United States and Great Britain.

BrightStar handles transatlantic broadcasts for CNN, BBC, Thames Television and the European Broadcasting Union. The company also handles TV broadcasts for World Communications, Turner Broadcasting and Canadian Broadcasting.

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BROADCAST engineering

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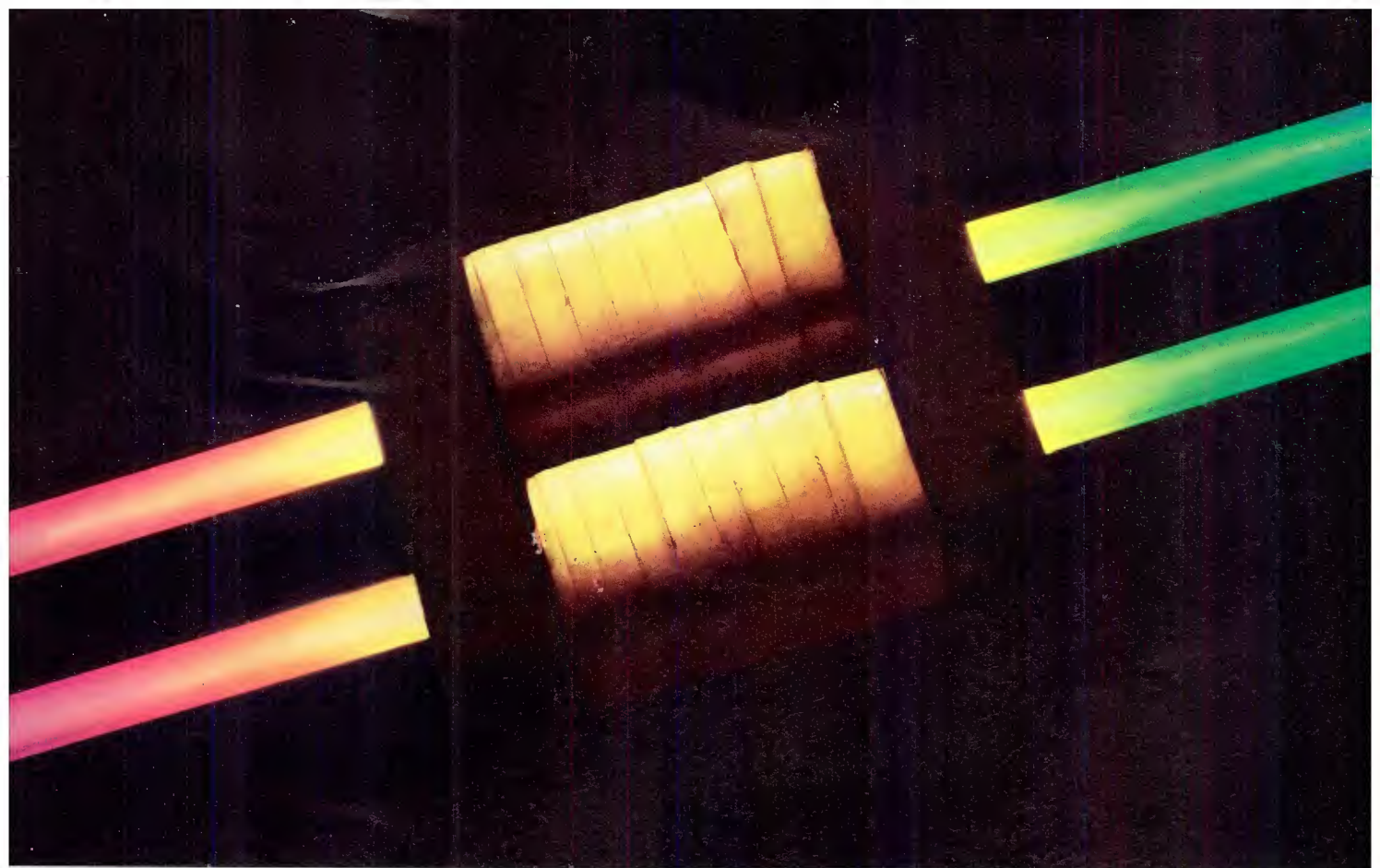
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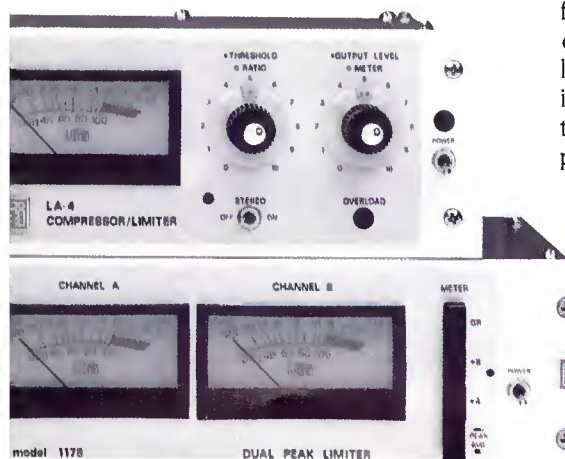
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FCC update

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



In a notice of rulemaking issued in February, the FCC proposed to delete restrictions on the acceptance of applications for new AM stations or applications for major changes in existing AM stations.

Current rules preclude acceptance of AM applications unless they meet one of the following criteria.

For a new daytime station:

- At least 25% of the area or population which would receive interference-free primary service does not receive such service from an authorized AM station or a 1m/Vm service from an authorized FM station; or
- The proposed station would provide the designated community with a first or second aural transmission service and no FM channel is available for use in the community; or
- At least 20% of the area or population of the community receives fewer than two daytime aural services and no FM channel is available for use in the community.

For unlimited time facilities:

- At least 25% of the area or population that would receive interference-free primary service at night from the proposed station does not receive such service from an authorized AM station or 1mV/m service from an authorized FM station; or
- The station would provide the community of license with a first or second authorized nighttime aural transmission service and no FM channel is available for use in the community; or
- At least 20% of the area or population of the proposed community of license receives fewer than two aural services at night and no FM channel is available for use in the community; or
- For applicants for Class II-B stations on one of the 25 Class I clear channels, that minority people hold more than 50% of the ownership interests in the applicant or that the applicant proposes to operate on a non-commercial basis.

In proposing to delete these restrictions, the commission questions whether, in light of the number of years the restrictions have been in place, there continues to be demand for new AM stations in the remaining eligible communities.

The commission is not contemplat-

ing a change in interference protection requirements, and all previously eligible applications for underserved areas or by minorities or educational groups will continue to be acceptable.

The most controversial aspect of this proceeding is deletion of the rule that in effect "reserves" the Class I clear channel frequencies for minorities, at least in larger communities. However, it does not appear the rule change will affect minority opportunities significantly because the clear channels already are cut off from further applications in most urban areas.

TV channel swaps

The FCC is considering changes to its rules that would permit commercial and non-commercial educational TV stations licensed to the same market area to exchange channels without being subject to competing applications.

Presently, such channel swaps can be arranged by contract but FCC policy requires that third parties be allowed to apply when a channel is first made available for commercial use. This has stifled channel swapping even where a trade would be technically beneficial.

The FCC views its proposal as a means of attracting financial support for public broadcasting. If channel swaps are allowed without the threat of competing applications, commercial UHF stations could take over a VHF frequency, or a non-short-spaced UHF channel, in return for payments that would be used by an educational station to improve its facilities or its programming.

The commission is requesting comments on whether this proposal should encompass operating stations only, and stations licensed to different communities in the same market. The permissible uses of funds obtained from trades is also covered in the inquiry.

Eliminating cable record keeping

Effective March 18, cable TV systems were relieved from most FCC-imposed record keeping requirements.

The only records that still must be maintained are for origination cable-

casts by candidates for public office, sponsorship identification and equal employment opportunities.

Not required are: records pertaining to local franchising, certificates of compliance, petitions to the commission, FCC rulings, FCC Forms 325, applications for transfer of a CARS station, network program non-duplication agreements, subscription cablecasting and FCC registration statements.

Also eliminated was the requirement that cable systems retain for FCC inspection records of the subscribers served during each quarter of operation.

These record-keeping requirements were eliminated because they no longer are necessary for federal oversight of cable operations. Also, the commission found that the paperwork involved in record keeping was too burdensome considering the "negligible" usage of local files by the public.

Broadcast auxiliary rules to be streamlined

The FCC has proposed changes to Part 74 of its rules to permit more efficient use of frequencies reserved for broadcast auxiliary stations. The proposals, intended to alleviate spectrum scarcity, involve the following:

- Division of the 944-952MHz aural STL band into 25kHz segments that can be stacked to provide various channel widths that will match the aural service more closely than present fixed-width channels;
- Reduction of the present maximum allowed 500kHz channel bandwidth in the 944-952MHz band to widths that more closely match the aural service of those channels;
- Division of the 2GHz and 7GHz TV pickup bands into 1MHz segments that can be stacked to provide various channel widths;
- Revision of the emission standards for the broadcast auxiliary bands above 944MHz to allow the use of any type modulation;
- Allowing TV auxiliary services to share the UHF-TV band on a non-interfering basis;
- Relaxing of the auxiliary service remote control rules; and
- Removal of the identification requirements for fixed auxiliary links.

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The New TEN-XL, Suddenly Money Is No Objection.



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Strictly TV

By Carl Bentz, technical editor

HDTV and 2CTV

"There can be no doubt that high definition is one of the most remarkable technical achievements of our times," E. E. B. MacKintosh, from the catalog to the Television Exhibition of 1937, London. "High definition" referenced 240-line mechanical and 405-line electronic TV systems that were being investigated by the BBC at the time. Compared to the approaches to TV prior to 1937, the systems shown were truly remarkable.¹

Another large step forward in TV image definition is being considered. As before, the prime question is how to do it.

Is there to be compatibility with present television? Should graduated steps reach the final goal? Or should there be a total break with the present?

Most technical seers predict a stepped approach to arrive at the "ultimate" television. We are now seeing preparations for the first step, improved and enhanced TV systems. Both will retain remnants of today's transmission standards. The eventual goal, however, is an international standard, which may not closely resemble any of the systems.

There is a working model for such a high definition system, NHK HDTV. NHK is synonymous with high definition television. As early as 1968, work began at the Nippon Hoso Kyokai, the Japan Broadcasting Corporation, to develop HDTV imaging.

Guided by Dr. Takahashi Fujio, HDTV evolved into a 1125-line image with a 5H:3V aspect ratio. In operation experimentally in Japan by 1973, NHK HDTV was first displayed outside Japan to rave reviews at the 1981 SMPTE TV conference.

Incompatible line and aspect ratio factors required new cameras, displays and recording systems. NHK

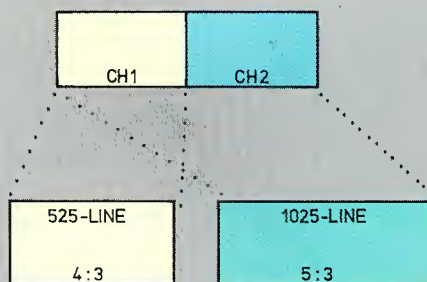


Figure 1. The signal source for a 525-line receiver is from satellite transponder "Channel 1" only. For the 1050-line receiver, the transponders for Channels 1 and 2 are the signal sources.

research and the Japanese manufacturers worked diligently to develop equipment for the HDTV system.

Large displays with diagonals greater than 22 inches and projection systems to 55 inches or greater were of particular interest, as large presentations are expected to show the greatest use of HDTV.

From the research came improved camera tubes and ventures into satellite broadcasting of the HDTV signal. Feasibility studies of DBS broadcasts at 22GHz in 1977 led to experiments with the Japanese BSE (Yuri) satellite in late 1978. Tests on terrestrial HDTV transmission at 38GHz occurred in 1980.

The NHK HDTV system works impressively. Sony and CBS proved that for U.S. observers in 1982. Today, many Japanese manufacturers have products that operate to the 1125-line specifications. Yet, there are drawbacks.

Foremost, the NHK system is incompatible with the world's three primary TV systems. The line rate is unrelated to all CCIR TV systems. The 5:3 aspect ratio is fine for wide screen

motion pictures and is more pleasing to the observer, but at present, millions of home displays around the world use the 4:3 ratio.

Another problem is that NHK HDTV is frequency hungry. As originally specified, the luminance signal has a 20MHz bandwidth, the equivalent of several NTSC or PAL/SECAM RF channels. Chrominance needs an additional 10MHz. Bandwidth compression can perhaps confine the signal to a 20MHz base-band spectrum. Yet the postulated RF modulated bandwidth remains about 72MHz to achieve a realistic S/N ratio.

Fujio says that incompatibility should be of no great concern. The world now uses three incompatible systems. Rather than politically bowing to a current standard, Fujio suggests an entirely different standard for world-wide use.

The NHK specification is not cast in concrete, as Fujio has expressed a willingness to work (and compromise) with others toward an international HDTV standard. No answer is offered about the extra bandwidth or the fact that it will reduce variety, a factor that U.S. viewers continuously demand.

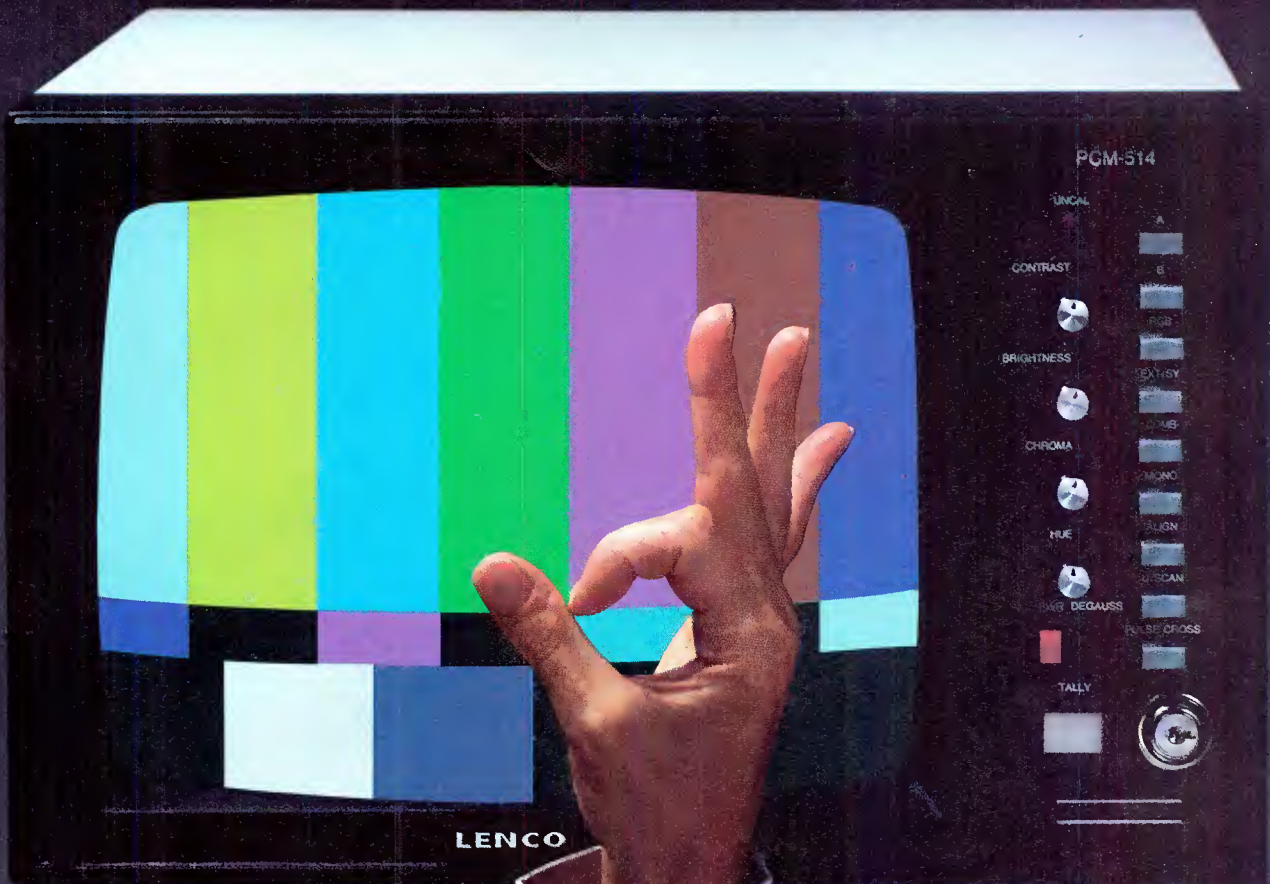
HDTV advantages

What would the 1125 lines get us? Greater resolution, using more than twice the number of lines of NTSC. The apparent line structure of an NTSC image is greatly reduced, particularly on large screen displays, as in movie theaters or conference centers.

The 2:1 interlace scheme retains the 60Hz field/s rate of NTSC. If 60Hz flicker troubles NTSC viewers, that problem would most likely remain.

The aspect ratio of 5:3 closely emulates the motion picture screen. If wide screen films form the bulk of

AT LAST A MONITOR WITH ITS FOCUS ON YOUR NEEDS.



At last there's a line of broadcast color monitors that's built the way you'd build them if you built them yourself—the Lenco 514 series.

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program materials, the ratio is reasonable. The eye is more mobile horizontally than vertically, which also suggests the wider display.

Finally, psychophysical experiments indicate the most pleasing visual display has a 1.8:1 ratio, actually slightly wider than the 5:3 case.

More scanning lines give improved vertical definition. Horizontal definition in the expanded width must be increased to match, from an apparent resolution of 240 to 660 pixels. Increasing horizontal and vertical resolution comes at the expense of greater video and RF bandwidths to carry the information. Compared to NTSC, with an effective luminance bandwidth of approximately 3.4MHz, NHK suggests a 20MHz bandwidth. For chroma, a 10MHz spectrum replaces the 0.8MHz of NTSC.

A CBS proposal

Compatibility with current TV displays and enhanced viewing on wide screen sets were goals of a project from the CBS Technology Center. In September 1983, CBS proposed a 2-channel approach to greater image definition (Figure 1).

Channel 1 would carry 525-line, 60-field video in time multiplexed

components (TMC) without color sub-carrier for 4:3 aspect ratio receivers. Multiple audio signals suggest stereo or multi-lingual broadcasts. For today's receivers, a satellite receiver with a TMC video to NTSC transcoder would be required.

Channel 2 also carries a 525-line image, but with a 5:3 aspect ratio. A special receiver combines the two channels to reconstitute a 1050-line image. Again a 2:1 interlace and 60 fields are used.

Within the center 80% of the image (the 4:3 aspect area), full 1050-line HDTV quality exists. To the left and right of the 4:3 area, interpolation recreates the 1050-line display. The interpolation scheme is similar to that in the GE's Comband system ("Strictly TV," March 1985).

Suppose the original material is generated in a 5:3 aspect ratio with 1050 lines. Prior to transmission it is processed as shown in Figure 2. Adjacent lines A and B are combined to form a 525-line image for the channel 1 signal.

In channel 2, the outside 10% on each side of the picture is combined, while the central portion consists of only the 525 B lines. In the dual-channel receiver relatively simple

arithmetic provides the reconstruction. B lines are displayed unchanged. A lines are derived by the formula

$$\text{Line A} = (\text{A+B}) - \text{B}$$

Just as in the MAC systems ("Strictly TV," January 1985), the CBS TMC video alternates color difference signals with each line of the central portion (in channel 1). In channel 2, the situation is far more complex. Not only must the signal contain B lines only color components, it must also provide color difference information for the two side portions.

Clock rates for the TMC approach would produce 903 luminance samples in channel 1 and 301 for color difference data. In channel 2, luminance occupies 846 samples, while color (for B lines) occupies 376 samples. The left and right expansion portions have 45 samples each.

In addition, channels 1 and 2 have 125 and 13 samples, respectively, for audio and data. Remaining samples, for a total of 1365 in a 63.55 s line, give partitioning and clamping data.

Each channel is limited to a 24MHz bandwidth on a Ku-band (12GHz) DBS satellite. Within the signals the luminance baseband is about 16MHz, while chroma is 8MHz. The video baseband component bandwidths are less than the NHK proposal, but they are considerably larger than NTSC values. The CBS approach would be more RF spectrum-efficient than NHK. An additional feature is pseudo-compatibility with NTSC.

On terrestrial transmissions

CBS also considered the question of terrestrial transmission for HDTV signals. This work took place in the San Francisco area in 1982. (See "Experiments at 12,290MHz," *Broadcast Engineering's Spec Book*, Dec. 15, 1982.)

Conclusions of the tests noted that the 12GHz land-based transmissions would be feasible for line-of-sight operation. The tests did not use HDTV video or the dual channel approach. The extent that those two factors would add to or detract from reception is unknown.

Overcoming incompatibility

There is a definite interest in making a change in the video format. There is no consensus in the approach that should be used to achieve that change. Should compatibility be a major concern? These questions seem best answered by the Ogden Nash comment, "You can't get there from here!"

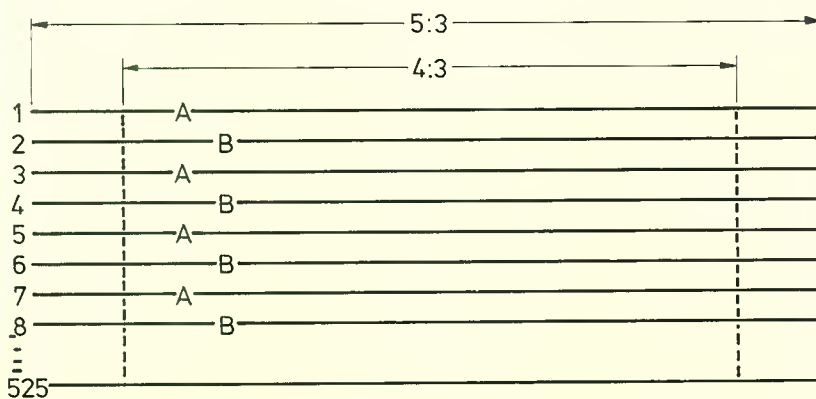


Figure 2a. One field of 1050-line image at transmission end.

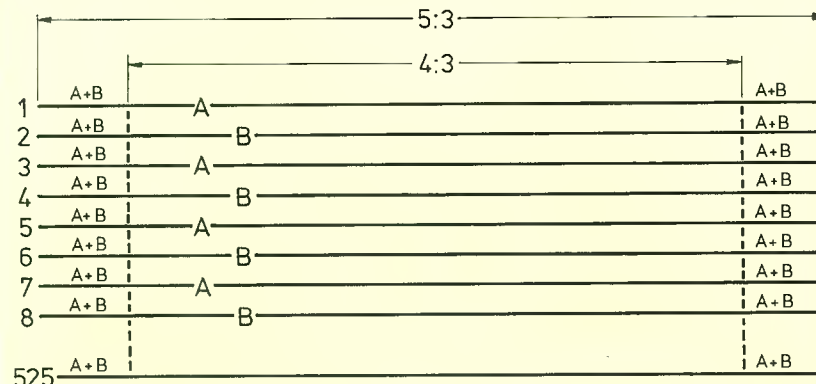


Figure 2b. One field of 1050-line image at 1050-line receiver.

1. Freeman, John P. "The Evolution of High Definition Television." *SMPTE Journal*, May 1984, page 492.

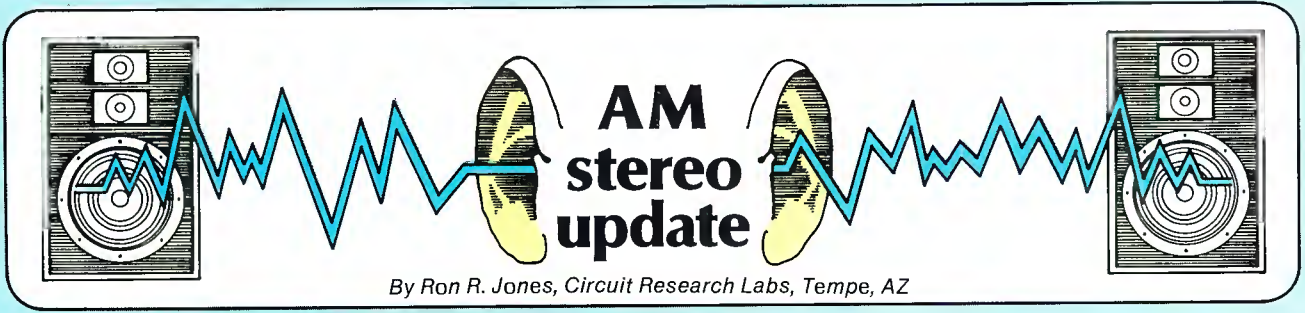
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AM stereo broadcasting has brought about the need for a different form of audio limiting: stereo matrix limiting. It's called stereo matrix limiting because the processing action has been shifted to the matrixed sum-and-difference axis of the stereo sound field. This method differs significantly from the conventional FM system, which operates on the left- and right-channel axes.

Matrix processing is needed for AM stereo broadcasting because it is essential to achieve monaural vs. stereo compatibility.

With AM stereo, generation of the algebraic sum and difference of the left and right channels occurs before the points of stereo modulation. This difference, compared to FM stereo transmission, makes conventional audio processing incompatible and matrix processing necessary.

AM stereo limiting patterns

The diagrams shown in Figures 1 and 2 are in a form that can be easily seen on an oscilloscope when monitoring the X - Y lissajous patterns produced at the right and left outputs of an AM station's limiter or stereo modulation monitor. If the limiter has L + R and L - R outputs, the patterns will be shifted counterclockwise by 45° from those illustrated.

Full matrix limiting

Figure 1 represents the oscilloscope X - Y display of the right and left limiter outputs with monaural support matrix limiting. Output levels of the L + R and L - R signals are adjusted for equal modulation (which is the point of maximum separation). As shown, the amplitude limit levels are perpendicular to the L + R and L - R axes, and intersect each other at the

left-channel and right-channel axis.

When stereo inputs temporarily shift to the full left-only or right-only axis, these limit levels allow the L + R component to remain at a 100% modulation, which maintains full monaural reception compatibility. The shaded part of Figure 1 highlights the increased areas of monaural support modulation produced by this system, compared to conventional left and right limiting (used with FM stereo transmissions).

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

Modified matrix limiting

When light or moderate amounts of limiting are used, full matrix processing produces outstanding results in monaural and stereo. Heavy amounts of limiting or processing can produce different results.

Extreme levels of audio processing, demanded by many AM radio stations, may cause certain types of overload in stereo receiver decoding circuits. To reduce the chances of such problems, a modified full matrix processing system has been developed.

Figure 2 represents the oscilloscope X - Y display of the right and left limiter outputs with the modified monaural support matrix limiting system. The significant differences between this limiting pattern and the one shown in Figure 1 can be seen in the left and bottom corners of the illustration. Here, the corners formed by the L + R and L - R axes are removed by an adjustable single-channel limiting network.

This system allows full monaural compatibility during most stereo conditions, but causes a reduction of L - R and negative peak L + R modulation levels during left-only or right-only

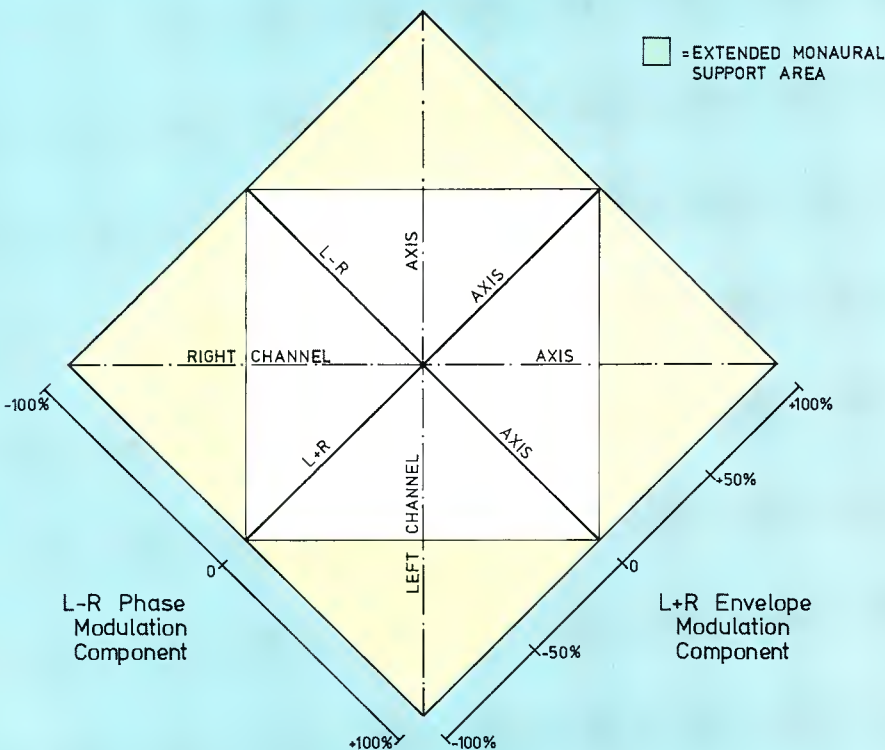


Figure 1. The full monaural support matrix AM stereo limiting pattern.



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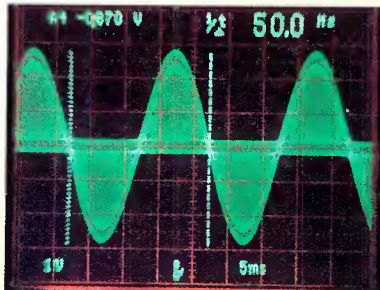
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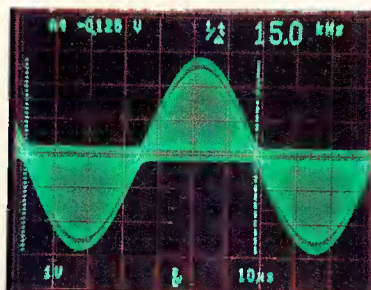
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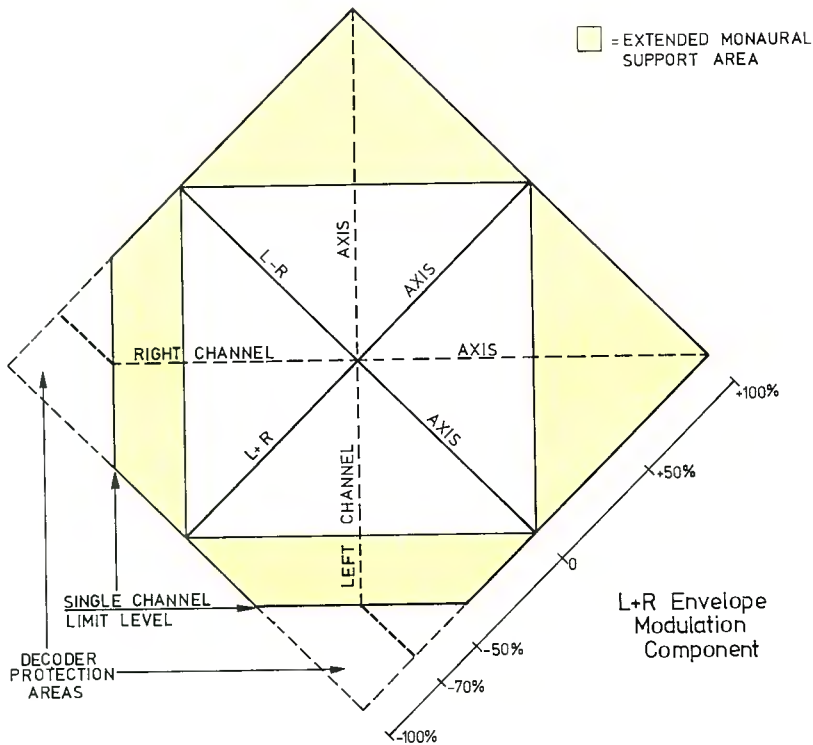


Figure 2. The monaural support matrix stereo limiting pattern with adjustable decoder protection (developed by CRL).

stereo conditions. As shown, the single-channel limits are set for a left- or right-only L + R negative peak of 70%, instead of the 100% level that would occur without such limiting.

This modified matrix system is designed to reduce potential problems associated with AM stereo transmissions. At the removed corners shown in Figure 2, L + R and L - R modulation components are at maximum and can cause decoding difficulties.

If high density negative peak L + R modulation is consistently allowed to reduce the transmitter carrier, the L - R decoding circuit in the receiver has little or no carrier to demodulate. The result can be that the stereo decoding system returns to monaural operation or produces distortion.

Depending on the degree of processing used and maximum L + R modulation depth, the single-channel limiting network can be adjusted to a level that prevents (or greatly reduces) stereo receiving problems. If the feature isn't desired, it can be defeated.

Next month in this column we will examine methods that can be used to monitor the performance of an AM stereo system. [:(=)]

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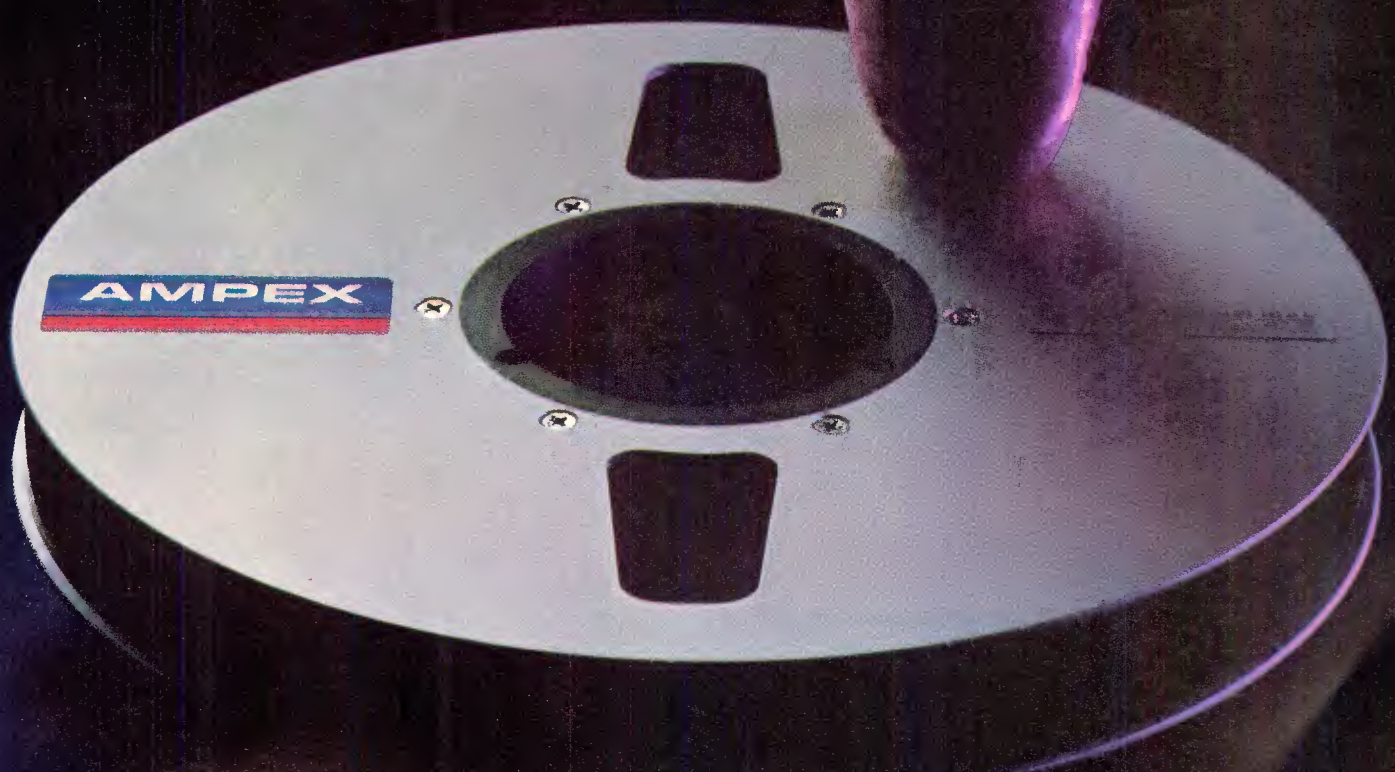
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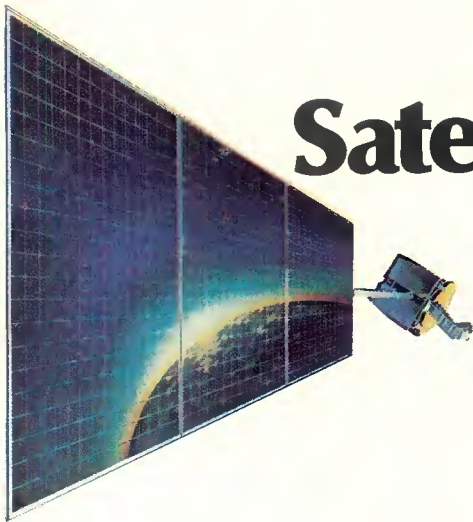
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Satellite update

By John Kinik, satellite correspondent

The FCC has established an Advisory Committee On Reduced Orbital Spacing in response to satellite communications industry pressure for a more detailed examination of the technical and economic implications of 2° spacing.

The policy, adopted in 1983, was primarily motivated by the demand for orbital positions which existed at that time. Before adopting the policy, the Commission requested comments from the industry, and, because of negative feedback, decided to phase in the closer spacing policy over a period of 10 years.

After a little more than one year, the FCC is being forced to re-examine its policy because of continuing opposition within the industry and the possibility of a new class of interference problems in the recently deregulated environment.

These potential interference problems would affect both C-band and Ku-band satellite systems and are threatening to put the brakes on the growth of satellite communications, just when it appears to be on the verge of blossoming into a major business. The key to this new growth is the small earth station antenna, in the 5- to 8-foot diameter range for C-band, and the 2- to 5-foot diameter range for medium power Ku-band.

Satellite downlink EIRPs have gradually increased over the past five years, as higher power traveling wave tube transponder output amplifiers have been developed. The result has been a steady drop in the size of earth station antennas, making possible the delivery of broadcast programming and data services to small dishes. New 2-way applications are about to be introduced also, for business communications networks, utilizing Ku-band satellites.

In the past six months, the satellite communications industry has had to face up to the reality that the success of 2° spacing depends on coordination and cooperation between satellite operators. However, deregulation of the satellite communications industry is occurring at the same time as an order-of-magnitude increase in the complexity of potential interference problems.

Higher power Ku-band satellites have been proposed, but if located adjacent to lower power satellites, would cause unacceptable interference into earth stations using the adjacent

The potential for interference problems is so great that it stimulated the creation of an association last autumn.

satellite. In C-band systems, existing small receiving antennas are subject to potential interference from a number of sources, including transmitting antennas with non-compliant sidelobe pattern characteristics, large mismatches in downlink EIRP between desired signal and interfering signal, and poorly aligned transportable transmitting antennas.

The potential for interference problems is so great that it stimulated the creation of a satellite communications industry spectrum managers' association last autumn. The FCC has charged the new advisory committee with finding a way to make 2° spacing work, and has welcomed the participation of any and all interested parties. The committee, which in-

cludes three working groups, is scheduled to report its findings and make recommendations by mid-year. The working groups will focus on earth stations, satellites, and coordination and includes representatives from all segments of the industry, including the spectrum managers' association formed previously. The task facing the committee is formidable, with recommendations expected on earth station antenna sidelobe performance improvement, antenna testing and performance verification, on-site testing, satellite performance improvement in areas such as polarization purity, Ku-band satellite transponder frequency plan standardization, system interference analysis standardization, and also the development of a centralized industry database and monitoring station.

This issue is so fundamental to the continued growth of satellite communications that it must be resolved as soon as possible, but it is questionable whether the industry can perform the massive amount of work necessary to meet the FCC's mid-year deadline. It is also difficult to visualize the degree of cooperation and integrity of cooperation that is necessary coming from a relatively new industry that has no tradition of such behavior in the past, simply because the situation did not demand it previously. Besides the advisory committee recommendations, the FCC must reconsider the 2° spacing policy in view of the apparently lower demand for orbital positions than appeared to exist at the time the policy was adopted. Several proposed Ku-band satellite systems have failed to meet financial requirements and have lost their FCC authorizations to proceed. Also, the rapid growth of fiber-optics networks for future telecommunications traffic must be factored in to ensure that the demand for future satellite capacity is realistic.

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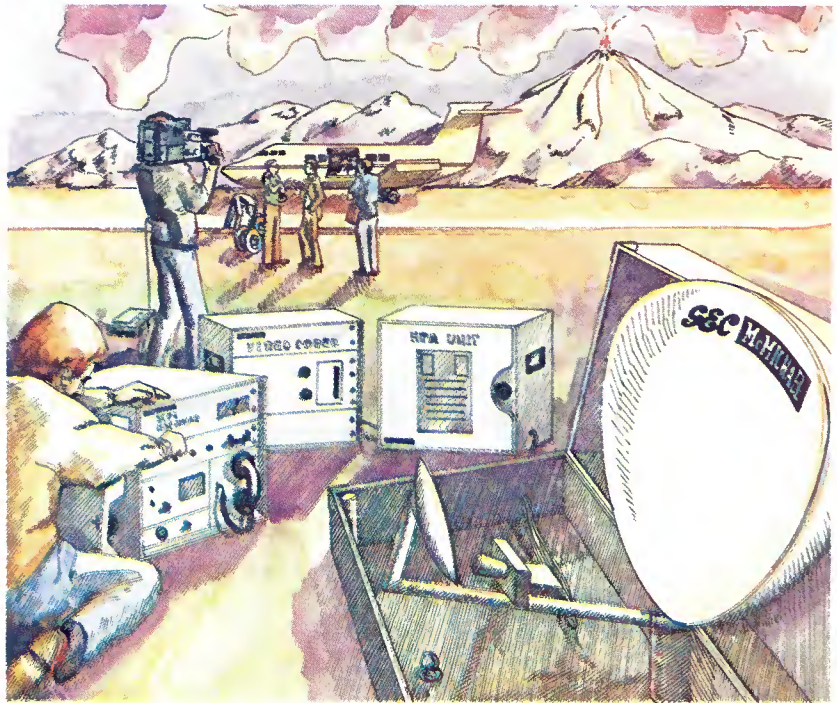
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The SNG terminal equipment is packaged in three shock-mounted aircraft enclosures. The majority of which weigh no more than 80 pounds. Since the weight and size of the system are so attractive, it can easily fit into an econoline-type van, allowing rapid deployment for live satellite coverage of local events.

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The McMichael Ku band antenna is the heart of the FLY-AWAY system since it allows real-time transmission from anywhere in the world.

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GEC McMichael, a leader in Ku band satellite transportable technology in the United Kingdom and Europe for over 6 years, just recently introduced its line of broadcast products to the United States. The development of the portable SNG system resulted from the company's

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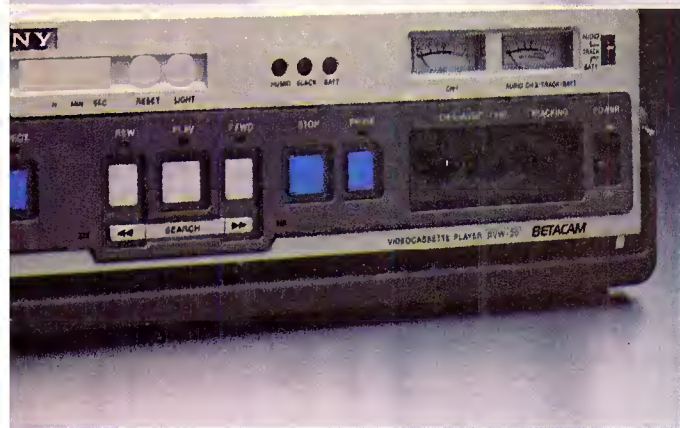
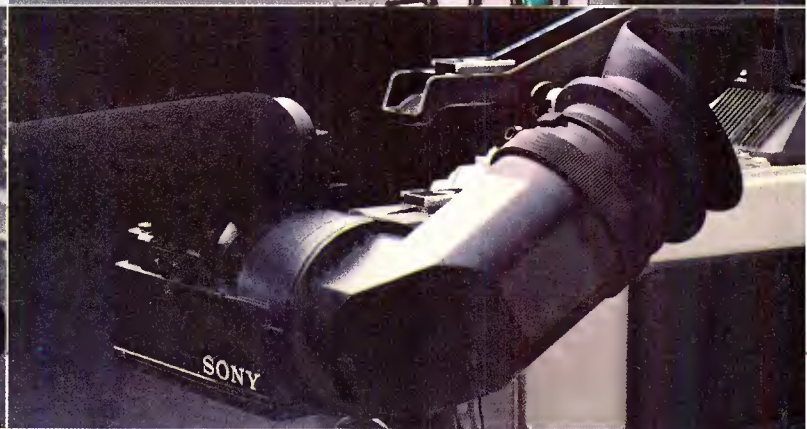
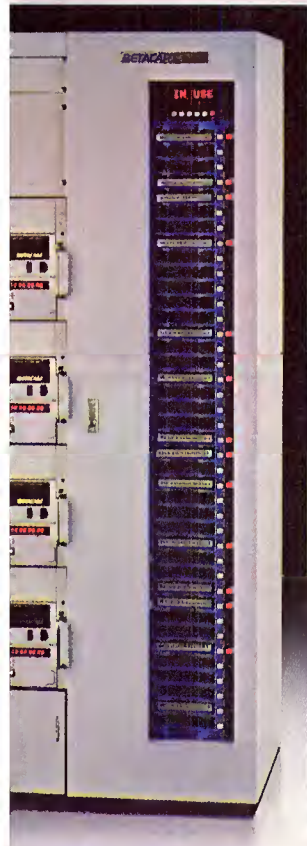
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t's not over yet

To most of us, our transmitting facilities are stalwart *towers* of our industry, representative of strength and prosperity. They are hardly the poisonous creatures they have been accused of being in recent months by parties concerned about non-ionizing radiation. Enter the federal government.

The FCC, for the most part, has agreed that a potential problem exists and has established guidelines on permissible exposure levels of humans to non-ionizing radiation from these facilities. The limits are reasonable and achievable.

Congratulations, FCC, on a job well done. Perhaps those individuals and groups screaming for a more stringent national policy will find another cause. Basically, broadcasters have won this battle, but the war is not yet over.

The potential health effects resulting from continuous exposure to high level radiation has become a significant concern to many industries and individuals in recent months. Among the industry groups brought into this fight are broadcasters, equipment manufacturers, common-carriers, power distribution companies and other firms and individuals who are involved in the use of equipment that generates high level electromagnetic fields.

Concern has been expressed not only regarding the use of high frequencies—such as the broadcast bands—but also low frequencies, where questions have been raised about the safety of exposure to high intensity fields at 60Hz.

The FCC and the Environmental Protection Agency (EPA) have been evaluating the radiation dilemma for some time. The court of the commission recently adjourned and rendered its verdict.

Effective Oct. 1, 1985, the RF energy guidelines limit human exposure to the levels recommended by the American National Standards Institute (ANSI). These safety standards are widely accepted as being both reasonable and achievable.

The new FCC guidelines limit human exposure to RF radiation to 100mW/cm² for AM transmission; 1mW/cm² for FM and VHF TV; and a calculated amount (f/300) mW/cm² for UHF TV. These calculate to 632V/m for AM; 63V/m for FM and VHF-TV; and 63 X (f/300)V/m for UHF TV.

For the short term, no sweat. But when renewal time rolls around, be prepared to prove your compliance, particularly if there are any modifications requested for your facility. There is no grandfather provision attached to the ruling, which includes AM, FM and TV operations (and other services as well).

So much for the FCC. But what happens when the EPA, whose jury is still out, renders its decision. The broadcast industry has reason to fear that the agency may enact more stringent radiation requirements.

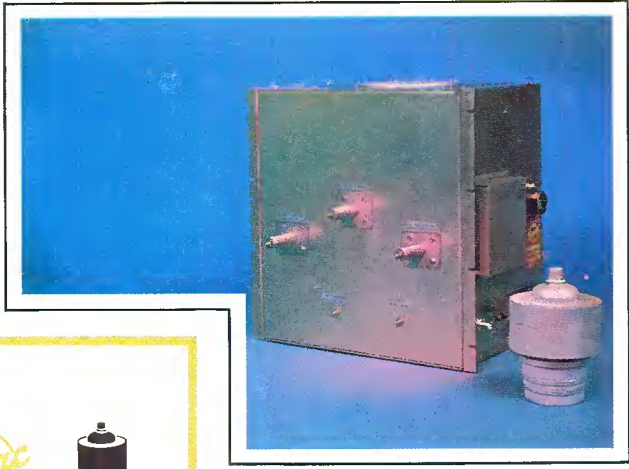
At last report, the EPA was considering at least six options as a way to address the questions posed by non-ionizing radiation. These are:

- No action at all on radiation limits;
- Standards that agree with the well-researched ANSI recommendations (as the FCC has already done);
- Standards that are 2.5 times more stringent than the ANSI recommendation;
- Standards that are 10 times more stringent than the ANSI recommendations;
- Standards based on research by other research organizations;
- Standards based on the USSR limit of one *microwatt* per square centimeter (a very stringent requirement).

The EPA also has determined the approximate cost to the broadcast industry at the various levels of proposed protection. If the national standard were established at the value recommended by ANSI, the cost to the broadcast industry is estimated by EPA to be \$15.1 million.

This would break down for FM broadcasters to approximately \$14,000 for each affected station. (This figure presupposes that the station could come into compliance at its current location and using its current tower.) If the standards were made more severe, the total cost would go up. At a protection level 10 times more stringent than the ANSI recommendation, the cost to the industry would double. If the USSR standard were accepted, the total cost would skyrocket to an estimated \$333.5 million.

Continued on page 98



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TV automation: Integration is the key

By Dale Buzan, general manager, Utah Scientific of Florida,
and Terry Kelly, president, ColorGraphics Systems

Automation systems cover a variety of automatic operations or computer controls. These operations can include, or involve, all departments of a television or radio plant, from accounting to tape machine control.

Automation can provide benefits in four prime areas. It increases speed of operations, increases information handling capabilities, reduces errors and provides improved record keeping.

At present, three areas of a broadcast station are amenable to computer assistance: traffic/billing, the newsroom and master control, all of which are related to revenue generation. Other likely candidates for automation in the future include live on-air operations and peripheral programming operations, such as feeds to non-broadcast outputs.

Keeping the books

Most stations are familiar with traffic and billing computerization. Many medium and large stations have had this equipment for some time. Traffic and billing systems keep track of spot availabilities, and ensure proper spot rotation and product separations. They accept input from national sales representatives and allow billing generation and invoice printing as the spots are run. Most systems provide program logs for the control room as a guide to properly load and air commercial spots and other programming.

A trend in recent years has been toward in-house systems for traffic and billing. This is mainly because of the increased power and decreased cost of the minicomputers normally associated with such tasks. The in-house concept has also met with favor, because it gives the station more control over the system.

Beyond the books

Equipment to assist the other areas

is available from several manufacturers, although installed systems number less than 5% of the broadcast facilities. Still, the future of automation is favorable, according to surveys. The automated newsroom, for example, is a likely 2- to 5-year goal at nearly 50% of all U.S. television stations.

News views

Newsroom systems aid in the flow of information through the newsroom. They allow more accurate and accessible record keeping and archiving, increased story production and a more up-to-date news product on the air.

In an electronic news system, incoming news wire services tie directly to the system and are categorized, then stored for review. Copy may be called up by wire service, date or time, subject, key word or words within stories (global search), and department. The material may be developed into stories or used as background. Most systems accept simultaneous wire services, including the new high speed services, storing up to 24 hours of each for later review.

With a news system, the assignment desk can track all pending stories, schedule crews, review past materials relating to breaking stories and send materials to reporters in the field. Improved organization of raw material likely to make interesting news allows assignment editors to keep track of up to twice as many stories as they could with paper systems.

This does not mean more stories on the air, but it does suggest a better mix of story opportunities and a more up-to-date look at the day's news.

Word processing, editing, rewrite and electronic mail functions replace typewriters in the newsroom with video display terminals. Communications within the station and in the

field are nearly instantaneous.

Also, reporters at the scene of a story can file stories using a portable computer tied to the station's central news processor through telephone modems.

News producers and managers using automated systems are better able to review story content and style, newscast cohesiveness, work output and story lineups or rundowns. Electronic assembly of the newscast rundown will include automatic timing of the computer. In some systems, an on-air monitoring function constantly updates the producer as to whether the show is light or heavy.

The producer's rundown can be sent to a digital teleprompter. A remote controller offers changing of the story line-up and smooth scrolling of the text.

Finally, some newsroom systems archive large amounts of script, assignment, and wire service copy onto digital discs. Quick access to the off-line information is possible.

Technical sectors

Master control systems literally take charge of the audio and video switching on the TV plant and handle the machine control functions required for programming continuity. They may automatically execute off-line network delay recording of satellite feeds.

Program schedules may be entered at a computer terminal or may be linked with a traffic and billing system.

Once a schedule has been executed by the automation system, as run logs are printed and electronically returned to traffic to aid reconciliation of the billing process. Some master control systems also print reports of what material is loaded on different tape machines, film and slide projec-

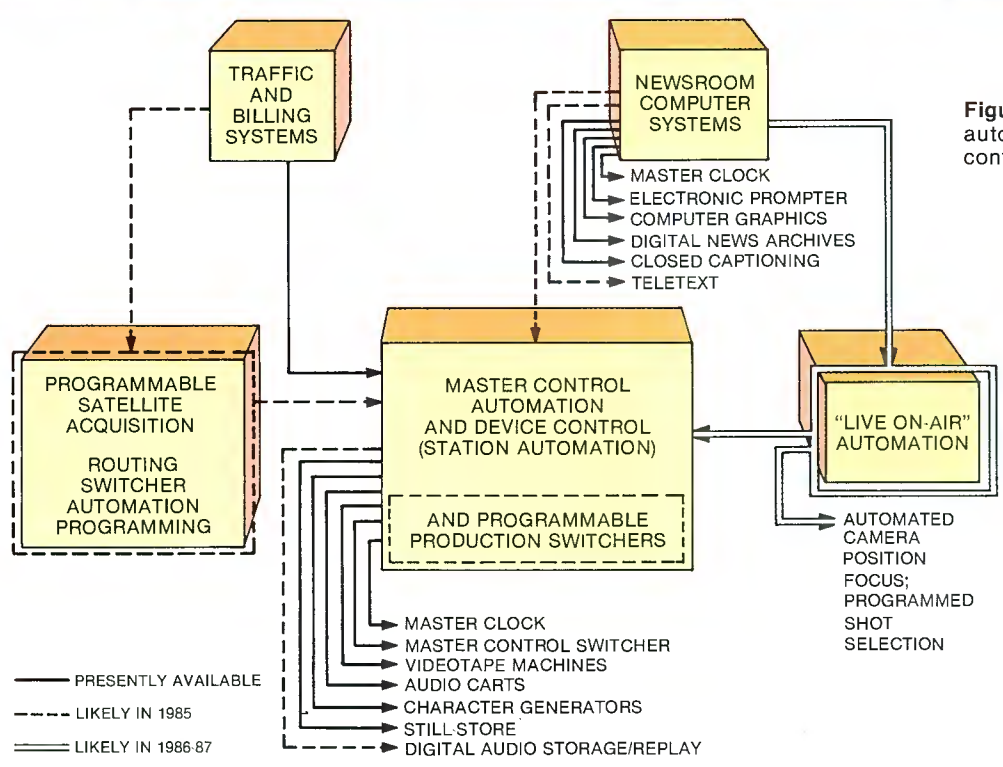


Figure 1. Interconnections of automation systems and device controls.

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Circle (15) on Reply Card

Automating Master Control

By Carl Bentz, technical editor

The trend to automation, including unrealized breakthroughs, will use existing equipment at your station.

Is there a TV master control operator who can boast a record of no muffed commercial or ID breaks? Probably not.

Smooth TV switching transitions mean consistent split-second timing and concentration, two uncommon human traits. The slightest timing error or loss of concentration can be devastating, causing a make-good to be scheduled, often at considerable expense to the station.

Commercial breaks gone awry is the prime reason for automation in TV

broadcasting. Additional reasons are a smoother, more consistent look to the station's operation and increased operator productivity. The quartz chip replaces inconsistent human timing with accurate efficiency, leaving the operator free for other duties. Instead of replacing personnel, automation brings a redirection of efforts.

To what degree automation? Perhaps your station needs only a few automated functions. Transmitter logging is common. A complete set of parameters is measured and printed every 10 minutes. Or, a video recorder could be started by tones to catch satellite feeds at 2 a.m., when no other programming is being sent.

Perhaps your station needs almost total automation. As more stations move toward on-air operation with cassette tape, semi-unattended (random access magazine) or operator-assisted (multiple deck) automation systems will find favor. Use of any cassette format should be simplified through the automated approach.

Using a log stored in its memory, the automation system requires only that each VTR, audio cart machine and slide projector is given the right program material. The operator then oversees and monitors the operation.

Remote control

Automation operation requires remote control capability. Mode changes from standby to operational must be possible by means of switch closures from either local or remote control panel switches.

Switch emulation with ICs or other solid-state devices in a digital clock can replace actual switches. Current sinking to ground through a solid-state device actuates the machine functions. When the binary states of several gates are correct, the clock starts the VTR or initiates any other function that can be remotely controlled. If a program length is known, the clock can also stop the VTR (or other machine) and signal that the tape be rewound.

VTR functions usually involved are play, record and stop. Three separate conductors, in parallel with normal switches, are required. Another conductor forms a common ground for all functions.

If the clock has separate control channels, automatic operation of

more than one machine is possible. However, each remote controlled machine will require a multiconductor hookup.

Monitoring the system

Visual feedback at the control point shows the status of automated equipment to the operator. LEDs, in parallel with control panel indicators, require only a few volts dc for operation. In the simplest approach, every displayed status requires an additional conductor in the interconnecting cable.

When multiple machines are involved, monitor wiring also increases. Logic gates and switches (Figure 1) may be arranged to permit one set of status indicators to serve all controlled devices.

Tone actuation

Time is often the control factor, but it may be desirable for one event to trigger another. The next event is started from end tones on the audio or control track of the tape being played.

When the tone is sensed (detected), perhaps with a simple IC circuit (Figure 2), a resulting pulse causes the next machine to start. A crosspoint on the master control switcher may be activated simultaneously.

Sequential activation with tones can run a series of program and commercial or ID segments, assuming segment timings are known and fit within the schedule. Such a series might consist of slides or character generator screens with audio cart messages or videocassettes. In such a system, machine control will normally be wired for a given sequence.

As a result, the slides, carts, etc., must be in the correct order. The system cannot rearrange the material.

A different tone activation method was developed in the CATV industry. Programs by satellite often include dual-tone multifrequency (DTMF) signals to start and to stop VCRs and to actuate signal switching for local commercial inserts. (Background on dual tone methods is found in "The Basics of Push-Button Dialing" on page 28.)

A DTMF control system could be tied to a dedicated telephone line. The tie allows a system operator to take control remotely from his home or office in case of equipment malfunc-

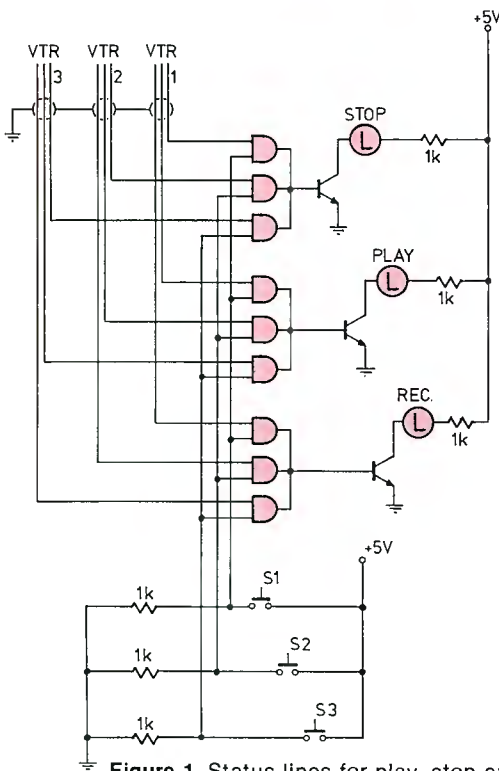


Figure 1. Status lines for play, stop and record from each VTR are connected to AND gates. S1, S2 and S3 select which VTR is to be monitored. When a VTR line is high and the switch is pressed, the output of the AND gate goes high, lighting the desired LED. AND gates are type 7408. Resistors are 1/4W. LEDs are general purpose, and using red, yellow and green could designate separate functions. Transistors are NPN.

The Professional Cassette Decks



Tandberg's new Series TCD 900 is a superior and cost-efficient alternative to the (unprofessional) practice of using inferior home tape decks for Professional applications. These new Professional Cassette Decks offer unparalleled sound capability, advanced mechanical and electronic design, plus extraordinary control flexibility based on an 8-Bit microprocessor with 32K of EPROM memory. These are the type of quality products for which Tandberg is well known, and are designed and built in keeping with the company's more than 50-year reputation for quality, performance and long-term owner loyalty.

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TCD 910 is designed to replace both reel-to-reel and cartridge machines in many applications, and is capable of producing tapes at sound and silence levels beyond that required by broadcast and studio requirements. Combined with its extremely

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- All audio circuitry uses high spec polypropylene capacitors and metal film resistors.
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- Electronically balanced XLR input/output connectors.
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- Wide range of options and accessories.

TCD 911 Cassette Playback Deck

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tions or garbled network tones.

DTMF tone signaling is found in translator and cassette-based automated LPTV systems, but less often in standard broadcast operations. Broadcast applications more often use the tones to alert the operator, who then performs the required functions.

Tying things together

Remote control automation with

parallel wires for each function of each machine becomes burdensome in large multimachine systems. The 2-tone method allows a somewhat simpler approach.

In satellite programming, the space link brings the tones to the operating site. A decoder senses the incoming signal and, perhaps with a micro-processor, takes control of the equipment. Each decoder could handle

several machines through a parallel control structure.

Alternatively, the tones may be delivered through a single signal line to decoders in several machines, one after another, in series. Each decoder or interface then operates its machine in accordance with internal wired instructions. A control line looping between several machines is termed a *party line* or *daisy chain* architecture.

The basics of push-button dialing

Push-button dialing, introduced by Bell Telephone during the 1960s, brought a new type of signaling to communications.

Where dial phones use a series of dc pulses to activate their switching networks, the push-button systems use tone-coded information. Tones provide faster and more reliable operation, and can be used directly over radio links.

The standard telephone keypad includes 12 buttons, arranged in four rows of three buttons. An

optional fourth row is possible. For each button on the keypad, a unique pair of tones are produced (table below). Close tone accuracy and stability is required. The waveform of the individual tones must be sinusoidal for reliable operation.

At the receiving end of the system, a series of decoding circuits are tuned to sense the presence of any of the possible seven (or eight) tones. Because the tones are generated in pairs, the decoder produces 12 (or 16) unique outputs, depending upon the combinations. Several of the IC manufacturers offer decoder chips that accept the encoded signal and produce high or low outputs on a specified pin, according to the tone pair detected.

Using the individual tone pairs (one keypad digit) limits the signaling capability to a maximum of 16 events. However, if more than one digit is used, far greater control capability is possible. For example, using two buttons (perhaps a 1 and 9) in sequence produces many more possibilities. The most common method uses a sequence of three buttons. Mathematically, the number of possible combinations is given by

$$n!/(n-m)!$$

For our example, $n = 12$, $m = 3$. The "!" sign is the "factorial" operator, which is calculated as

$$12! = 12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

which equals 479,001,600. The value produced by the equation becomes

$$12!/(12-3)! = 12!/9! = 1320$$

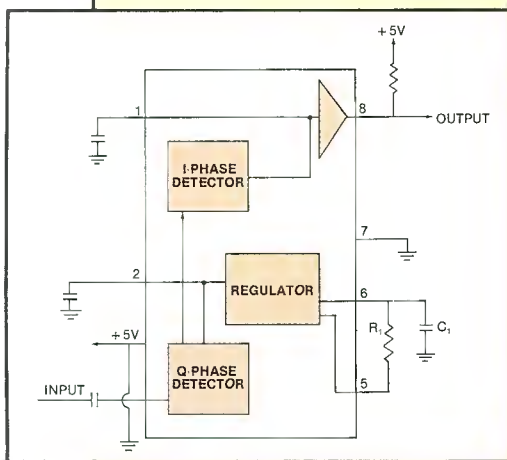
By using 3-digit sequences from the 12 possibilities, 1320 unique combinations are available for specific control functions. Using a 16-button keypad would increase the total significantly.

Integrating computerized control into broadcasting requires that the various system units must converse with one another. Such interactive interfacing is the purpose of data bus systems. *Bus* refers to the pathway along which data travels between system components. Buses are further specified as *serial* or *parallel*, depending upon the format of the data.

In general, most broadcast automation equipment will fall into one of three types: RS-232-C, RS-422 and IEEE-488. The RS systems pass serial data, while the IEEE-488 approach, sometimes called the general purpose interface bus (GPIB), is a parallel structure. Of the three, GPIB is the least common in the station, finding its primary use in automated test equipment.

RS-232-C

RS-232-C, as a digital interface, is specified to have two states: OFF and ON. It can also be called Marking and Spacing or binary states of 1 and 0. Voltage levels existing in these circuit states shall be greater than 3Vdc, but less than 25Vdc for the OFF or 1 condition. The ON or 0 condition lies between -3Vdc and -25Vdc. The impedances across which these voltages are measured shall fall between 3000Ω and 7000Ω, non-inductive. Shunting capacitance shall be greater than 2500pF. Each interface connector pin is defined for RS-232-C as shown in the table, page 30.



Block diagram of the National LM567 tone decoder IC. Seven decoders may be combined through logical NOR gates to form a DTMF decoder. One such device is needed for each row and column of a typical telephone touchpad. R_1 and C_1 determine the frequency of IC operation.

1209Hz	1336Hz	1477Hz	1633Hz		
1	2	3	A	697Hz	
4	5	6	B	770Hz	
7	8	9	C	852Hz	
*	0	#	D	941Hz	

Touch tone frequencies for a 16-button keypad.

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April 1985 *Broadcast Engineering* 29

Digital discussions

The major automation systems installed today involve a central computer. With a majority of reel-type VTRs, the computer will be separate from the VTRs. Cassette-based systems may use a separate controller, if individual playback machines are involved. The new generation systems with random access cassette search and retrieval or multideck packages include a controlling computer.

Two methods to interface the controlled equipment to the computer are common. With the first method, systems are based on an RS-232-C link,

with individual lines to each machine. (See "The Local Bus," below.)

In the second, the computer converses with each controlled machine through a party line. Each device has an assigned ID code, so the computer precedes all instructions with the ID for that device to which it is talking. The interconnection is by means of coaxial cable or a twisted pair of wires. These control methods use serial bus. Serial, in this case, refers to the data format of the instructions.

The system may be composed of two types of controlled equipment. Some machines may be both listener

and talker. Others may only listen for commands and respond through operation. In general, however, each machine responds only when talked to (Figure 3).

When the microprocessor in a device is called, it answers, stating its current status. This process is called *handshaking*. If the central processor must take control of an operating machine, an overriding *interrupt* command is issued. When an interrupt is received, the machine microprocessor initiates a predefined set of instructions to handle system shutdown.

Perhaps the VTR has not been pre-

The local bus

Operation of equipment through an RS-232-C connection requires that each unit be fed through an individual link with the control computer. Although there are 25 parallel conductors in the cable, data streams are passed through only four. The data stream is sequential in nature. Other conductors carry 1 or 0 levels in accordance to the status condition of the system.

An adaptation of RS-232 may be used in conjunction with ICs called universal asynchronous receiver transmitters (UART). UARTs convert the parallel 25-conductor configuration to a coaxial cable format. Although strict RS-232-C requires individual cables, UARTs allow the individual controlled unit to be addressed through a daisy-chain approach.

RS-422

The RS-422 serial bus requires a balanced pair of conductors to link the controlling and controlled points. RS-423 is identical except for an unbalanced conductor pair. A 4-wire configuration is also possible. Data may be synchronous or non-synchronous with a bit rate maximum of 2Mb/s. In an RS-422 system, either a twisted pair (balanced) or coaxial (unbalanced) line loops from the control computer to all controlled units. Each unit is addressed in the serial code bit stream with its own ID.

IEEE-488

A single 24-conductor bus con-

nnects up to 15 instruments to the control computer. Communication is by means of a byte-serial, bit-parallel format. The bus includes eight bidirectional data lines, eight command lines and eight ground lines. Transmission line paths are limited to slightly more than 65 feet, with data rates greater than 1Mb/s.

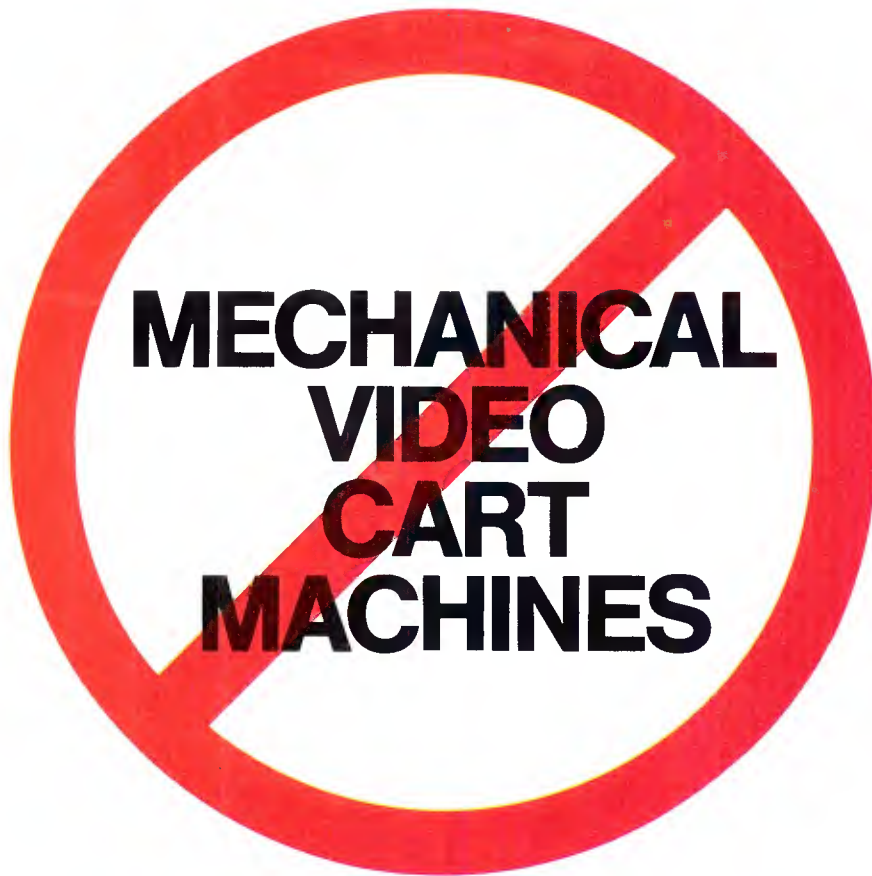
Data may be transferred only after a 3-wire handshaking procedure is completed. The three lines are named *data valid*, *not ready for data* and *not data accepted*. In this GPIB method every operation must be confirmed as completed by all addressed units. When confirmation is completed, the next step may be initiated.

Pin # Conductor Description

1	Protective Ground
2	Transmitted Data
3	Received Data
4	Request to Send
5	Clear to Send
6	Data Set Ready
7	Signal Ground/Common Return
8	Received Line Signal Detector
9	(Data Set Testing)
10	(Data Set Testing)
11	Unassigned
12	Secondary Received Line Signal Detector
13	Secondary Clear to Send
14	Secondary Transmitted Data
15	Transmission Signal Element Timing
16	Secondary Received Data
17	Receiver Signal Element Timing
18	Unassigned
19	Secondary Request to Send
20	Data Terminal Ready
21	Signal Quality Detector
22	Ring Indicator
23	Data Signal Rate Selector
24	Transmit Signal Element Timing
25	Unassigned

RS-232-C pin assignments.

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pared for operation; that is no tape has been loaded. If that VTR is instructed to play, the central computer must know the status. The system issues a fault alert condition, ideally soon enough that the operator may correct the fault. VTR sensors tell the computer to indicate the cause of the fault on the control terminal CRT.

However, if the machine is ready, it tells the computer, and instructions are communicated, as required, to put the VTR into action.

Such a conversation between the controller and a number of peripheral devices (VTRs, switchers, etc.), consists of a stream or series of bits, thus the term *serial*. Data bursts on the bus are fast enough to make responses from controlled units seem instantaneous. The bit rates may be hundreds or thousands of bits per second.

A terminal or keyboard with a CRT display is the operator's connection to the system. The CRT shows the status either in menu presentations or in colored graphic displays. A printer connected to the central processor provides a hard copy of events as necessary.

Dumb vs. smart

Automation equipment falls into two categories. Machines requiring an operator to set them up fall into the *dumb* category. The operator performs all necessary adjustments, finds the program beginning and backs the tape up for the desired pre-roll.

With these functions complete, the operator switches the machine to *READY* and the automation computer then takes over. Such machines may use microprocessors to monitor their operation and to report status. They do not necessarily perform diagnostic, preparatory or corrective actions.

With smart equipment, the operator needs only to load the tape onto the machine and then release the machine to prepare itself for operation. With

no further instructions from the central processor, the VTR searches for a header data block, which contains pertinent data about the program on the tape.

With that information, the VTR calls the central processor to check if it has the correct material by comparison with the log in the central memory. Upon finding a data match, the smart machine proceeds to the beginning of the program, sets the desired pre-roll time and places itself in standby mode until called upon. A message on the system CRT notes the machine as ready.

In the absence of a data match, the VTR alerts the operator, and the VTR may be unloaded. The smart VTR helps to prevent the error, and yet takes time from the central system only to check for a match. In the case of last-minute log changes, a manual override allows human operators to take system control.

The header could include an index of several cuts on one tape. With this index, numerous segments can be loaded into the automation system at once. A random access system finds the desired item, allotting cycling time for an item to be located and prepared for play.

Data can be provided in various ways for the automation system, but the operator also needs to see what program material is involved. Barcodes have been used in several system designs. A reel of tape, audio cartridge or videocassette may have a barcode label, similar to universal product codes found in stores.

The label, a pattern of parallel lines of varying widths, identifies the contents. Name, running duration and other data may be encoded in the label.

Several configurations can use the barcodes. If the system consists of a number of individual reel or cassette playback machines, each needing individual loading of material, each machine might include a barcode reader accessory.

The operator loads the program or segment, then passes the reader across the label. Data from the label are immediately sent to the computer along with the identity of the machine where the segment is located.

For systems with a random access library (magazine), when the cassette is first placed into an automation storage magazine, the barcode is read and the cassette's storage address, along with program data, are stored in the computer's memory. As the controller prepares for the next event, the cassette address allows the mechanism to find the correct cassette quickly. The cassette is shuttled to the next available playback deck, cued, and the machine placed in standby.

Event verification

Automated billing is an important feature in the commercial station, and the business computer must know if all events went according to plan. Commercial spots are sold against particular programs or specified time slots. If the Paradise Pizza Palace spot was erroneously replaced by Old Yeller Dog Food, you can plan for a make-good. A means of verifying what did run is essential.

When events match the schedule, the printed as-run log merely notes each event. The business computer receives a signal to bill the client according to his advertising contract. If errors occur, special notes or flags are printed on the log to show the error. The billing computer is signaled regarding the error and notes the discrepancy in the client's account record.

Barcodes allow verification, but we must assume the correct label is placed on the right cassette. An additional method of checking could be helpful.

A data header on a tape could provide identification to cue the correct material for airplay. The block could be compared against the barcode. But perhaps a means of checking the actual segment against the header and barcode would be worthwhile.

Another step toward verifying the segment is through encoding an ID into the video. Longitudinal (LTC) or vertical interval (VITC) time codes, more commonly found with editing procedures, allow this additional step. "Time code: TV's sprocket holes," page 36, shows the data structure of the time code signal. Reader modules

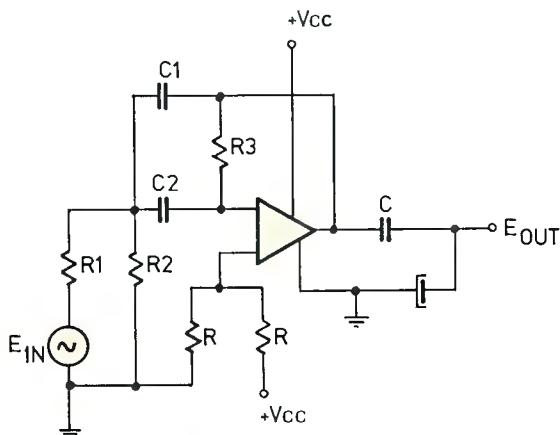


Figure 2. A linear IC may be used as a tone detector in a bandpass filter circuit. R1, R2, R3 and C2 determine the desired tone frequency.

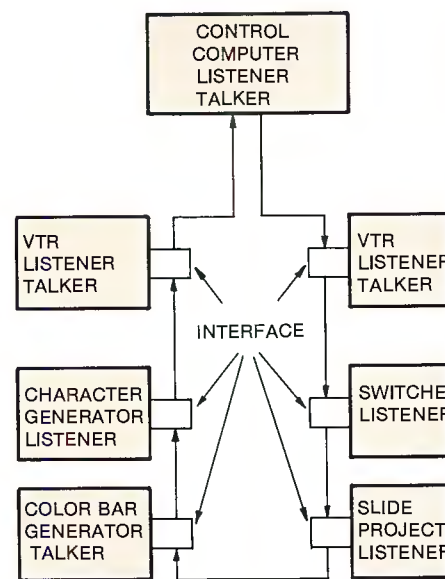


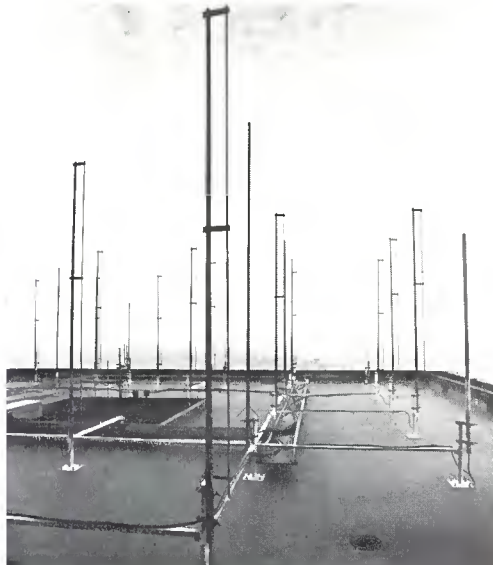
Figure 3. A daisy-chain communication structure uses an interface on each device to catch information intended for the device.

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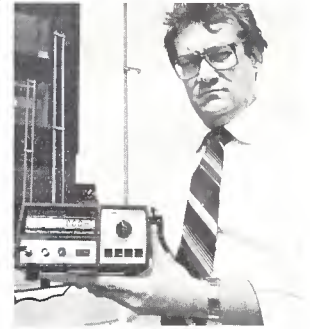


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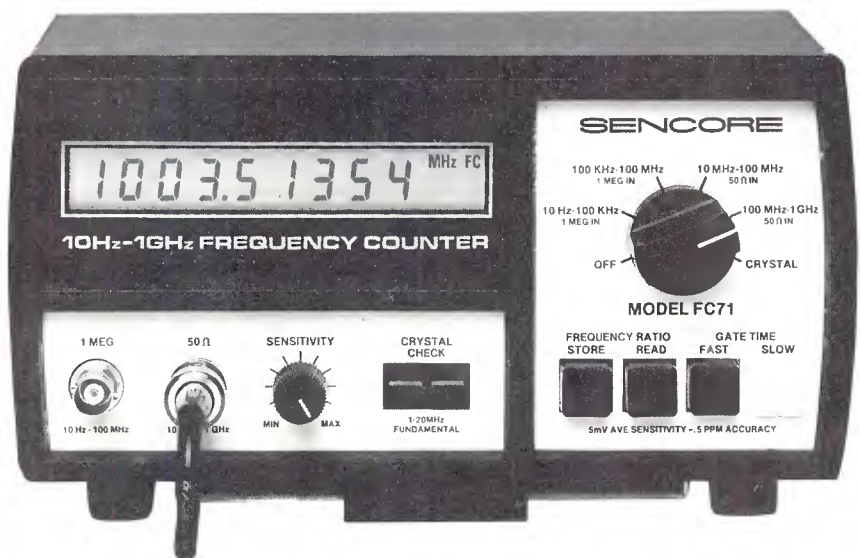
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verify the segment as the tape is set up, played or both.

For this application of the time code signal, user bits contain the ID data. If both LTC and VITC are used, the ID can be read during still, play and search modes of the VTR, that is, whenever the tape is in contact with a sensing head. The code is recorded at the same time the tape is prepared. Time codes also serve automation with in and out cues, just as in editing.

The horizontal sync period may also be used for verification. The H-sync pulse may be short, but ID information can be encoded into the μ s interval. For broadcast use, a TBC will replace sync before the signal goes on air, preventing the encoded data from interfering with signal reception.

Like time codes, this system requires the data to be generated as the tape is prepared. It also requires the VTR to faithfully reproduce the sync interval. Of the two data encoding schemes, time code is the more reliable.

Broadcast quality

It is possible to detect how a video segment appeared on-air. Just as the correct segment must run at 8:25 p.m., it must run properly. The client does not wish to pay for a spot that was unwatchable.

Vertical interval switching provides an uninterrupted sync pulse train in the switcher output video with a change in segments. Gating circuits may be combined to sense the train. If a disturbance in sync during fields or frames is detected, it may tie back to the automation system. When the log is printed, a flag denotes problems during the segment.

To observe play quality, photo sensors on the monitor screen can watch for undesirable disruptions in the video. The sensors, tied to the computer, see a constant raster, unless video breakup occurs. When a noise bar (tracking error) or other disturbance disrupts the constant line pattern on the screen, the computer flags the printed log with the discrepancy. Quality sensors may also tie to the station business system to automatically handle possible accounting needs.

Transmitter control

The completely automated TV station has a transmission monitoring system to sense out-of-tolerance parameters. A printer and CRT keep the operator informed of STL, tower and transmitter status. Meanwhile, correction signals pass to automatic proc-amps to compensate video problems, and power controllers for over-

or under-power conditions.

If carriers should fail, a carrier sensor communicates with program information. A flag to traffic indicates rescheduling needs for all commercials that should have run during the outage.

Faulty automation

Early attempts at TV automation often failed miserably. Commercials and programs alike were chopped unceremoniously. Some problems were caused by unreliable equipment. Some were the result of misunderstood equipment. Many were the result of human errors.

If the traffic secretary loads the wrong program data into the computer log, the system might never find the "Sesame Street" episode to run at 11 a.m. For that situation, manual override of the system is a must for the operator on duty.

Although computers seldom make mistakes with good data, they cannot counteract human error or equipment faults. The automation system requires a good partnership with a human operator. At the same time, automation does relieve the human partner from many menial tasks. Keeping a watchful eye on the operation is not one of those tasks. |:-(-)))))

Orban TV Stereo is on the air.

San Francisco, Calif. Orban is now delivering its new BTSC Stereo Generator for television sound known as Model 8182A/SG. According to Bob Orban, it includes many exclusive features such as built-in monitor decoding, and test modes that let the user go on the air *without* a stereo monitor.

The company reports that it is also delivering its Model 8182A, a field-proven companion multiband limiter/compressor (which includes the CBS Automatic Loudness Controller standard). This processor assures natural sound on both voice and music programming (compared to single-band units which often pump severely on music with dominant bass) and is an integral part of the stereo generator.

Orban states that the company is presently delivering everything needed to get on the air in stereo NOW. And at a fair price to boot. (\$9990, for the complete system, \$4995, for stations already having the 8182A audio processor).



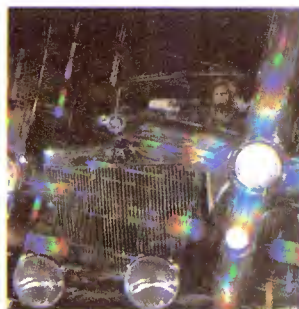
Orban is well known in the broadcast industry for its excellence in FM stereo audio processors and stereo generators. Its customers report consistent reliability, superior documentation and responsive customer support.

There are many Orban Broadcast products Dealers throughout the country. The names of Dealers can be obtained directly from Orban.

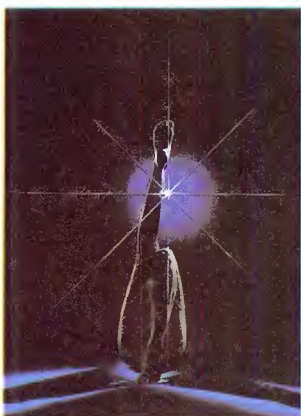
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A flash of light and an explosion of color! Your creativity becomes positively electric!

Unbelievably, these exotic expressions of spectra are produced by simply adding a filter to the front of your lens or the filter wheel of your camera. Just add motion and these filters come alive!

Eight geometric patterns of color in diffraction. Eight stars of


unsurpassed crispness and clarity. Each series of filters is created by the magic of laser and holographic techniques.

Drive yourself to diffraction. You don't just see these special visual effects . . . you experience them! Add breath-taking brilliance to your own creativity.

Call or write for more information . . . then dazzle yourself!



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Tune into the Dictaphone 5600 Veritrac logger. And never get your signals crossed again.

For more information, fill in the coupon or call toll-free:
1-800-431-1708 (Except in Hawaii and Alaska) In New York call **1-914-967-2249**
Or mail to: Dictaphone Corporation,
120 Old Post Road, Rye, NY 10580

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 Title _____ Phone _____
 Company _____
 Address _____
 City _____ State _____ Zip _____

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Dictaphone

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Time code: TV's sprocket holes

By Carl Bentz, technical editor

How can you tell where a particular frame occurs within a program? The answer is through time code data. This type of information is essential for exact video editing. It can also be useful for automation.

Two types of time code are now used. Longitudinal (LTC) or serial code is recorded along the length of the tape as an audio signal. Vertical interval (VITC) time code is generated and inserted into an unused line of the video vertical interval, then recorded as part of the video signal.

For NTSC use, each second of time is divided into 2400 equal segments, or 80 bits per frame. Thus, every frame of video may be individually identified. The format provides hours, minutes, seconds and frames as shown in Figure 1. Data in the various bit positions are counted only if the state of the data changes from 1 to 0 or 0 to 1 in the middle of the bit period.

Some of the bits are defined for specific information. Bit 10, for example, is called the drop frame bit and designates if the material is based on 30 frames per second video or 24 frames per second motion picture time. Bit 11 is used for color framing purposes, with a "1" indicating that 4-field color framing for NTSC applies. The final 15 bits of each frame are designated for time code sync.

Mixed within the format are eight 4-bit groups called user bits. These may include any type of information and must be recorded at the time the remainder of the code is placed on the tape. Automation verification is a possible use of these data bits.

Compared to LTC, the VITC code includes 10 additional bits of data. Two sync bits are inserted before each of the time segments. Bit 27, unassigned in LTC, is a video field mark, with a "1" meaning color field 1 or 3, and a "0" denoting field 2 or 4. Bits 82 through 89 are called the cyclic redundancy check (CRC) and provide for error correction.

LTC vs. VITC

LTC code requires an audio track on the tape, often one of the two tracks usually provided. Some systems are designed for a special head and track for the code. VITC does not require any special track or head. It is part of the audio.

LTC code may be prerecorded with video black. The video can be later placed on the tape with respect to the code. User bits must be included when the code is originally recorded. If user bits are changed, the entire code strips must be rerecorded. VITC cannot be prerecorded. Similarly, user bits may be changed only if the video is changed.

LTC works over a wide speed range, but it is not effective at still frame and very low speeds. VITC also works at almost any speed where a video field is read completely. However, in high speed forward or rewind, VITC may become ineffective.

The greatest application of time code systems is for editing. If all video segments are recorded with time code prior to editing, it is possible to create a decision list based on the TC numbers. A computerized editing controller may then take control of a system of VTRs, VCRs, other video sources, switchers and effects systems to do the final editing job.

With time code, special video processing is possible. For example, if coloring in motion picture films used on TV needs correction, it can be done automatically as the movie is televised, all based on the time code. Electronic panning of wide screen images for TV is also controllable through this means.

Time code can provide automation cues as well. More preparation may be required for this application. However, combining time and user bit verification possibilities make a full time code system with both LTC and VITC functions a valuable aid to automation. 1:7-2)))

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



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

Compare pictures. You'll notice the AK-30 produces a superrefined video image. The kind of image broadcasters love to see. But that's not surprising with these kinds of specifications: Horizontal resolution is 650 lines center. S/N is a very quiet 62dB (-6dB gain), the highest ratio in the industry. Digital registration is 0.05%, 0.1% and 0.25%. And illumination is a mere 24 lux at f1.4 (+18dB gain).

This high level of performance is achieved with a unique combination of image-enhancing circuitry and high-focus-field Plumbicon* tubes.

You'll also appreciate the AK-30's automatic circuits. Like auto-white balance with memory for setting 2 color temperatures. Pre-settable black stretcher. Auto-black balance, and a knee circuit for variable dynamic range.

Together, they let you customize the image you're shooting for.

Still, the AK-30 has plenty more going for it. Consider its dual outputs. One works with standard NTSC. The other lets you set new standards because it's compatible with component recording. That means you can use it as part of our famous M-format Recam system.

The Panasonic AK-30. Compare it to the world's bestselling broadcast camera. And see why it stands out far ahead.

For more information call your nearest Panasonic regional office: Northeast: (201) 348-7336 Southeast: (404) 925-6772. Central: (317) 852-5973. West: (619) 941-3387. In Canada call: (416) 624-5010.

*Plumbicon is a registered trademark of N.V. Philips for TV camera tubes.

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April 1985 **Broadcast Engineering** 37

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Program automation for radio

By Jerry Whitaker, editor

Program automation for radio stations is nothing new. But fluid market conditions, satellite technology and economics are changing the way many broadcasters view this alternative to the live announcer. The options are numerous, and growing each year.

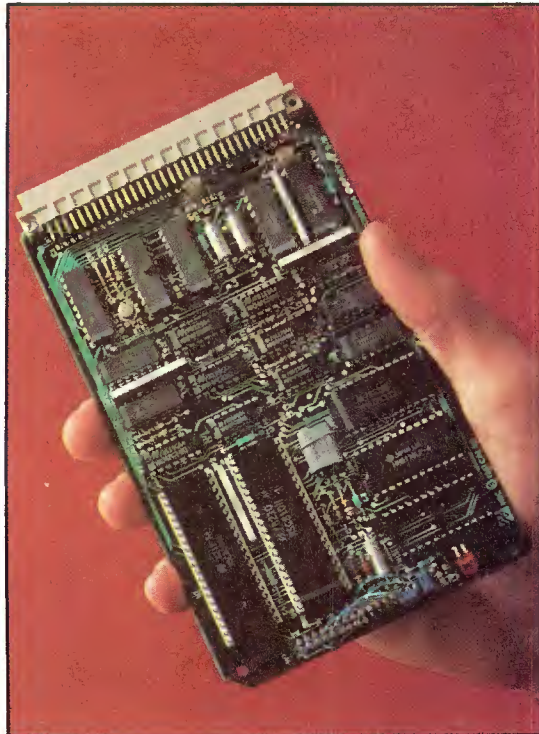
Satellite technology has had a great impact on broadcasting in the short time it has been generally available to the industry. A number of networks offer complete programming services for all or part of the broadcast day. It is conceivable that before long, satellite programming may become a serious challenge to the long-established syndicated music program services, which have been the mainstay of most automated stations.

The music service people are doing their part, however, to meet these new challenges. Sophisticated voice-tracking systems have been devised, and high visibility community involvement is being encouraged as a way to create unique station images that satellite programming cannot easily match.

Increased market competition has led some stations to abandon their automated formats in an effort to attract listeners with a live sound. Others have decided to go live during certain parts of the day, such as morning and afternoon drive, and automated for the rest of the broadcast day.

Automation equipment manufacturers have responded to the marketplace changes with a variety of products. Many simple, inexpensive controllers are available to automate satellite-programmed stations, which generally require less hardware and computer intelligence than the classic full-function automation system. These mini-controllers are also finding their way into live operations as a way to improve operator performance and add *walk-away* time to the system.

The other end of the equipment spectrum is seeing a great deal of interest in interfacing automation sys-



The microprocessor is changing the way radio stations are operated. Intelligent controllers can be used for full automation, live-assist or business system interface. Shown is a new CMOS single-board microcomputer based on the National NSC800 microprocessor unit.

tems with dedicated business computer systems. Such installations can do virtually all of the paperwork needed at a station, once the proper information has been entered. The computer will generate a log, load it into the automation system, read the commercial data from the system as it is run on the air and generate billing invoices, in addition to performing other financial or personnel-oriented tasks.

The fuel that makes the automation wheels turn is, of course, money. An accurate cost vs. benefit analysis of the needs of each installation is required to determine which avenue is the best to follow.

A full service program automation/business computer system requires a large initial investment of time and money by the station. In

many cases, such a system will pay for itself in two or three years. Some, however, will not.

Program and business automation does not mean that the office staff can be dismissed. The computer must be programmed by someone and checked by someone else. It will not answer the phone or settle disputes between the sales and production departments. And although business automation in the broadcast industry has allowed workers to do their jobs more efficiently, in most cases, it has not resulted in substantial savings in personnel costs, relative to pre-computer times.

Many large business systems are expandable from a basic arrangement to the full configuration. This allows the user to make the move to full automation in a series of steps, rather than one large leap.

Automation/equipment

The traditional radio automation system has come a long way from the stepper relay and program peg-board days. Current models feature microcomputer controllers that can be updated to new functions through replacement of programmable read only memory (PROM) chips loaded with the latest software instructions. Disk drives are used on many systems for mass storage of program data, allowing easy loading or dumping of the station schedule. A disk of the program schedule also provides backup in the event of a system crash that erases the memory.

The classic program automation system is built around a central computer and source machine interface chassis (Figure 1). Recent product introductions have added personal computer systems to equipment options available to broadcasters (Figure 2).

Interface circuits allow an off-the-shelf stand-alone personal computer (PC) to control source machines and monitor secondary cue tones and network control signals. Software for the PC provides the user with many of

*The only one in the field
with 1/2" color playback that's as good as 1."*



Is it a "wrap" or isn't it? Now you can tell right on the spot. Because the Panasonic® Recam™ AU-220 is the only 1/2" VCR that gives you the quality of 1" color playback in the field. So you can instantly see what you've shot. Either through the viewfinder or a monitor.

Consider the facts: The Panasonic AU-220 records, utilizing the M-Format, on standard 1/2" VHS cassettes. Yet it delivers the kind of picture quality that's long been the broadcast standard. Luminance is 4.0MHz (typical). Chrominance is 1.0MHz. While the video S/N is every bit as good as 1" with chrominance better than 50dB.

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

switchable SMPTE time code generator. And it's compatible, not only with component analog video equipment, but also with YC and NTSC.

The Panasonic AU-220. 1" color quality from 1/2" tape makes it one of a kind.

For more information, call your nearest Panasonic regional office. Northeast: (201) 348-7336. Southeast: (404) 925-6772. Central: (317) 852-5973. West: (619) 941-3387. Canada: (416) 624-5010.

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Panasonic® just made dead air a



"Please stand by." Three words that make any broadcaster fighting mad. But now you can fight back because the MVP-100 video tape cart machine from Panasonic Broadcast Systems has just eliminated dead air for good. And virtually eliminated your biggest problem. "Make Goods."

Built-in Redundancy

The MVP-100 maintains broadcast continuity with an incredible array of technical achievements. Starting with its automatically threaded tape transport systems. Available in 8, 12, 16, 20, or 24 transport configurations. Each transport can be

individually programmed and controlled. All with the accuracy of SMPTE time code identification through the MVP-100's built-in computer.

Automatic Continuous Programming

News spots, commercials, editorials, station IDs, promos, even program length material can be scheduled in advance and automatically aired. But what really sets the MVP-100 apart is how easily it eliminates dead air. With its built-in recorders and spot players, you can forget about the hassle and expense of "double rolling" a second machine. Because the MVP-100 plays protection copies

ANOTHER BROADCAST INNOVATION



dead issue.

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

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

YIQ Format Delivers 1" Quality from 1/2" Tape

Total, reliable automation of your broadcast day is just one reason to make the MVP-100 an integral

part of your station. The picture quality of its YIQ, M-format is another. Especially when you consider how good it is. One-inch quality from 1/2" VHS tape just about says it all.

The Panasonic MVP-100. Let it make dead air a dead issue for you. Call your nearest Panasonic regional office. Northeast: (201) 348-7336. Southeast: (404) 925-6772. Central: (317) 852-5973. West: (619) 941-3387. Canada: (416) 624-5010.

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the usual automation features. A PC-based system may also offer the station business features such as traffic, billing, logging, order processing, sales management reporting, invoice and affidavit preparation and ac-

counts receivable/payable.

An automation system is a complex piece of equipment that is not easily broken down into specifications. There is no substitute for hands-on experience. This experience should

come from several days of on-the-job training at the manufacturer's plant, or at least the recommendation of another broadcaster currently using the system. Most manufacturers will supply prospective buyers with a list of stations using their gear. Many companies also have complete working models at their manufacturing plants for examination.

Automation system designs vary widely from one manufacturer to another. Each unit has its own particular set of functions and features. Prices also vary, so comparison shopping is strongly advised.

Most automation systems feature plain-text video displays and printouts of commercial messages and other events. This feature saves a great deal of time in commercial verification work. A printout of nothing but code numbers is difficult to check because traffic personnel must constantly refer to look-up tables. Figure 3 shows a typical plain-text automation system printout.

No two automation systems are programmed the same, but once the operational codes are learned by the

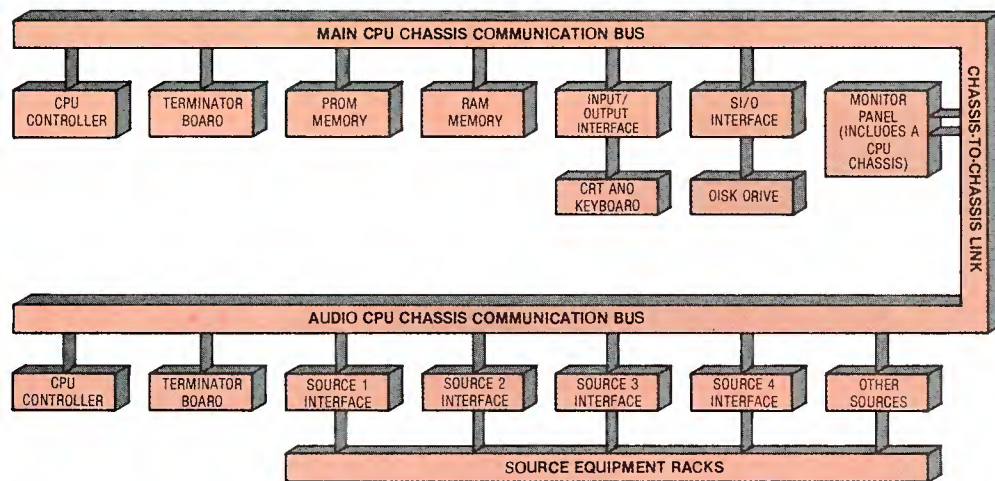


Figure 1. The architecture of a typical program automation system. Multiple microcomputers may be used, depending on the system design, to control various functions.

Whose new AGC packs 110 dB of dynamic range into 1-3/4 inches of rack space?

Only the new Harris Ulti-Mate 91 Tri Band AGC! Here's more signal shaping flexibility than you'll get from anything else on the market...with phase coherent design that won't degrade even digital source material. Ulti-Mate's phase coherent circuitry insures waveform fidelity and minimizes distortion as signals are processed and amplified.

Improve any audio source
You'll hear the difference immediately. Beef up your audio chain with Ulti-Mate's unprecedented 110 dB dynamic range. Use it as your final broadband limiter. Put it in front of your Optimod or other audio processing system for a remarkable improvement in sound. The linear VCA gain control allows extraordinary processing capability to enhance even the purest system.

Stereo Ready

When you're ready for stereo—whether it's AM, FM or TV—so is Ulti-Mate 91. It's totally compatible with all broadcast stereo systems. And it can drive your STL, too.

Takes only 1 3/4" of rack space

The Harris Ulti-Mate 91 Tri Band AGC slips neatly into 1 3/4" of vertical rack space (3 1/2" for stereo version). Adjustments are deftly concealed but easily accessed through a slide-out drawer. And if unauthorized adjustments are a concern, secure tamper proofing is easily achieved.

First-rate equipment for first-place ratings

Good sound is the currency of Radio;

it buys audience. Ulti-Mate gives you better dynamic equalization through the phase coherent Tri Band AGC, for markedly improved signal transmission. At a surprisingly low cost.

The Harris Ulti-Mate 91 Tri Band AGC. Audio processing has never been this good. For more information, contact Harris Corporation, Studio Division, P. O. Box 4290, Quincy, Illinois 62305. 217/222-8200.

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For your information, our name is Harris.

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Only the beginning

A thing of beauty . . . this Dynair System 21.

Begin with this single, high density frame using as few as 10 inputs and 10 outputs. Select combinations of video, audio, time code, data, tally, or machine control switch modules.

Grow sensibly, easily and cost effectively to impressive matrices of one thousand inputs and one thousand outputs of every module type by simply adding frames and modules.

Grow into high definition TV, if this possibility is in your future, without changing a thing. Bandwidth of the System 21 is already 30 MHz.

Write or phone. We would like to send you additional information. Give us a chance to begin with you as you upgrade your plant.

DYNAIR

5275 Market Street, San Diego, CA 92114 U.S.A. Phone (619) 263-7711 TWX (910) 335-2040

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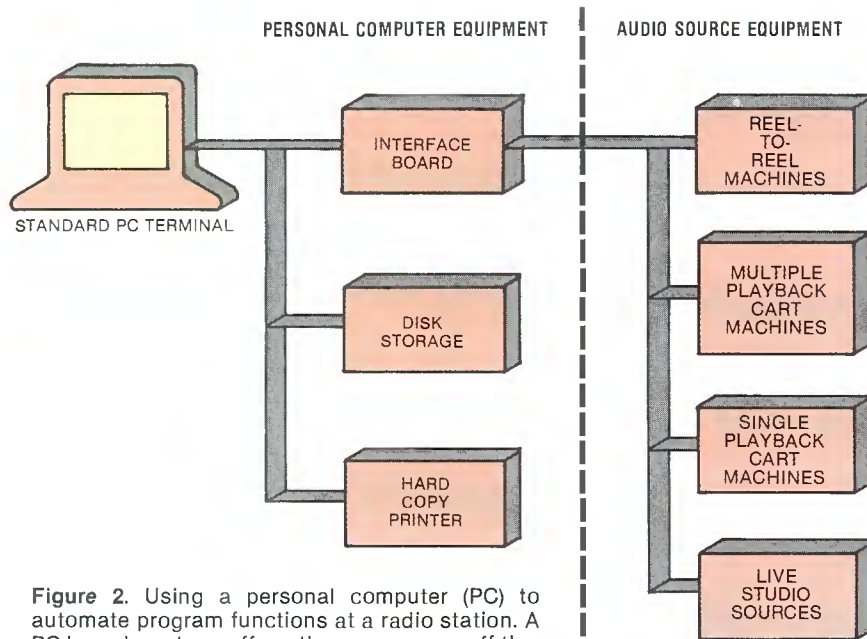


Figure 2. Using a personal computer (PC) to automate program functions at a radio station. A PC-based system offers the user many off-the-shelf business office options.

```

06:01:09AM 0501 STATION-ID
06:01:12AM 0804 RELAY
06:01:12AM 0705 MENS...FROM RKO
06:05:15AM 0511 STAR BASE WEAR. OPEN 7 CM
06:05:25AM 0502 HEATHER
06:05:50AM 0511 STAR BASE WEAR. CLOSE 7 CM
06:06:03AM 0506 CONCERT PROMO FOR LIFESTYLES 30 CM
06:06:46AM 0100 OPEN-UT-MUSIC
06:06:47AM 0200 MUSIC
06:10:31AM 0300 MUSIC
06:13:27AM 0547 SENIOR RESOURCE CENTER 30 PSA
06:13:50AM 0100 OPEN-UT-MUSIC
06:13:52AM 0200 MUSIC
06:16:54AM 0100 BOTH-UT-MUSIC
06:16:55AM 0400 MUSIC
06:19:38AM 0503
06:19:42AM 0541 ANGELOS 4-5 30 CM
06:20:13AM 0803 RELAY
06:20:13AM 0100 OPEN-UT-MUSIC
06:20:15AM 0200 MUSIC
06:24:02AM 0100 OPEN-UT-MUSIC
06:24:03AM 0400 MUSIC
06:26:52AM 0300 MUSIC
06:30:17AM 0804 RELAY
06:30:17AM 0542 LOLETA CHEESE CO. 60 CM
06:31:19AM 0544 LIFESTYLES (SPRING SPRING) 30 CM
06:31:54AM 0100 OPEN-UT-MUSIC
06:31:55AM 0200 MUSIC
06:35:50AM 0300 MUSIC
06:39:21AM 0547 JARCH OF DIMES GARR. AUTO 30 PSA/CM
06:39:53AM 0100 OPEN-UT-MUSIC
06:39:55AM 0200 MUSIC
06:43:34AM 0100 BOTH-UT-MUSIC
06:43:47AM SILENCE SENSE
06:43:47AM 0400 MUSIC
06:46:57AM 0503
06:47:01AM 0531 DAVES SADDLERY 3-31 30 CM
06:47:32AM 0100 OPEN-UT-MUSIC
06:47:41AM 0200 MUSIC
06:51:09AM 0100 OPEN-UT-MUSIC
06:51:15AM 0400 MUSIC
06:54:30AM 0300 MUSIC
06:58:26AM 0501 STATION-ID
06:58:31AM 0804 RELAY
06:58:31AM 0530 PATS MARKET 4-1 30 CM

```

Figure 3. A typical program log plain-text printout. Many automation systems also feature discrepancy logging for notifying operators of tape or machine problems.

user, the day-to-day loading of commercial schedules and programming instructions is accomplished with relative ease. Most units allow various format files to be created in memory for music rotation, commercial clusters and special programs. These subroutines greatly simplify programming of the system, reduce the number of potential errors in loading or editing the schedule and conserve expensive memory space.

Front office functions

A full-scale automation system can be used not only for complete automation of the station's program facilities, but also as a component in a larger business computer that handles front office functions. This step in the automation process can be as simple or complex as the station desires.

Sophisticated systems are available that eliminate all paperwork from the point at which the sales orders are entered. The computer will create a log, adhering to separation limits and format restrictions. This information will be loaded into the slave automation system, which monitors the unit's performance and reads out commercial data as spots are aired (Figure 4).

A comparison is automatically made between what was scheduled to run and what was actually aired. A discrepancy report is then compiled, showing defective cartridges or source machines.

Billing information is pulled from the business computer memory at appropriate times and invoices are generated, based on accurate and complete data from the peripheral automation system.

Radio station computer packages are also available with features that are more common to business mini-computers, such as accounts receivable, cash receipts, general ledger and accounts payable.

Group-owned radio stations located in different geographical areas can be linked using such computer systems with dedicated or dial-up telephone company lines. This feature can result in considerable savings in time and money for large stations that require close cooperation (financial and otherwise) among various elements of the corporation. Word processing packages are then available to greatly speed the generation of correspondence and advertising copy.

Total automation of a station provides numerous benefits to management, including timely, concise information on cash flow, inventory con-



Fuji 1/2-inch professional tape. Because you'll go to any length to get the story.

No one ever said getting a story was easy. So you want a 1/2-inch tape that makes the effort pay.

You want a 1/2-inch tape that can take the high-speed transport of systems like the Sony Betacam™, or M-Format equipment. One that survives editing hazards like constant shuttling and quick stops. Which means you want a cassette with a precision-engineered transport mechanism, and a videotape with a unique DUROBACK backcoating that keeps the tape on track.

When it's air time, you want a 1/2-inch tape that will deliver the best performance possible. Which means a tape with outstanding video and color S/N performance, regardless of how many times the tape is used. It also means a tape with the absolute minimum number of dropouts even after extensive use, thanks to special anti-static leader and trailer tapes.

Finally, you want a 1/2-inch tape with extremely low wow and flutter, so that stereo broadcasts sound as clear as they look.

In short, you want Fuji's H421 and H321 1/2-inch professional videotape. Because Fuji's 1/2-inch tape is the shortest distance between just getting the picture and getting it just right.

For more information on Fuji 1/2-inch professional videotape, call your Fuji representative. He'll go to any length to tell you what you want to know.



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Nobody gives you better performance.

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trol, FCC compliance, sales trends, budget status and collection problems. A sophisticated automation system can be, in the right application, a lifeboat for a station drowning in a sea of paperwork.

Live assist

In lieu of total automation of a station's facilities, the use of a standard automation system to assist a disc jockey in running a live show has become popular. The *live-assist* can be for the entire day or specific day parts.

Full-scale live-assist finds little application in small market stations, because the primary reason for purchasing a standard automation system is often to reduce the daily operating costs of the plant. Larger stations, on the other hand, can usually justify the installation of an automation system for live-assist functions because of the added flexibility and improved execution it brings to an otherwise manual operation.

With live-assist, the operator does not have to cue records, find and stack carts or keep a program log. The automation system will handle these duties, resulting in a cleaner on-air sound with fewer mistakes and encouraging more creative performance from air personnel.

News and talk stations can use live-assist to allow their talent to concentrate on the issues being discussed,

rather than what cart needs to be played next. Routine, pre-programmed functions can be scheduled days in advance; the operator needs only to push a next button to call up the spot sequence. For specific newscasts, the reporter can simply push the next button for each actuality.

Live-assist can also be used to automate certain functions not directly related to the on-air sound. For example, real time controllers can be set up to record network feeds at predetermined times, freeing station personnel from these tasks.

Need vs. cost factors determine the best route for a station to follow when considering the purchase of an automation control system. If the disc jockeys have so many tasks to perform that spots are missed, or the on-air sound otherwise suffers, live-assist is a cost-effective solution. Likewise, if a station continually misses network news or sports feeds that need to be tape-delayed for later broadcast, some sort of live-assist is in order.

Live-assist hardware comes in a wide variety of designs. Such gear can generally be divided into two categories: *sequential steppers* and *smart peripherals*. A sequential stepper is just what the name implies: a control unit that will perform a set number of consecutive pre-programmed functions. Smart peripherals are generally source machines with additional

logic, and perhaps some memory, that will perform pre-defined actions when addressed by the user or an external controller.

For special applications, custom-designed systems may be required, incorporating both sequential steppers and smart peripherals. Stations requiring a specialized control unit for their operation should also examine the possibility of constructing the device themselves. TTL and CMOS technology has made it possible to build sophisticated logic systems for a relatively low price.

Program sources

An automated station has a number of options when it comes to program source material. It can generate its own music library using either a reel-to-reel or cartridge format, subscribe to one of the many music services or climb on board a satellite network.

Music libraries and programs generated in-house have the obvious benefit that the format of the station can be tailored to whatever management wants. The drawbacks are the time and money involved in assembling and maintaining a large library.

Broadcasters who turn that chore over to a music service have many formats from which to choose. Everything from country music to hard rock is available, with varying amounts of disc jockey talk.

Some music libraries are beginning to appear on cassette tape formats. Cassette storage of program material allows new flexibility for the station, given proper supervision of the system by a computer.

A large number of program elements can be stored on a single cassette. One estimate puts the practical density at 50 monophonic music selections or 76 mono commercial announcements. A supervisory computer can search for the required program elements using control signals encoded on each tape.

The ability to search a cassette for a particular element and automatically cue-up opens the door to an entirely new philosophy toward program automation. Recent improvements in the audio quality of cassette tape decks make such a system a viable alternative to reel-to-reel source machines in some applications.

An increasingly popular method of delivering program material to subscriber stations across the country involves the use of satellite links. The main benefit of satellite distribution is simplification of station operation,

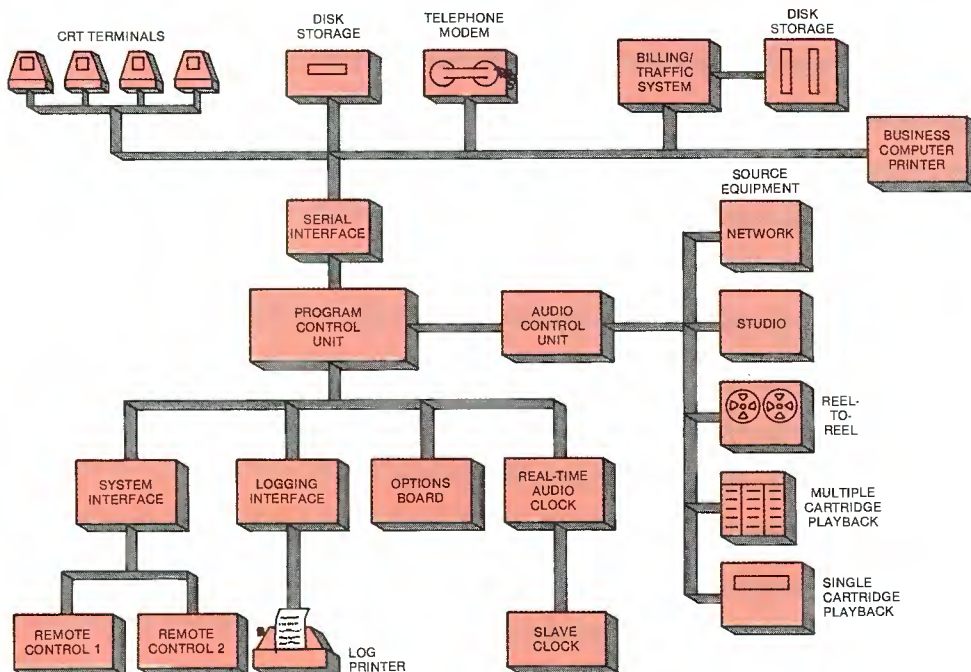
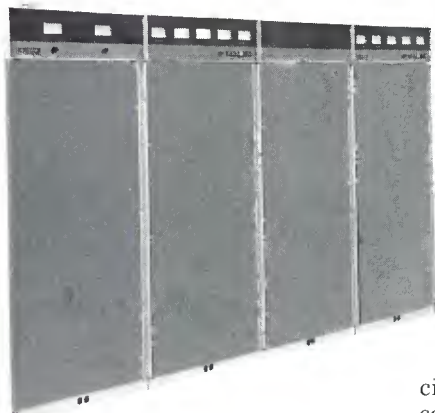


Figure 4. The architecture of a full-scale program automation system interfaced with a business computer for order and invoice processing.

UHF-TV broadcasters: Grab a pencil... you're about to see just how much money our transmitter can save you.

	Your Transmitter	Harris TVE-60S
Power consumption	_____ kW	130 kW
Times hours on air per year	_____ hrs.	_____ hrs.
Times cost per kilowatt hour	_____ \$/Kwh	_____ \$/Kwh
Equals yearly electricity cost	\$ _____	\$ _____

Replacing your transmitter with a Harris TVE-60S
saves you \$ _____ per year.



Harris builds the world's most efficient UHF-TV transmitters. Do a few quick calculations above and prove it to yourself. If you're running a 55 kW or 60 kW transmitter, compare it with our TVE-60S, 60 kW model. Replace your transmitter with a Harris TVE-60S, and save up to \$25,000 a year in utility bills!

Success with the Varian "S"

Harris engineered every efficiency improvement technique available into its entire UHF transmitter line. An example is the most effective use of the new Varian "S" series super high effi-

ciency klystron with variable visual coupler. Harris operates these klystrons with a new design high voltage pulser for up to 68% peak visual beam efficiency. In addition, klystrons are steam cooled—*not* liquid cooled—for high efficiency and long life.

How we dispatch distortion

Pushing klystrons to peak operating efficiencies causes picture-distorting, non-linear operation. Harris UHF transmitters are equipped with the MCP-2 visual exciter. Its uniquely simple Quad Corrector effectively cancels distortions, so you get the lowest total power consumption *and* performance specifications unsurpassed by any competitive model.

FM quality stereo and SAP

Extremely low incidental phase modulation (less than 2°) and a highly linear wideband aural exciter give you FM quality stereo and Second Audio Program performance as well. And every Harris transmitter is shipped stereo-ready. No awkward retrofits. No costly modifications.

Get on line with a Harris UHF-TV transmitter. Contact Harris Corporation, Broadcast Transmission Division, P.O. Box 4290, Quincy, Illinois 62305. 217/222-8200.



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Continuous Product Innovation

Beginning with the first solid-state portable transmitter in 1964, B-line fixed and portable equipment in 1967, G-line terrestrial radio in 1970 and up to present day with a complete line of ENG equipment, M/A-COM MAC has been the technological innovator. We have delivered the most advanced and reliable equipment spanning both local broadcasters and major networks around the world. To further our role as product innovators, we introduced a new series of portables, a new central receiver and a helicopter skypod system in 1983. In 1984, we introduced the 40 GHz portable system, multiband radios and a state-of-the-art ENG receiver.

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Commitment To Service

As part of our commitment to total customer satisfaction, we now have two dedicated domestic service and support centers: Eastern region – Massachusetts (800) 343-3006 and

Western region – California (714) 538-3772. Plus, for product information, write to me, Duke Brown, M/A-COM MAC, Inc., 63 Third Avenue, Burlington, MA 01803 or call (617) 272-3100, Ext. 4331.

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REELS WITH EQUAL PRECISION
AND GENTLENESS

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MOTOR AND INDIVIDUALLY
REPLACEABLE HEADS

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PANEL—ALL OPERATOR
CONTROLS UP FRONT

TBC-6 WITH 32 LINE MEMORY
AND 28 LINE CORRECTION
WINDOW; PERFORMANCE
MATCHED TO VPR-6.

DUAL NUMERIC READOUTS—
ONE FOR TAPE TIME/TIME
CODE; ONE FOR CUE POINTS,
DIAGNOSTIC CODES, TAPE
SPEED, SETUP CODES

Now, Here It Is The New VPR-6.

When hundreds of users worldwide told us what they wanted in a one-inch VTR, we listened closely and then designed and built it. It's our new VPR-6, the easiest VTR to operate, service and maintain of any in its class. And it's in the price/performance ratio that most users want.

Smart, yes. Complicated, no.

Intelligent but not intimidating, the new VPR-6 offers features that allow you to get the job done more productively. For example, virtually all machine setup procedures can be done at the highly efficient control panel. Most board-edge controls typically found in VTR's have been eliminated.

You insisted on fast but gentle tape handling... the VPR-6 shuttles tape at speeds approaching 500 ips and handles all reel sizes from spot to 2 hours with equal precision and gentleness. The servo microprocessor senses when the end of the tape is near and slows down the reels and scanner and unthreads the tape gently.

You asked for power-down memory... so we built in a long-life battery to protect setups, edit and cue points and all editor configuration parameters.

"Make it easier to troubleshoot," you said, and we built in an extensive diagnostics system that constantly monitors many system conditions and warns you if a fault occurs. You can even run from the control panel a diagnostic routine using a logic probe to test every IC in direct communication with the two microprocessors.

A tried and true transport

You demanded reliability. Not wanting to tamper with success, we borrowed the tape transport and mechanical

printed wiring boards and backplane connectors throughout. The modular package allows convenient access to any part of the VTR for easy maintenance.



A TBC to Match

Because you wanted play speeds from -1 to 3X normal and picture in shuttle, we also developed the new TBC-6 digital time base corrector, performance-matched to the VPR-6. Its 32-line memory and 28-line correction window are the largest in any TBC appropriate for a VTR of this type.

State of the art editing

So much for recording and playback, how about editing? The VPR-6 has all the capabilities you asked for, including split audio-video auto edit and auto tag. RS-422 serial communications capability lets VPR-6 function efficiently in a state-of-the-art editing system with the Ampex ACE and other edit controllers.

First-rate audio

"Make audio better," you said, and we did. The VPR-6 has audio (as well as video) confidence playback. The audio system also offers high quality stereo phase and an optional fourth audio channel for EBU systems.

Selection of styles

Most users may agree on capabilities, but you prefer a variety of configurations to choose from. So, we offer the VPR-6/TBC-6 in four console styles as well as tabletop and rackmount versions. Many Ampex video accessories work with it, including some you may now own.

In production now

The VPR-6 is too good to wait for, so it's already in factory production. Ask your Ampex video sales engineer



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What to expect in transmitter control systems

By Whit Smith, Harris, Quincy, IL

Computers can monitor, control and diagnose problems at remote transmitter sites. However, the systems' capabilities have notable limitations.

Transmitter control systems traditionally use relays, motorized potentiometers and variacs. But for the last several years, discrete digital IC logic has been replacing mechanical control.

The change from mechanical to electronic control is relatively easy, as

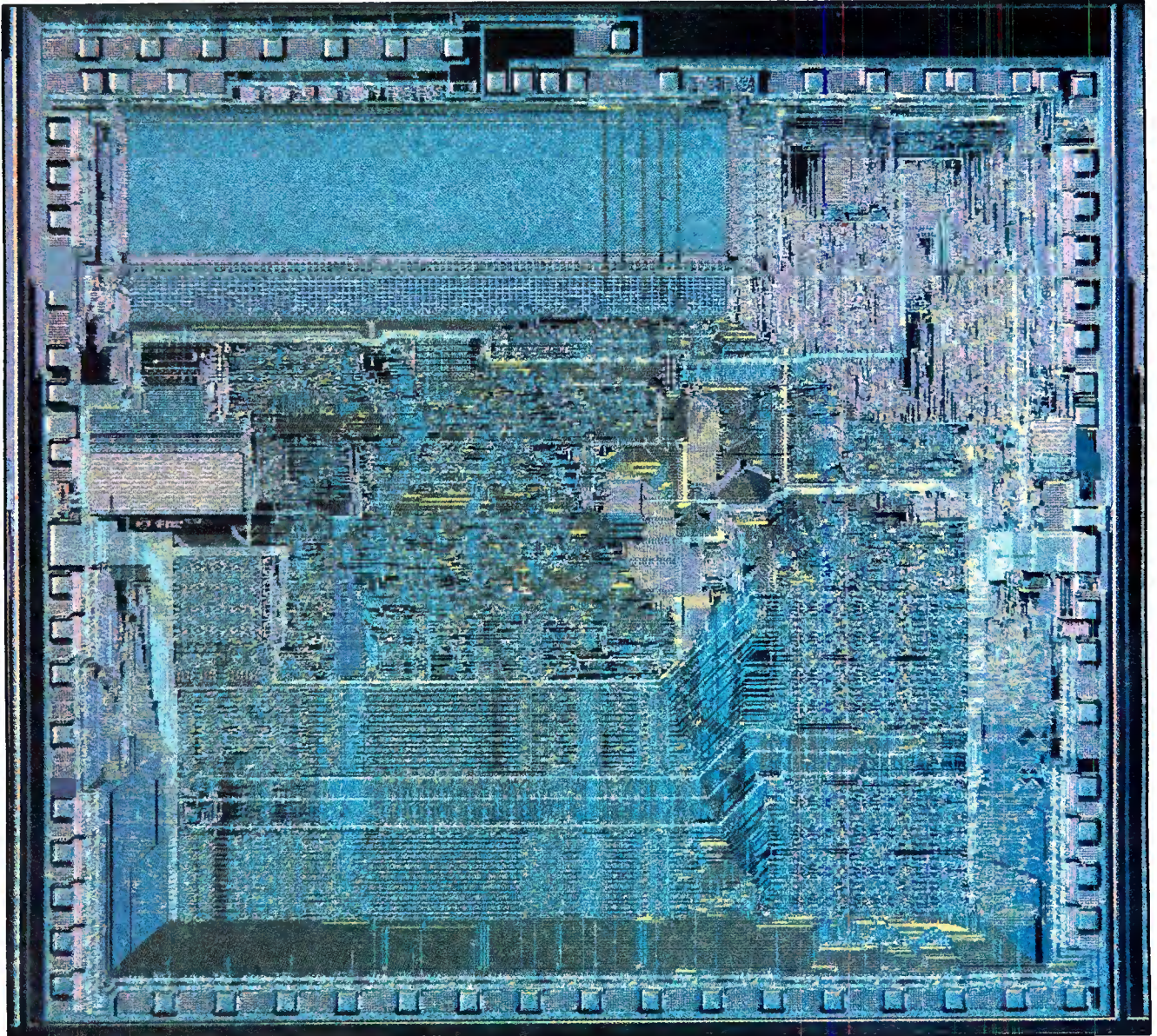
AND and OR gates and counters can closely simulate series and paralleled relays, motorized potentiometers and stepping relays. Adding extra features to the control design is also greatly simplified.

Service benefits support this transition as well. All control logic can be on the same circuit boards, which already contain power comparing, overload and resistive divider circuitry. For most maintenance, you only need access to the PC board housing the related circuitry, instead of

crawling around inside the transmitter, VOM in hand, to check power relays and contactors.

In new generations of transmitters, however, discrete IC logic may not reasonably handle all of the desirable control functions. With enough dis-

Microprocessors, such as this National Semiconductor NS 32032 chip, allow versatile monitoring, control and diagnostic programming. Present systems, however, require fewer capabilities and usually use 8- or 16-bit processors instead of a 32-bit device.



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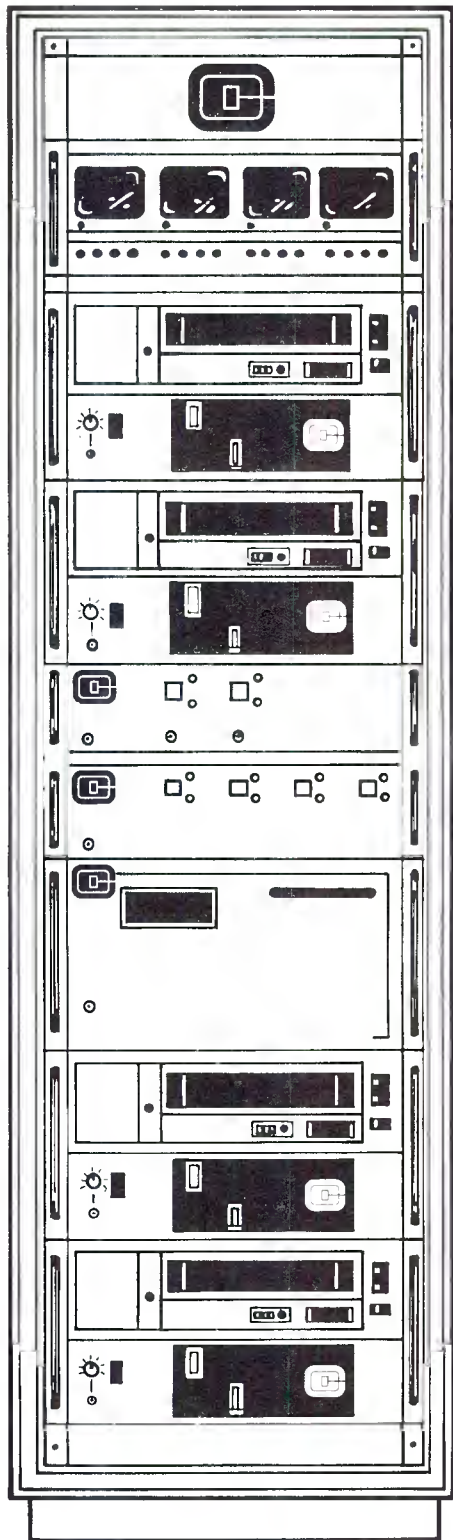
CCI custom-builds the system to your specifications in our own plant. If you later change your mind about the way your system should operate, no problem. Our CMOS circuitry is driven by EPROMs, so just tell us what you want done differently, and we'll blast a new EPROM. Presto, the change is made.

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crete logic, a designer could build almost any system, but the cost and maintenance of such systems become staggering.

Consider, for example, discrete control logic in a dual TV transmitter, where multiple visual, aural and emergency multiplex RF paths join multiple high voltage power supplies and control points. The number of PC boards, their location and their internal communication become unwieldy.

When they are built, such systems often require extensive modifications to meet a station's custom desires, increasing costs of custom systems and system upgrades.

The use of MPU (microprocessor unit) control logic in transmitter equipment, however, suggests more sophisticated control than previous technology allowed.

Microprocessor technology

MPU-based circuits can perform the same functions as more complex discrete device counterparts. Far fewer parts are needed, because the function description is stored as a program in a solid-state memory. With discrete devices, the interconnection of a large number of fixed function ICs defines the control architecture.

The MPU is merely a generalized

device that follows specific instructions presented to it from external or internal memory sources. The instructions are executed quickly, with speeds from 100,000 to 4 million instructions per second. The instructions are organized so that when interfaced to appropriate circuitry, the resulting controller may count broomsticks or calculate linearized VSWR readings from forward and reflected RF power levels.

The set of control functions are stored as a computer program, instead of being implemented by etched traces on a PC board. As a result, the design engineer may maximize the controller performance, given the same transducer inputs and controllable outputs of the discrete controller.

The same information, from which the discrete IC controller displayed tube plate voltage, tube current, forward and reflected RF powers before, can now automatically reduce power to a safe operating level. The transmission line is protected from high VSWR, or a tube from excess dissipation, until the problem is corrected. Previously, these conditions would have shut down the transmitter.

With intelligent use of computer control, the transmitter can do much more. Specifically, areas where MPU technology will be best used include transmitter monitoring, control and diagnostics.

Monitoring/Display

Most monitoring has relied on mechanical D'Arsonval movements physically located on the transmitter and at the station control point. At the transmitter, several dedicated meters display major parameters, while a separate multimeter indicates the other values as selected with a multiple position switch.

Typically, far fewer parameters are sent to the remote control site than are available at the transmitter. They are normally observed one at a time because of limitations in the STL or telephone link bandwidths or other hardware.

MPU technology overrides the limitations of mechanical meters and switching mechanisms. The computer's transducers are calibrated to internal voltage references, compared to the variable resistor and set screw references of the mechanical meter. The computer stores information as absolute digital numbers, not as analog values. Thus, several digital displays at different locations show the same reading, while two mechanical meters tend to show different values, unless they and their communications link are calibrated frequently. The computer system offers

Continued on page 58

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One lens for every ENG and EFP production—Fujinon's new 14X is smaller, lighter, "weatherized" for use anywhere and available with an ultra-compact built-in pattern projector. For studio use, choose from a full array of conversion accessories including Fujinon's exclusive multi-processor shot box, servo focus with remote demand or conventional remote zoom and focus controls. And for added flexibility, select Fujinon's front-mounted wide and tele-converters.

The new 14X offers more than size, weight and range advantages (a 2X

range extender is built in). Its F1.7 maximum aperture remains absolutely flat from 9mm to 103mm. In addition, corner resolution has been increased while longitudinal chromatic aberration has been reduced. And with its weatherized features, the new 14X is the ideal lens to take into the field.

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OPT MOD-AM[®] STEREO.

In the past, if you were considering C-QUAM[®] AM stereo, the exciter manufacturer may have suggested a certain audio processor. But now you have a choice—after extensive testing in Motorola's lab, OPTIMOD-AM Model 9100A/2 with the new #1-S Stereo Compatibility Card has been fully approved by Motorola for use in C-QUAM installations. There are *already* scores of 9100A/2's driving C-QUAM exciters. Now that Motorola is telling its customers and using the 9100A/2 to demonstrate their system at trade shows and technical exhibitions, we expect OPTIMOD-AM to become an even more popular choice for C-QUAM stereo. (In addition to C-QUAM, the versatile 9100A/2 can be configured to operate ideally with *any* of the other AM stereo systems.)

OPTIMOD-AM: The Original AM Stereo Matrix Processor

Our 9100A/2 was designed *from the ground up* for the matrix (sum-and-difference) processing that is necessary to achieve full loudness on mono radios. So we only need to use *two* carefully-harmonized AGC stages from input to output: a slow "hand on the pot" AGC, and a six-band limiter with patented distortion-cancelled multiband clipper. The result? Competitive loudness is complemented by uncanny smoothness and naturalness. Pumping and other processing artifacts are below perceptibility. And efficient single-chassis card-cage construction assures easy circuit board access without removing the unit from the rack.

In contrast, the competition added a matrix processor onto an existing non-matrix system. There are four boxes, four power supplies, and up to *six* stages of AGC in cascade. One large board is used per box, making updates and repairs inconvenient. Is it any wonder that this system not only introduces more processing artifacts, but is also substantially *costlier* than OPTIMOD-AM?

Single-Channel Modulation Control

To prevent distortion in C-QUAM receivers, Motorola recommends limiting single-channel modulation to 75% negative. In published advertising, our competitor has falsely claimed that our system works by switching to mono under single-channel conditions. In fact, we perform as much control as possible by L and R clipping. Distortion is prevented by a variable-blend circuit which reduces L-R gain as necessary to prevent overdriving the clippers. On most program material, the effect is inaudible. On material with extreme stereo separation, image width is slightly reduced. However, the signal never becomes mono, or even close to it. And sound on mono radios is *never audibly affected*. Because most of your diary-holders will be listening in mono for some time to come, we think this point is crucial.

In contrast, our competitor performs this control by means of limiters in the L and R channels. If the limiters are not coupled, this can cause a stereo image shift similar to "platform motion." And this circuit can punch "holes" in both stereo *and* mono when the limiters act.

As usual, there's no free lunch. But Orban's system fully protects your mono listeners, while our competitor's doesn't.

Preemphasis

OPTIMOD-AM offers a continuously-variable front-panel HF EQ control. This boosts high frequencies to extend the effective bandwidth of the receiver, providing a sound more competitive with FM. Its curves were computer-optimized on the basis of a two-year engineering study of typical auto, table, and portable radios. With the introduction of new wider-band AM stereo radios, we made available three plug-in modules which can change the *family of curves* produced by the HF EQ control to suit the needs of your target audience. In addition, we provide a fully-parametric BASS EQ control.

The competition offers an EQ control on their matrix processor which provides only a single curve family of unspecified origin. If you use their four-band compressor, you also get a four-band graphic-type equalizer.

We believe that most stations do not want or need excessive numbers of equalization controls which, if misadjusted, can easily produce colored, honky, unnatural, and fatiguing sound. OPTIMOD provides controls to get the sound right—not controls to lead you astray.

But if your situation demands a broader equalization range, you can combine our 622B stereo Parametric Equalizer with OPTIMOD-AM to create an integrated *system* with far more powerful equalization capabilities than the competition—at about the same cost as our competitor's processor alone!*

Consistency

Many consultants now believe that one of the keys to a polished, professional, audience-building sound is *consistency* in texture and tonal balance from source to source. OPTIMOD-AM's six-band limiter with steep-slope crossovers provides this consistency automatically—laborious re-equalization and processing in the production studio are almost never required.

MOTOROLA
APPROVED



Even with their four-band compressor, the competition can't match this level of consistency because of their compressor and crossover design. The longer you listen, the more you'll appreciate OPTIMOD-AM's superiority.

Protecting Your Investment

We like to think that Orban earned its #1 place in audio processing with a solidly-engineered and superb-sounding product line which is backed with ten years of quality, reliability, and customer service—plus the best manuals and documentation in the industry. Plug-in construction allows low-cost updates as AM stereo technology advances. All these factors combine to protect your substantial investment in AM stereo processing—for C-QUAM, or any other system.

Fighting The FM Challenge

Your FM competition is after your audience share. OPTIMOD-AM offers a remarkably favorable tradeoff between loudness and processing artifacts, plus smoothness, consistency, and a bright, open sound that holds its own against FM stereo—on *real-world* AM radios.

When you add it all up, it becomes clear that there's really only *one* choice for AM Stereo processing: OPTIMOD-AM 9100A/2.

—Robert Orban

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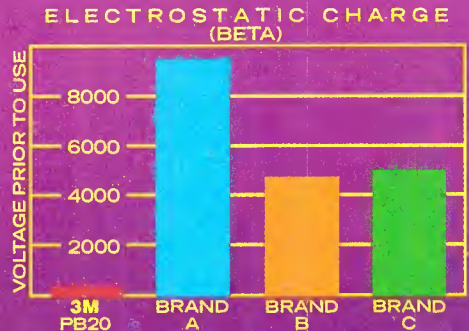
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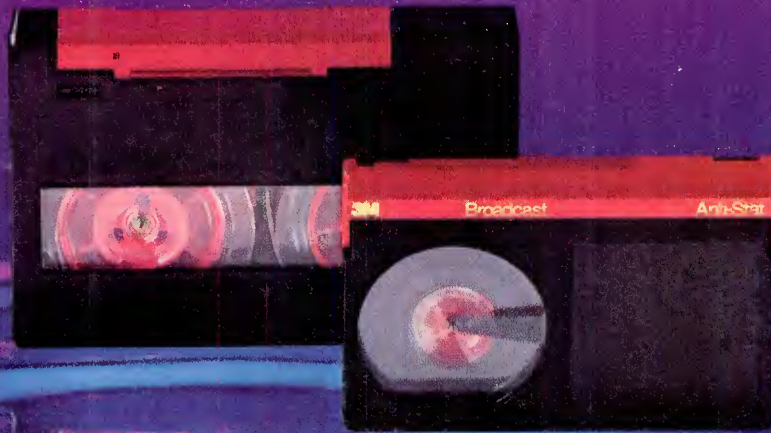
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OUR TAPE
ANTI-STAT...ANTI-DROPOUT.



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repeatability not possible with mechanical meters.

D'Arsonval meters normally allow about 2% of full scale accuracy because of mechanical limitations. Current transducers and A/D converters give more accurate readings.

An inexpensive 10-bit A/D converter, for example, presents a 100% range with a resolution of 1024 parts, or an accuracy of approximately $\pm 0.1\%$. Parts of greater precision are generally used in broadcast equipment. Often only one A/D device is used in the circuit and is shared among all the parameters measured.

Because the converters are referenced to one source, all maintain the same level of accuracy.

Intelligent digital displays, such as alphanumeric LEDs and LCDs, bargraphs or even CRTs, present parameters for best human perception. For example, a filament voltage may best be given as a 7-segment digital

Relaxed remote control rules

New FCC rules took effect on Dec. 1, 1984, for AM and FM stations operating by remote control. The changes, in recognition of improvements in transmission system reliability, give greater operational flexibility. Personnel requirements remain unchanged.

An operator at the remote control point must be able to monitor

vital parameters of the system. The only required operational control, however, is transmitter shut-down in case a problem cannot be corrected using facilities at the remote point. Various wired or wireless monitoring telemetry methods may be used, including Telco lines and microwave and subcarrier radio links.

Facilities for corrective adjustments are allowed, but not mandatory, except in AM installations using separate day and night equipment.

When remote control equipment fails, the maximum repair time is lengthened to three hours. If control is not re-established or an operator is not at the site within three hours, the transmitter must cease RF radiation.

Operation must also cease if out-of-tolerance parameters can-

not be corrected immediately, either locally or from the remote point.

The commission must be notified (within three days of first use) if control is to be initiated at any location other than the transmitter building or the main studio and will be used when no one is on duty at those locations.

AM directional stations must apply for commission approval before beginning remote control operation from any location, including a non-colocated main studio. Approval of an application for such operation is dependent upon prior commission approval of the antenna sampling system.

If you are planning changes to your remote control system, consult part 73 of the FCC rules and your station's attorney for assistance.

"Flexibility and ease of operation; two reasons why KCPT automated with Alamar."

John Long
Chief Engineer



KCPT Channel 19, Kansas City

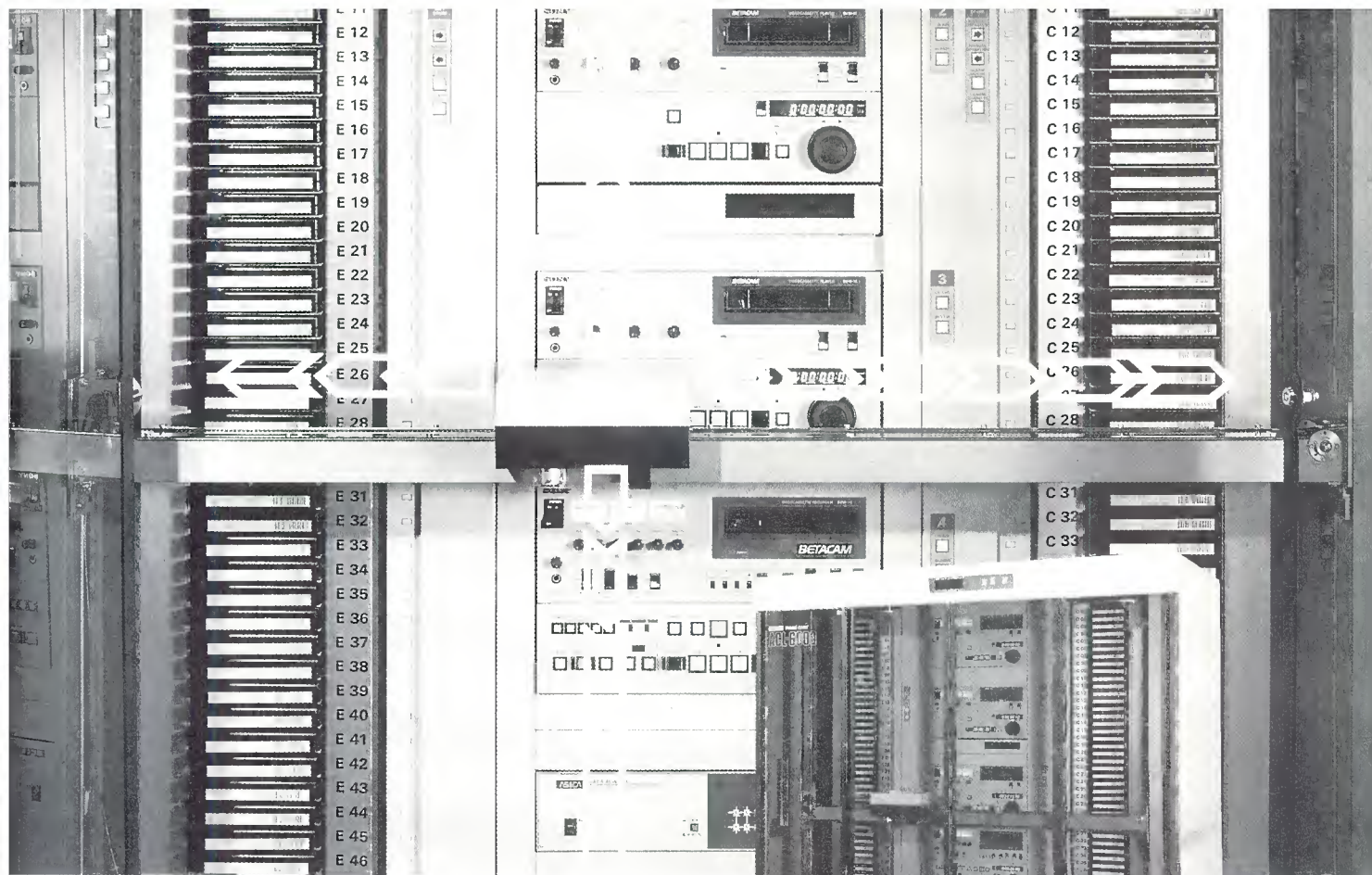


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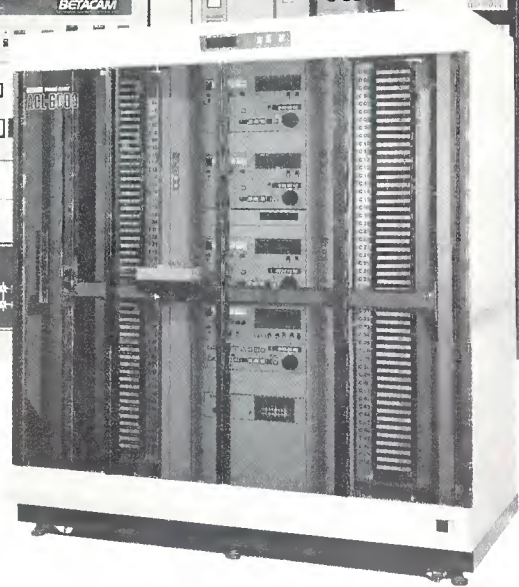
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VIDEO CART

ASACA ACL-6000B

Automatic Random Access Cart System



600 Video Cassette Capacity is the ideal system for Commercial Broadcast Programming

With the one cassette/one program system, ASACA's Video Cart enables concentrated management and automatic/continuous transmission of 600 cassettes. It shows its power especially in sending CMs, news and station breaks.

- ◆ Completely automatic/continuous random access operation.
- ◆ ACL-6000B utilizes a sophisticated bar code reader/identification system to eliminate any possibility of error.

- ◆ One cassette/one program format facilitates program scheduling.
- ◆ The high speed cassette delivery system enables the ACL-6000B to complete the program unload/load access time in 15 seconds.
- ◆ Programs that have completed their daily schedule are automatically ejected to provide space for additional cassettes.
- ◆ A highly accurate queing system utilizing SMPTE Time Code has been designed for precise start and stop points of the commercial program.
- ◆ The ACL-6000B utilizes either Betacom or M-format 1/2 inch cassettes.



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number. IPA reflected power might better be shown as a bargraph to simplify the tuning process, where relative readings and rate of change are important.

An alphanumeric display shows the name of the parameter along with its value. You do not need to reference an isolated number back to its source. Meanwhile, system designers have the freedom to add new parameters without hardware changes.

As the desired parameter count increases, the MPU-driven display becomes cheaper than meters. With CRTs and other 2-dimensional devices, many parameters can be simultaneously offered in any format desired, such as the bargraphs, X-Y graphs or even colored graphic diagrams.

Another benefit gained with an MPU handling information gathering includes the ability to more thoroughly analyze and to chronologically catalog the data. Given the dc input and RF output powers of a tube, efficiency and dissipation can be calculated. These are useful values that cannot be directly measured.

The measured information can be stored for days or weeks, if desired. This could be useful for legal purposes, as well as for predicting trends in component life. A short-term

history of relevant transmitter parameters may aid in solving cases of previously unexplained overloads and faults. Now you can look at a snapshot of transmitter conditions immediately preceding the fault. The picture may divulge the fault's cause.

Control

Traditional control systems used resistor-capacitor timing circuits to switch contactors according to chronological sequences determined by hardware. Analog op-amp feedback loops also used RC circuits for such functions as automatic power control. The only other control inputs came from external (typically human) sources. MPU technology expands the control possibilities.

Timing sequences no longer depend upon questionable RC time constant accuracy. The crystal-controlled clock of the MPU counts the time between step/start contactor actuation, filament warm-up and rundown times and other time related functions. Timing functions are freed from independently tweaked and thermally sensitive resistive and capacitive elements.

Crystal accuracies, typically to several parts per million, allow microsecond resolutions. For manufacturers, the result is simpler initial

calibration of the system. Broadcasters benefit with fewer knobs to be adjusted.

The intelligence of the system allows more than simple sequencing. In step/starting a power supply, the charging current or voltage across a capacitor can serve to indicate when to close the main contactors and then remove the starter resistors. A software timer provides a safety backup to protect starter hardware from a shorted power supply circuit.

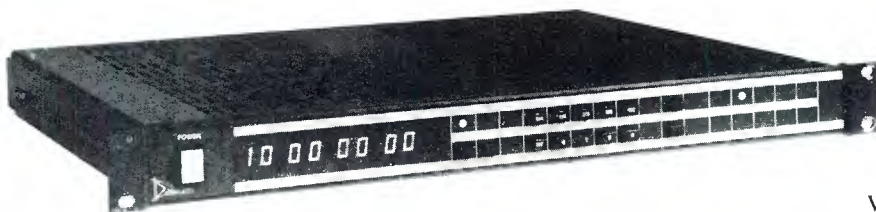
Output power can be raised and lowered to keep the tube to within a safe operating area, given the mentioned parameters as input data. The transmitter can fail softly, but not go completely off the air, as in the case of a VSWR mismatch from antenna icing.

The control mechanisms include voltage-controlled power supplies and regulators, motorized variacs, resistors and reactive components and relays. Additional solid-state components are under development to replace older mechanical methods. An example is the PIN diode RF switcher, which replaces an RF relay for multiple exciter switching.

Phase controlled triacs control power supply circuits where variacs and hand switched multiple-tap transformers were required previously. These electronically controlled

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devices are becoming less expensive and more reliable than their electromechanical counterparts.

In addition, the electronic components respond much faster to control signal inputs.

The same displays used for metered parameters can also indicate the transmitter control functions. The user can see when a contactor has been activated. With clever designs, no auxiliary contacts are necessary for feedback from the contactor. The controller deduces a closure from the presence of voltage in another part of the circuit and shows a successful contact closure (or else a fault).

Diagnostics

Computer technology can also be used to diagnose problems that occur in transmitter hardware. Many electronic equipment manufacturers include fault tree diagrams in product instruction books to aid in identifying equipment problems. The computer can use the information to passively step through a fault diagram residing in its software and specify a fault or narrow the possibilities.

The controller may inform station personnel of a possible problem and indicate what it thinks the problem to be. The short history saved prior to shutdown enables the diagnostic soft-

ware to analyze not only the static readings but also enable it to look at the transmitter as it makes state transitions.

Active diagnostics are extensions of computer self-test methods. Diagnostics require more monitoring transducers and the ability to exercise control functions as part of a test mode. This includes "flexing" of contactors and motorized components to see if they are working properly.

Well defined test signals, such as TV VITS or multiple audio tones, can be injected into the input of the system. Monitoring these signals throughout the RF chain with appropriate demodulators and transducers allows the controller to diagnose the health of each stage. Such tests can be run during station down times or continually, as with the TV VITS, which can be injected during each vertical retrace.

Although not implemented in any commercial broadcast equipment at this writing, this data could automatically tune RF stages or exciters and amplifiers to dynamically bring the devices into specification. The procedure could compensate for some failures or perform normal maintenance tasks.

Historical diagnostics use the information gathered for a period of time to indicate detrimental trends. Changing V-I characteristics of a tube filament aid predictions of tube life. The power requirements of an ion pump for a klystron tube may indicate that vacuum seals are deteriorating.

The limitations of diagnostic capabilities lie in what can be measured, what can be controlled and how well the designer defines the possible faults. These are the manufacturer's responsibilities. A transmitter designed without diagnostics in mind cannot be specific about the problems it may encounter.

However, with forethought in design, technical personnel can drive to the transmitter site, knowing what parts and test gear to carry. The extra capital cost to the broadcaster for the diagnostic capability will pay for itself in terms of maintenance and technical personnel time.

Serial remote

Another benefit of MPU control involves serial communications. Instead of a dedicated wire or channel per parameter, all information available at one end of a serial link may be sent to the other end over a single channel. This permits easy hardware expansion at the transmitter site, compared with using traditional remote control applications.

Serial communications involve sending and receiving digital codes in a time sequence over a single channel.

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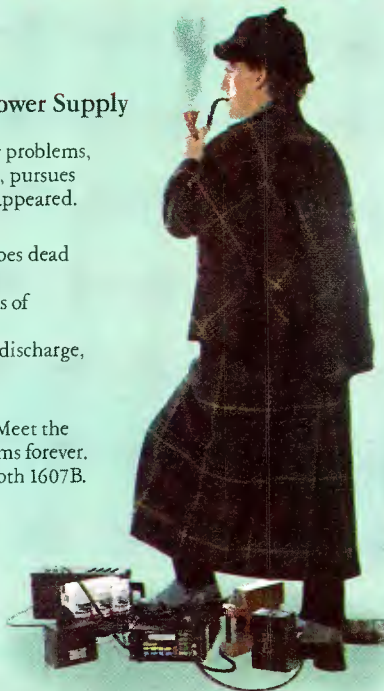
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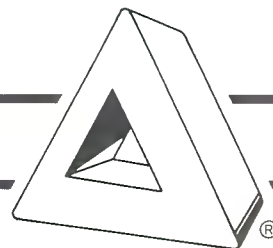
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The codes must be recognizable by both sending and receiving hardware. The speed of transmission is a function of the channel bandwidth. A 300bit/s channel passes about 30 characters of text or may update several metering channels per second.

Typical methods use two specific audio frequencies for voice grade bandwidth telephone channels (300bit/s), phase shift keying for higher speed channels requiring a carrier (9600bit/s over telephone leased lines), or voltage level changes on dedicated local lines (1Mb/s).

Algorithms (formulas) provide methods for error detection and correction (or retransmission requests). Examples of serial communication applications include RTTY, computer terminals and infrared television remote controls.

At the transmitter site, serial links allow controllers within a multiple transmitter configuration to communicate with a minimum of external wiring. Serial lines will soon be used within the transmitter itself to communicate commands and status between different parts of the transmitter. Again, this lowers wiring costs.

A serial link between studio and transmitter sites gives the operator ac-

cess to all information available to the transmitter controller. A series of parameters are observable in any desired order. Instead of dedicating many channels on an STL to the status of discrete functions, one channel carries all the information. The controllers at each end organize the information for display.

MPU control offers a new form of maintenance services. The consultants providing this service contact the transmitter site at regular intervals and inquire as to the health of the hardware. If problems are diagnosed, they are reported to the station management or directly repaired as part of the service agreement. This approach is used with fixed aircraft navigation beacons on a worldwide scale.

Various links may connect the transmitter to the service or monitoring location. Modems may use the public telephone network for data rates from 300 to 9600bit/s.

Other possibilities include a terrestrial microwave STL channel, a transmitter SCA channel for 1-way status monitoring or direct satellite networks. The SCA channel approach allows monitoring of equipment status from anywhere within the station's coverage area with a receiver,

modem and a personal computer.

Drawbacks to computer-based controls include the cost of additional transducers and control devices, a different type of maintenance and different failure modes. Parts of the industry have also resisted the use of MPU-based controllers.

Traditional control and monitoring can be accomplished with transducers and control circuits, which cost about the same as similar discrete logic controllers. However, to achieve a reasonable degree of diagnostic capability, hardware costing much more must be integral to the transmitter. The industry has not yet taken that step.

If properly built, the MPU control circuits will have reliability figures many magnitudes higher than the rest of the transmitter. They draw little power, and they do not get hot. (General Motors' repair manuals for late model cars tell mechanics to replace everything before replacing the computer-based control unit. It rarely fails even in an automotive environment.)

The people who understand RF hardware may not usually understand computer hardware. This is also true of the manufacturers. Traditionally, a technician fixes a transmitter with a VOM and an oscilloscope. Some sta-



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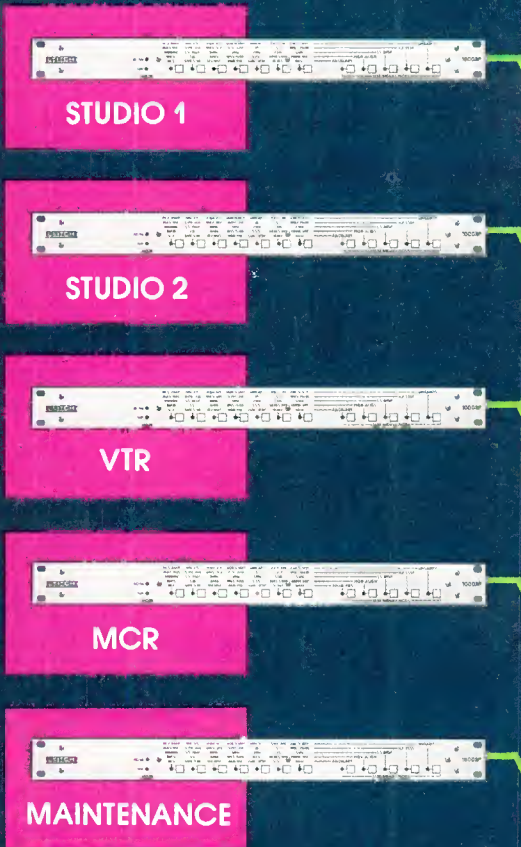
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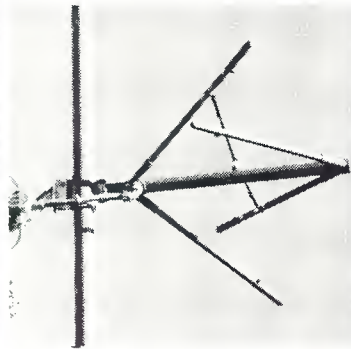


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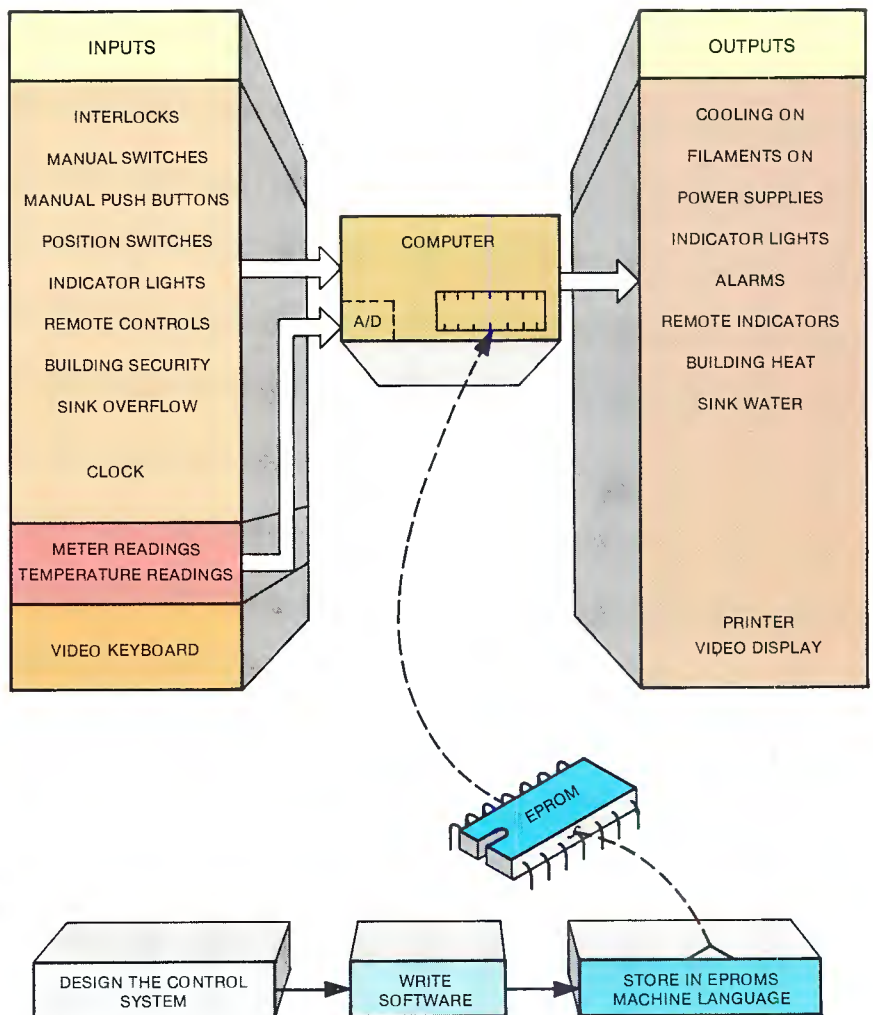


Figure 1. Possible features available with a microprocessor-based control system.

Continued from page 64
tions have little more equipment available. With relays or discrete digital logic, the technician has a chance of tracing a push-button depression through the control circuits to the final result of this action with his scope and meter.

Under computer control, all signals pass through the MPU circuits, which may not have fixed function paths. Conventional test equipment does not tell its user anything useful. Therefore, an anxiety exists concerning owning microprocessor based equipment. This does not need to be the case.

First, the controller will probably never break. Second, if it partially fails, but the self test software still operates, the controller attempts to define its situation and guide service personnel through the repair procedure.

If the core of the processor's circuits are gone, you will have to determine which parts to replace to get the transmitter back on the air.

There are many ways to fix a broken microprocessor controller. Methods include board swapping and kernel

isolation at the circuit level. The controller can also be treated as another black box and replaced like a car control unit.

Before buying an MPU-based transmitter, broadcasters should make sure that equipment manufacturers fully support their products. This support should include thorough and readable technical manuals, the availability of technical training for station maintenance personnel and field service support.

You should also check the hardware for ease of maintenance. The location of various controller components should be well defined and in an easy-to-reach place to facilitate board swapping.

Microprocessor-based control circuits have arrived. They pose new maintenance problems, but with their reliability and benefits, they will become universally used. They offer better control, monitoring, diagnostic and communication capabilities than their predecessors.

Meanwhile, their use facilitates the economics of automated stations and eases the rising costs of technical labor.

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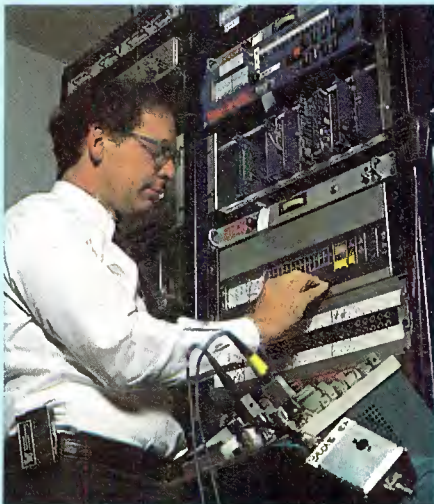
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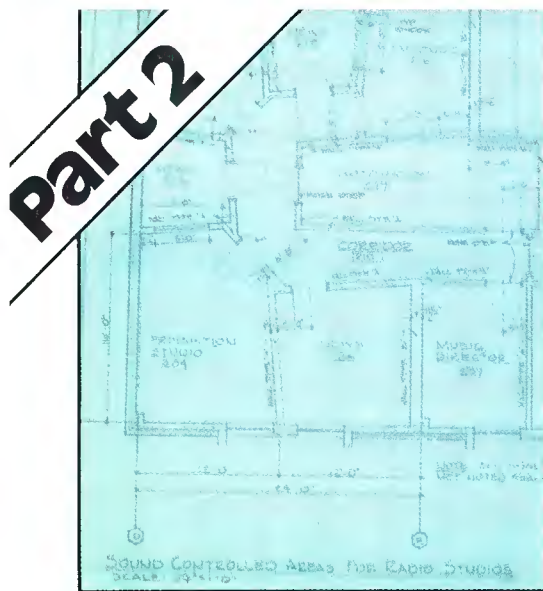
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Studio acoustics

By Eric Neil Angevine, P.E.

If someone were to ask you "What is an acoustical material?" what would your response be? If you answered that "Any material is an acoustical material," you would be correct, because all materials are sound absorptive in varying degrees.

But where do you draw the line on acoustical absorption? If a material that is 75% absorptive is an acoustical material, what about one that is 60%? What about 50%? 40%? 25%? And some materials offer little acoustical absorption but have other properties that make them good acoustical materials.

In Part I, we discussed the internal acoustics of studio spaces, but that is only one of the acoustical concerns that broadcasters must consider. The problem of sound transmission into or out of the studio is just as important. Although this is commonly thought of as keeping the outside world out, it is equally important to keep studio sound in.

Materials that provide high percentages of sound absorption are usually not good at containing sound. Although sound absorptive products are usually made of soft, fibrous or porous materials, building components that make good sound barriers are solid and massive.

A material's capacity for containing sound is generally a function of its surface weight (expressed in pounds per square foot of area). Some common materials that make good sound barriers are concrete, gypsum board, sheet steel and masonry products. Lead is another heavy material known for controlling the transmission of sound. The advantage to using lead is that it conforms to almost any shape, when used in thin sheets. However, lead is expensive. Its use in building construction is limited, because the expense is hardly ever justified by the minimal wall thickness that can be achieved.

The sound transmission loss of a typical homogeneous material is shown in Figure 1. For most common building materials, the audible frequencies are in the mass-controlled portion of the curve (Region II) where sound attenuation increases by 6dB per octave (doubling of frequency). From this, you can see that nearly all products contain high-frequency sound better than sound at low frequencies. You may have noticed that it is most difficult to contain the low-frequency "beat" from music.

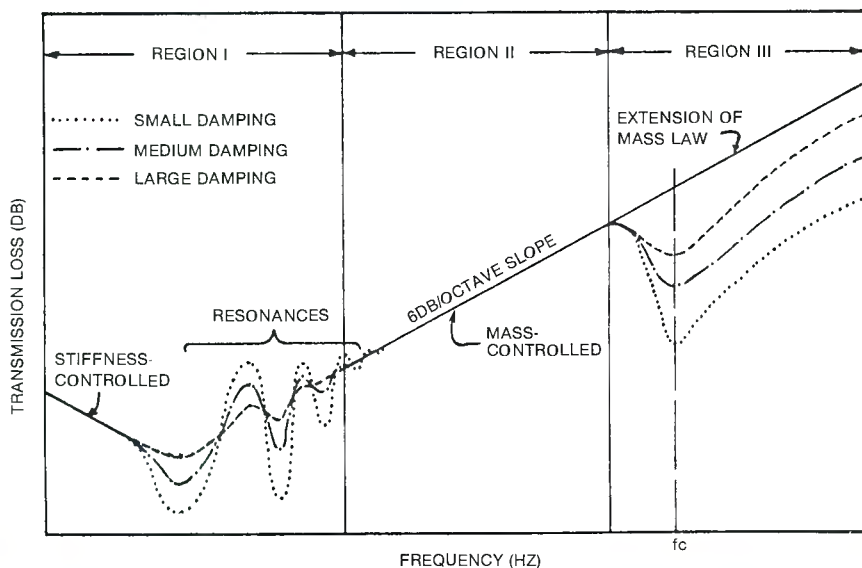


Figure 1. Sound transmission loss of typical materials.



This interior view of a production studio shows splayed walls with panels of fabric-faced absorption alternating with absorption faced with wood battens.

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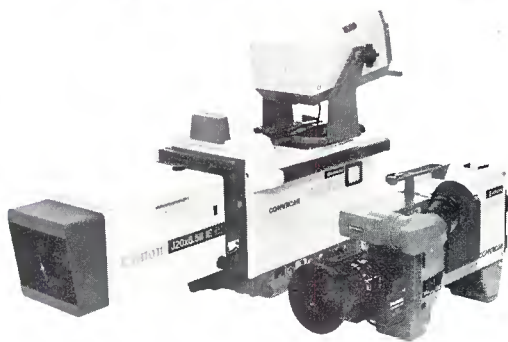
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At very low frequencies, the sound transmission characteristic is stiffness-controlled, and here it is best if the material is somewhat limp—or at least not excessively stiff. Within some range of high frequencies, there is a coincidence frequency, f_c , at which the material tends to be a poor barrier. In theory, a material will transmit all sound at the coincidence frequency if it impinges on the wall at a singular angle of incidence. Fortunately, in real life, sound strikes real walls at all angles and the coincidence effect is not so severe.

The mass law for sound transmission loss may be expressed as

$$TL = 20 \log w + 20 \log f - 33.5 \text{ dB}$$

where TL is the transmission loss at frequency, f and w is the surface weight of the wall in pounds per square foot. (In instances in which the wall's mass is given in kilograms per square meter, the subtracted constant term becomes 47.)

The frequency dependent term is responsible for the 6dB per octave slope of the mass-controlled portion of the curve. Similarly, the other term implies a 6dB increase in transmission loss with a doubling of surface weight. This indicates that a doubling of the amount of material in a homogeneous wall will increase the sound transmission loss by only 6dB. From this, you can see that it would not be effective to use thicker walls in an effort to improve sound insulation.

The sound transmission loss provided by two totally independent walls would be the sum of the sound transmission loss of each. From this, you should note that two 4-inch concrete or masonry walls provide far more sound attenuation than a single 8-inch wall. However, it is difficult to provide truly independent support for two walls constructed side by side. In practice, it is commonly estimated that the total sound transmission loss will be equal to the loss of the heavier wall plus one-half of the sound transmission loss of the other wall.

Although the mass law predicts that heavy materials will provide greater sound attenuation than light ones, structural constraints often limit the quantity of heavy materials that can be used in modern construction. A common problem occurs when you want to construct studio spaces on an upper floor of an existing building. The use of concrete or masonry products is almost always prohibited because of their weight. However, it is possible to achieve large amounts of sound transmission loss using lighter products if they can be installed in a way that independently supports the various layers.

Most of the techniques used to improve the sound transmission loss of lightweight frame walls are designed to isolate the individual layers of material from one another. A wood stud wall, commonly found in residential construction, rigidly ties the gypsum board panels together so that they act as a unit. In fact, a wall with 1/2-inch drywall on each side of wood studs is no better as a sound barrier than a wall with one inch of gypsum board on only one side.

The common improvement for wood frame construction is the staggered stud wall, where 2x4 studs are attached to 2x6 plates alternately on one side, then the other. In this way, the two sides of the wall are supported by separate sets of studs and connected only at the top and bottom.

An improvement on the wood stud is the lightweight metal stud. These steel channels have cut-out webs to prevent the transmission of structural vibration from one side of the wall to the other. Metal studs are commonly used for most commercial construction.

There are two products on the market designed to give wood stud walls the same vibration isolation as walls built with lightweight metal studs. Resilient furring channels are applied across the wood studs and the gypsum board is attached to them. If properly built, wood stud walls with resilient furring channels can be as good as partitions with lightweight metal studs. Care must be taken that the drywall is screwed to the channels between the studs, so that screws do not anchor the wallboard to the studs. The use of resilient furring channels on one side of a wood stud wall is usually adequate, but they may be used on both sides of a partition for critical applications.

A second product which is commonly misunderstood and often misused is sound deadening board or sound control board. This wood fiber board is designed to be a resilient underlayer for gypsum wallboard. It does not provide significant sound attenuation by itself. As with resilient channels, be careful that the drywall is not attached directly to the studs through the underlayer. One way of guaranteeing this is to nail or screw the sound deadening board to the studs and then attach the wallboard to it with an adhesive. Even using this technique, it is important that the nails be dimpled or set so that their heads do not contact the wallboard.

In the completed wall, a trapped air-space in the wall cavity will act like a spring, tying the two sides of the partition together. At some frequency, a resonance occurs, at which the sound transmission loss is much less than at

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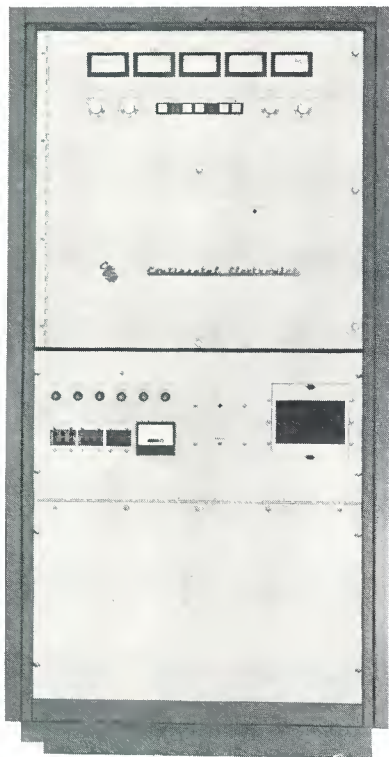
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Left: Photo shows excellent dynamic response of Continental's 5 kW AM transmitter at 20Hz modulation. Right: photo of modulation wave form shows effect of Instantaneous Peak Limiter

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other frequencies. The frequency at which this occurs depends on the mass of the two sides of the wall and the thickness of the cavity. Additional resonances are associated with the dimensions of the cavity; that is, the height or thickness of the cavity and stud spacing.

It is possible to reduce the cavity resonances and the air-spring resonance by applying acoustic absorption in the cavity. Note that the use of absorptive insulation within a wall does not increase the sound transmission loss of the materials, but only reduces the resonances. It will be largely ineffective in improving the overall sound transmission loss of a wood stud wall without resilient isolation. The insulation should fill the cavity comfortably without being compressed. It is a common practice to specify this insulation to be one-half inch thinner than the cavity thickness, to prevent its bridging the cavity.

A wall with several layers of wall-board on each side is naturally better than a similar wall with only one layer on each side, but the same rules apply here that apply to the homogeneous wall. A wall with two layers of drywall on each side provides only 6dB more sound attenuation at any frequency than the same wall with only one layer on each side.

To construct a frame wall with really outstanding sound attenuation, it is necessary to provide at least two sets of studs, and employ some of the techniques discussed earlier. One studio wall of this type is shown in Figure 2. Note that this wall is assumed to be constructed with wood studs. If it were constructed with lightweight metal studs, the resilient furring channels would be unnecessary.

Small pieces of Homasote are specified for insulating use beneath the wall and above and below the window. Homasote is a soft material that provides a resilient cushion and improves the isolation of the wall from the floor. Another technique for reducing the structural connection between the two sides of the wall in concrete construction is an expansion joint in the floor between the two sides of the wall.

The sound transmission loss of any wall is usually limited by sound leaks and the sound transmission loss of elements such as doors and windows. It is important that a sound reducing wall be carefully constructed and tightly sealed at the floor, ceiling and room corners. If the wall does not extend to the underside of the floor or roof deck above, a ceiling of comparable construction must be used.

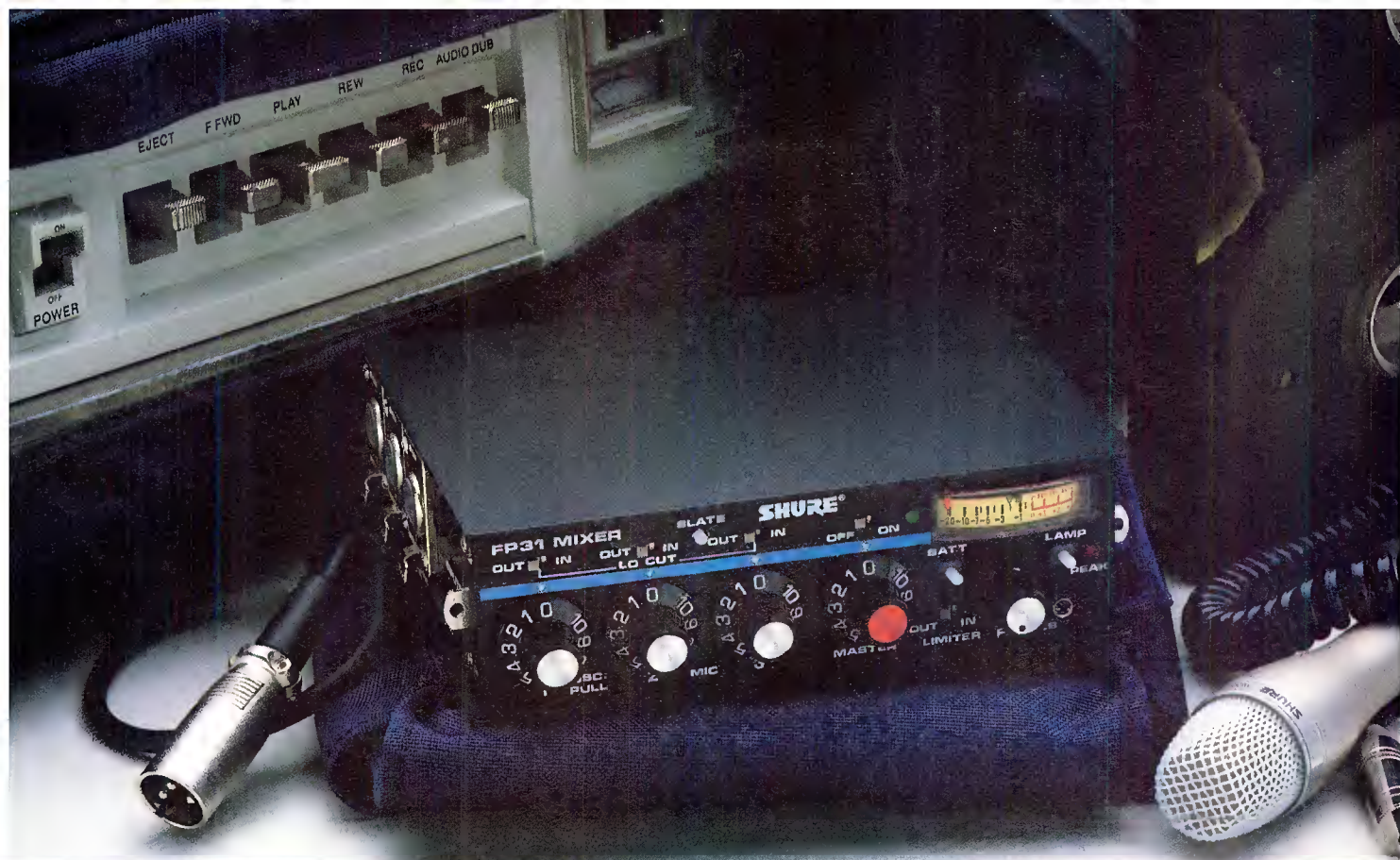
The sound transmission loss due to a wall with even small sound leaks may be approximated by the expression

$$TL = 10 \log \frac{\text{area of wall}}{\text{area of leaks}}$$

Because the leaks are small, you may think they pose no problem. Consider then, a wall in which leaks amount to no more than 0.01% of its area. The formula indicates that the transmission loss is limited to $10 \log (100/0.01) = 40\text{dB}$. Because a good wall may provide a sound transmission loss of 50dB or 60dB, this limitation is a serious defect. To guarantee a transmission loss up to 60dB, sound leaks must be limited to less than 0.0001%, equivalent to a 1/8-inch-square hole in an 8'x12' wall.



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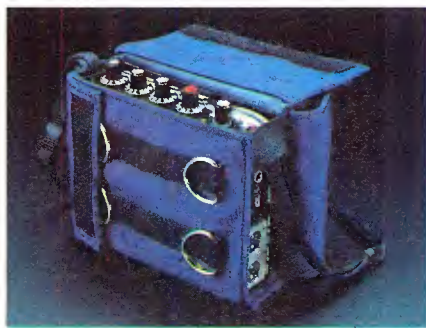
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down on the tape for locating specific takes, and there's also a built-in mic for voice slating.

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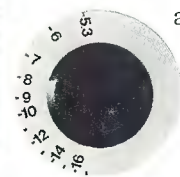
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Windows and doors also reduce the effectiveness of a sound enclosure. Doors or windows seldom provide the same degree of sound attenuation as the wall. As long as their area is kept to a practical minimum and they provide fair sound transmission loss, their effect will not be disastrous, but will reduce the overall sound transmission loss of the wall assembly.

A typical single-glazed window will have a sound transmission loss of less than 40dB, even at high frequencies. Therefore, double- or triple-glazed windows are necessary in partitions where high sound attenuation is expected. Because glass panes of different thickness have different coincidence frequencies, the use of two or more varying thicknesses will reduce the coincidence effect. Laminated glass panels are available that also reduce the coincidence effect.

It was formerly thought that sloping one pane with respect to the other would increase the sound transmission loss of the assembly. Recent research shows this is not true, but common practice still includes this detail in order to minimize double reflections from the glass. Sloping panels should tilt out of the wall at the top, to prevent images of the ceiling lighting from being reflected into the eyes of room occupants.

The individual panes of glass should be supported independently. In a double wall, each pane of a double-glazed window can be mounted in one half of the wall, as shown in Figure 2. The airspace between the panes is lined with acoustical absorption to reduce the cavity resonances.

Doors present a similar problem. It is possible to select doors that provide high values of sound insulation. However, in the most critical installations, it may be difficult to provide a sound transmission loss equal to that of the wall without using two doors. You can mount two doors in the same frame, one swinging into the room, and one swinging out, but a more popular and effective approach is two doors on either side of a small vestibule. This forms a sound lock through which people can enter even when the studio is in use. The use of two doors and a sound lock may be less costly than a single door with a high sound transmission loss rating.

Just as a window can compromise the sound transmission loss of a wall, a view panel in a door can limit the sound attenuation of the door. Keep in mind that the dimensions of a view panel usually govern the sound transmission loss, and therefore a long, narrow pane is better than a square pane of equal area.

As you might have guessed, the factor affecting the sound attenuation of

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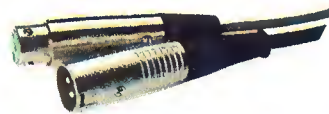
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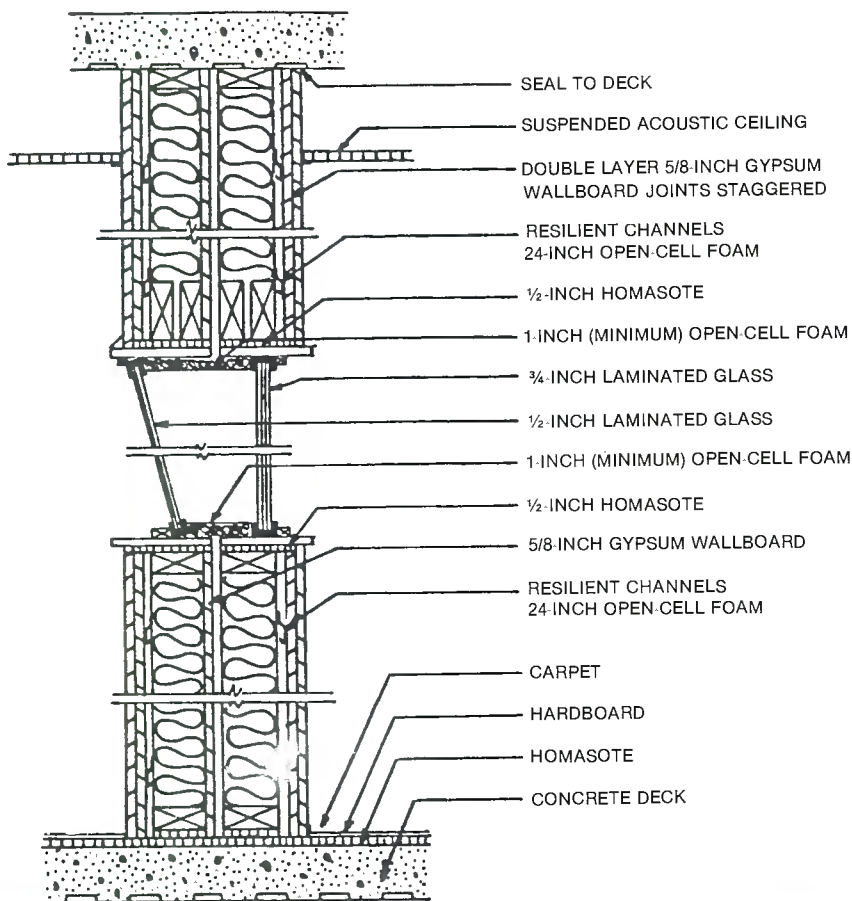


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a door is usually how well it fits into its frame when it is closed. A door used to provide a large sound transmission loss must be properly sealed on all four sides. Numerous types of seals are available for the head and jambs, as well as for the floor. The best seal at the bottom is always a threshold, but sweeps and drop seals can be used. Drop seals provide a good positive seal when properly adjusted, but the adjustment must be checked periodically to assure that the seal is maintained.

Doors, windows and walls are rated for their ability to contain sound by a single-figure metric known as the sound transmission class (STC). Like all single-figure ratings, STC does not tell the whole story. The STC rating does not indicate the sound transmission loss at any frequency, but only a sort of average. Be aware that the STC rating may be several decibels greater than the sound transmission loss at any frequency. You must also keep in mind that the STC rating was developed primarily for use in speech privacy calculations. Therefore, it may not indicate an enclosure's capability of containing broadband sound, such as music or mechanical equipment noise, which may contain a large amount of low-frequency energy.

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April 1985 *Broadcast Engineering* 79

Charting a course for AM improvement

By Michael C. Rau, NAB, Washington DC

Consider AM's assorted technical problems. Among those presently identified are AM skywave interference; the nature of electromagnetic noise; narrowband AM receivers; excessive boosting of high audio frequencies; spreading of communities beyond the intended interference-free service area of local AM stations; a lack of centralized technical information; spurious emissions and/or distortion caused by transmitter transient distortion; and widespread interference from electrical devices. Are there solutions to these problems? Perhaps. Some may be beyond solution.

In response to these identified subjects, the AM Improvement Committee has suggested eight specific considerations. Briefly, these are:

- To begin an industry-wide AM promotion campaign;
- To establish a center for AM technical information;
- To urge AM broadcasters to limit boost of audio frequencies above 12kHz before transmission;
- To improve AM transmitting antenna fidelity through broadbanding;
- To research promising new antenna designs;
- To research transmitter transient distortion (TTD);

AM vs. FM

The bad news is that AM continues to have a declining audience compared to FM listeners. The good news is that the decline is declining!

Figures from the fall 1984 RADAR report show that the trend of AM listener shifts to FM has once again been broken during the period from May 2, 1984 to Oct. 23, 1984. A similar reduction in the decline occurred in a similar period during 1981.

Although the most recent measurement indicates a decline of 3.7% (approximately 300,000 listeners), the previous period proclaimed a drop of 6.3% or nearly double.

The trends of FM growth and AM loss, shown below, have been a cause for alarm by many in the radio industry. Among the efforts to improve the status of the standard broadcast service is a special AM Improvement Committee of the NAB. Recent recommendations by that group are being studied for implementation as soon as possible.

- To work closely with receiver and IC manufacturers; and finally
- To work for mitigation of existing and potential RF interference from electrical devices.

Let us focus on each of these points in turn. We will expand on efforts afoot or needed to implement the recommendations.

Promoting AM

Launching an industry-wide campaign to promote AM radio appears the most difficult of the suggestions to implement on a nationwide basis. Certainly the broadcast industry could mount an AM listening campaign. However, obstacles may shadow the success of such a quality-oriented promotional effort.

A campaign to sensitize people, who already listen to AM radio, that AM can sound good, must carry an implicit message. AM can, indeed, sound great—but only on new generation radio receivers. The listener must be enticed to experience how good AM can sound.

Unless radio stations promote and present quality AM receivers to the public, virtually the only place the consumer can listen to quality radio is in a store that sells quality receivers. The campaign to increase quality consciousness for AM must, at least in the beginning, be formulated to bring consumers into retail receiver outlets.

Encouraging the sale of quality radios in itself presents no problems. However, which radios should be designated as *quality*? Who or what will decide which specifications of the radios determine quality? What minimal specifications will be taken as acceptable? Can a broadcaster be assured that nearby retailers will carry the specified radios? Can those radios be properly demonstrated in the shop? Many retail outlets do not provide for reception of AM.

Perhaps a standards committee could formulate evaluation guidelines for AM receivers. The results could furnish an input for the quality radio campaign. Sadly, committees consume considerable time as well as financial and personnel resources, but they offer no assurance that the endeavor will be successful.

Note that several localities, such as New Orleans, have mounted cam-

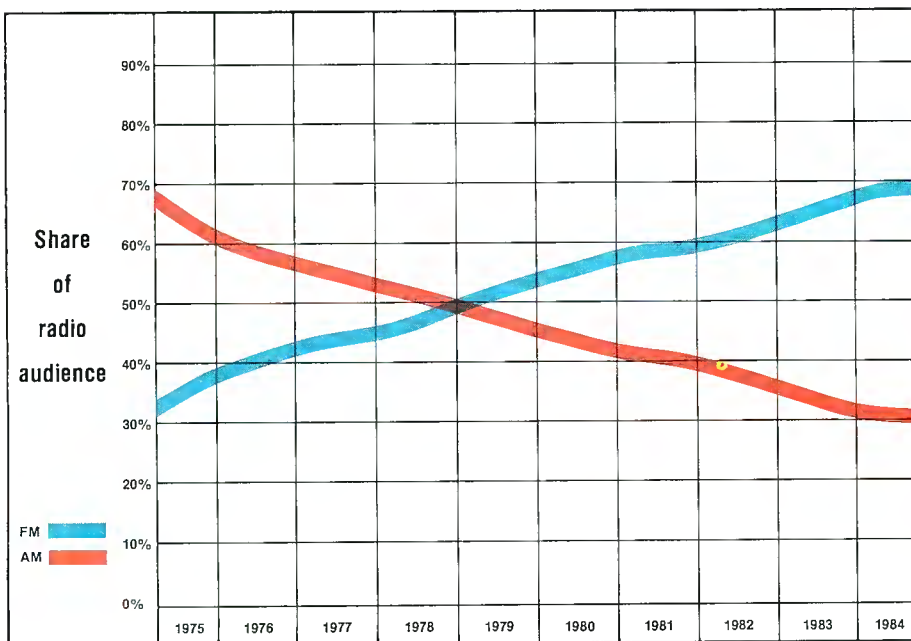


Figure 1. Trends in radio listening audiences.

Courtesy of NBC Radio Research

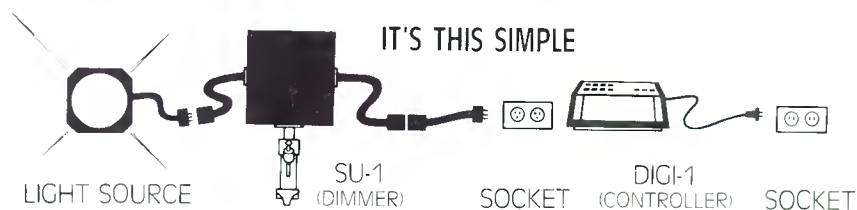
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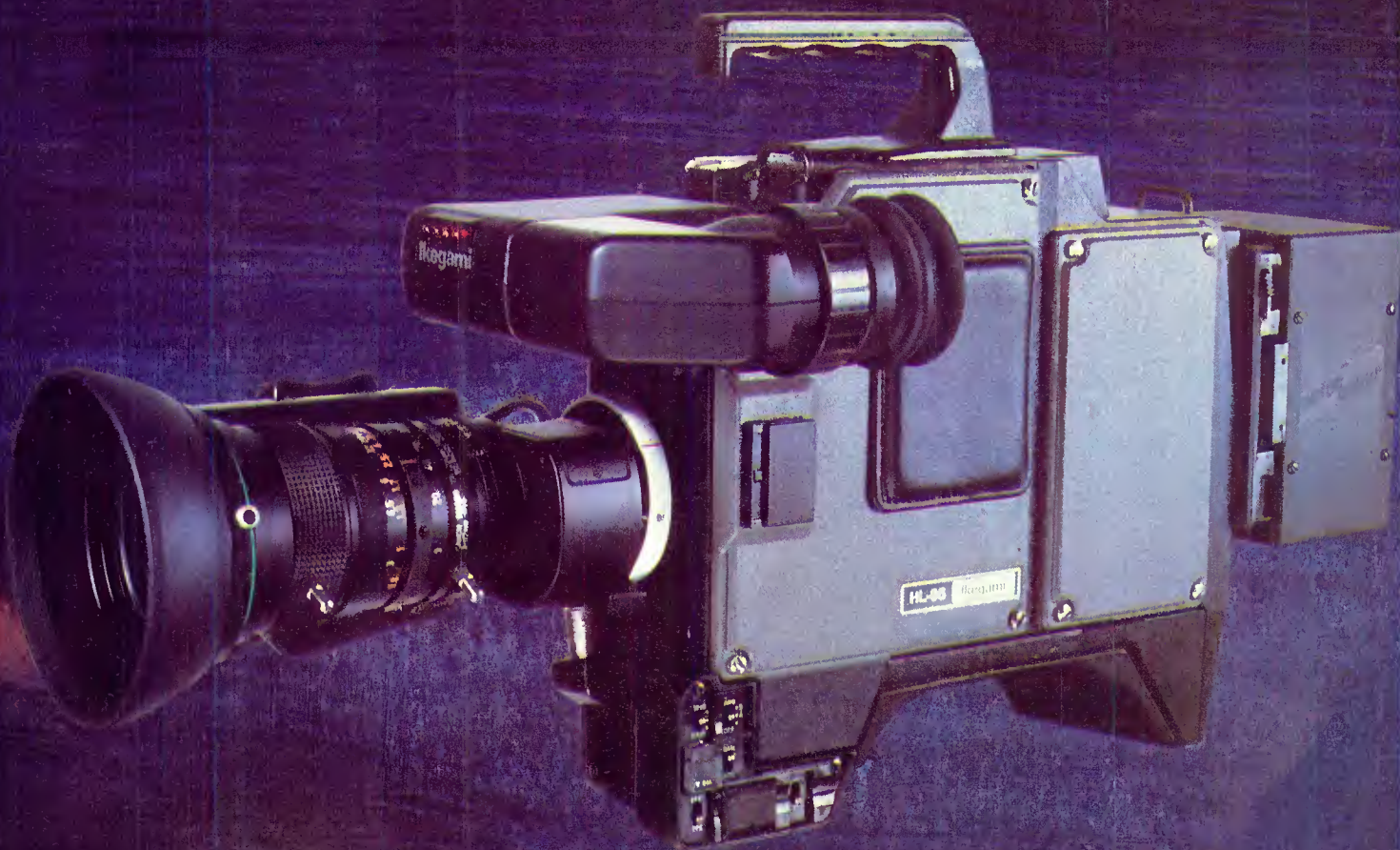
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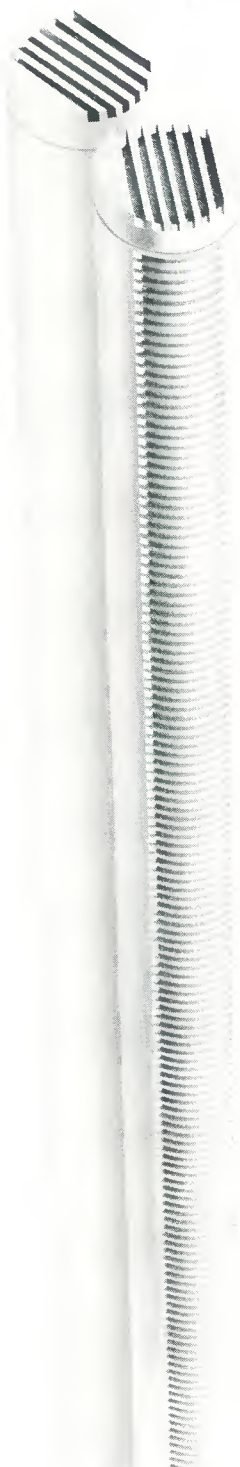
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paigns to promote the quality aspects of AM radio in general. Also the benefits of AM stereo and selected radio receivers have been stressed. Perhaps campaigns focusing on AM improvement are best initiated on a local level.

Technical aid

As of this writing, a technical reference center is being established at NAB. A student intern has been hired to complete the information-gathering process by convention time. This service will be provided to NAB members at no charge.

A chief engineer needing information on any particular aspect of AM engineering may contact the center. A comprehensive bibliography of the available materials will be furnished to the caller. Finally, by contacting the NAB Science and Technology Department, you can obtain a copy of the desired article or paper.

A second move toward technical assistance will be completed by year's end. NAB plans a collection of useful articles as a primer on basic AM radio frequency maintenance in an effort to increase quality technical operation.

Reduce the boost

The practice of boosting transmitted audio above 12kHz should be limited. Many industry engineers believe it is unnecessary to pre-emphasize these frequencies to realize good quality AM reception. A significant benefit to AM listenability because of less interference would result if frequencies above 12kHz were reduced. Many AM audio processors already contain such filtering, in effect implementing this recommendation.

The committee found no consensus on the pre-emphasis issue. It was agreed that significant interference exists on adjacent channels from excessively boosted audio frequencies above 12kHz. At the same time, there

is little, if any, benefit to the audio fidelity of co-channel AM reception.

Although a standard pre-emphasis curve could not be agreed upon, the committee was positive toward establishing a de-emphasis standard for AM receivers.

Current antenna systems

A spot study of directional antenna arrays operating at 1300kHz revealed that many could be improved through broadbanding. Known techniques are highly technical in nature and usually require the services of a skilled engineering consultant.

To assist the station personnel in accomplishing the task, the reference center will include material about the broadband process. Such material will be available to NAB members upon request.

Future antenna systems

Supplementary antenna designs offer the potential to significantly attenuate skywave radiation in specified directions. They promise to enhance groundwave coverage by as much as 15dB in the areas where coverage is now limited because of distant signal protection requirements.

A computer model has been developed to analyze the theoretical characteristics of such antennas. A 27MHz model antenna is under development. A report of this work and suggestions to implement the concept will be released when the work is finished.

The transmitter

Transmitter transient distortion (TTD) potentially causes interference with no apparent compensating benefit. The nature and causes of TTD and some of its effects remain unknown. Research into transmitter designs may find cures for TTD in existing systems. Investigation on this topic is under way.

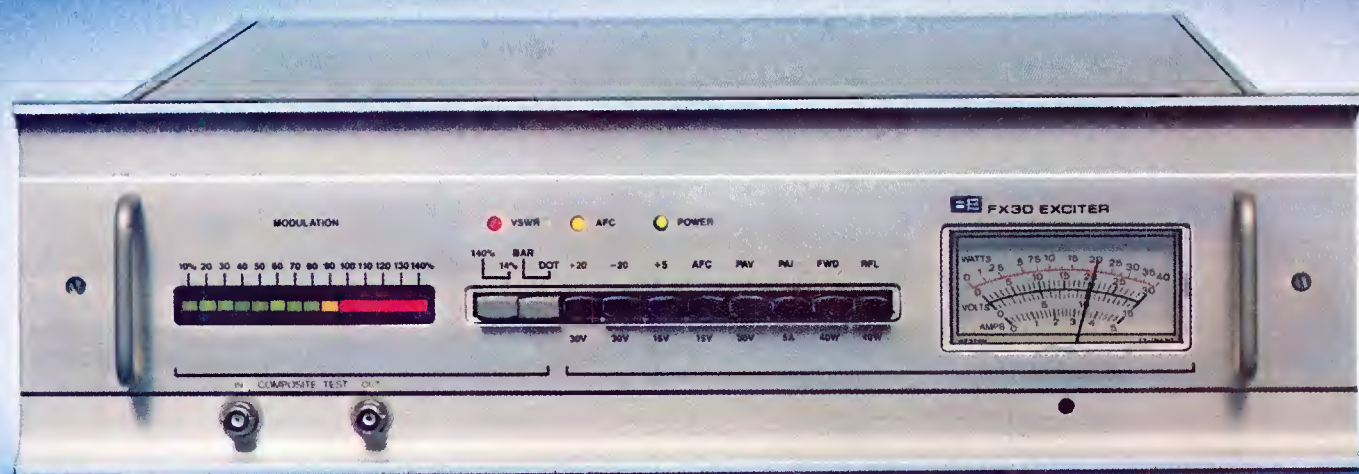
Background

In October 1983, the NAB Engineering Advisory Committee saw the need to address AM technical problems on an industry-wide basis. It was held that NAB and its technical staff should be responsible to examine pertinent issues and develop solutions and strategies to those issues. The purpose of the AM Improvement Committee was to collect, to study and to analyze problems facing AM transmission and reception and to develop ways to improve technical quality in AM broadcasting.

An array of topics were covered during the eight committee meetings held in 1984. Industry experts were solicited for their views. Letters from interested GMs, CEs and other industry representatives and participants were received. All submissions to the committee were considered.

AM stereo is without a doubt an AM improvement. Its controversial nature precludes a consensus in various issues. As a result, stereo was not within the scope of the committee's mandated work.

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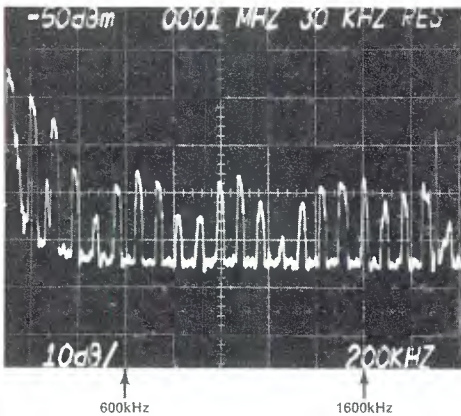


Figure 2. RF lighting device emissions.

Semiconductor designs

Developing high quality, useful and inexpensive ICs for AM radios presupposes that the IC is the most determinative factor in the design of today's AM radio receiver. You can argue that premise because many ICs produced today are capable of far greater quality than the radio which is built around them. Reasons for this involve the increased expense of additional components in the radio to take advantage of the IC's quality features.

The committee suggestion seeks to influence development of future ICs, to lower the unit costs and to make

them more attractive to future generations of AM receivers. Quality ICs will only find widespread use if their cost/performance ratio is low.

Highlighting interference

Existing and potential RF interference from automotive ignition systems, vacuum cleaner motors and various electrical fixtures impedes quality AM, notwithstanding potential receiver improvements such as noise blanking.

The pending introduction of RF lighting technology will significantly cut energy costs, by replacing the ubiquitous incandescent light bulb with RF devices. Unfortunately, many RF lighting devices emit energy at AM broadcast frequencies, both over the air and through the power line. (See Figure 1.) A current FCC Notice of Inquiry is exploring the issues of RF lighting; the need for regulation of such equipment; and interference protections to be provided to the AM radio service.

We do not know the extent that RF lightbulbs will significantly impair the AM radio listening environment. A current NAB research program is comparing electrical interference to AM reception from existing devices with the likely interference from new RF lighting equipment.

If the RF lighting would not significantly increase existing interference, opposing such technology would not benefit AM broadcasters. We should instead find means to reduce existing sources. If RF lighting significantly increases interference over existing devices, NAB should act to ensure that the FCC adopts regulations carefully designed to protect the AM radio service.

The mandate

This summarizes AM improvement matters as of early March. NAB is pursuing each option as time and resources permit. No guarantees are given, but the committee consensus places the task of researching AM problems and offering AM solutions on the shoulders of the industry's largest trade association. A failure to address the industry's real problems would be an abdication of NAB's responsibility to its AM members.

Comments and suggestions should be addressed to AM Improvement Committee, NAB, 1771 N Street, N.W., Washington, DC 20036. For those interested in the discussion and background of the issues, a copy of the NAB AM Technical Improvement Report may be obtained by calling NAB Science and Technology at 202-429-5339.

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Why mechanical solutions have failed

Extremely critical tolerances are essential to keep phase error in check. Visualize your cart playback head being expanded to 300 feet high—as tall as a football field is long. Even on this greatly exaggerated scale, tape path errors of as little as two inches will cause signal cancellation within the audio passband for the mono listeners of your stereo programming! Obviously, these close tolerances in the tape heads and moving tape paths cannot be maintained mechanically. And a tape cartridge that

is acceptable one day can be made a dud the next... simply by being dropped.

How Phase Fixer works

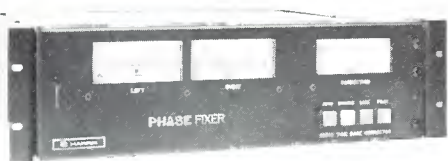
The Harris Phase Fixer consists of two compact rack-mounted units. The first, a pilot encoder, injects an inaudible pilot signal on the audio as it is recorded onto tape. The second unit is the time base corrector. When an encoded tape is played, the time base corrector is automatically enabled, *electronically* reducing stereo phase error and flutter to insignificant levels. Tapes that are not encoded will play normally.

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THE CART MACHINE VS. THE SMART MACHINE.

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And, in the belief that an ounce of prevention is worth many times its weight in makegoods, they solve problems before they occur—such as warning a technician that he's about to remove a cassette that's due to air shortly.

The Betacart is communicative in other ways, too. It's smart enough to guide your technicians through its operation, and will even interface directly with your station's main computer.

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The end result of all this electronic

THE MACHINE INSPIRED BY BILLIONS OF DOLLARS WORTH OF COMMERCIAL FAILURES.

sophistication is the kind of mechanical simplicity that virtually eliminates breakdowns—not to mention the makegoods, excessive downtime and high maintenance costs that are generally part of the package.

And, as its name implies, the Sony Betacart uses Betacam cassettes—which cost less than a third of what 2-inch cartridges cost. Its format also makes the system ideal for ENG use during newscasts—thanks to its compatibility with the Betacam™ camera/recorder, along with its multiple video and audio outputs and freeze/instant-start capabilities.

All these advantages, plus its low initial cost make the Sony

Betacart multicassette an investment that will pay for itself quickly. And it will keep paying off in new ways. Its stereo capability, for example, will allow you to capitalize on the coming introduction of stereo TV broadcasting.

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

After all, to err may be human. But there's nothing divine about having to forgive a machine.

SONY
Broadcast



Field report: Shure FP31 mixer

By Richard Rudman, engineering manager, KFWB radio, Los Angeles

The Shure FP31 is a 3-channel portable remote audio mixer designed for radio and TV ENG and EFP. The mixer is intended for applications requiring more sophisticated handling of audio sources at remote location events than built-in mixing equipment available on cassette VTRs or audio/tape machines can provide. The unit is also designed as a stand-alone remote radio mixer.

Operational features

The FP31 provides three transformer-coupled XLR connector inputs, which are switch-selectable for microphone or line level signals. A low-cut filter may be switched into each input channel to reduce low-frequency ambient noise.

Figure 1 shows the low-frequency roll-off provided by the filter (15dB at 30Hz). The slope of the filter is gentle (6dB per octave) to prevent unnatural coloring of the input signal.

Simplex (phantom) or A-B power for condenser microphones is available on each input. Three separate switches determine the microphone powering method used: no dc applied (for dynamic microphones); 9V dc (for A-B power); and 11V to 18V dc (for simplex power). No dc is applied to any channel that has been switched to the line input position.

Battery access is through a trap door and latch assembly on the rear apron of the unit. The polarity for battery insertion is clearly marked, although it is possible to insert all three batteries

backwards and close the door. If this happens, however, a protection diode will prevent any damage to the unit.

The mixer provides two transformer-coupled XLR connector outputs, each switchable to either a low impedance balanced microphone level (for driving a portable VTR or audio recorder) or a 600 Ω balanced line level (for driving a telephone company loop).

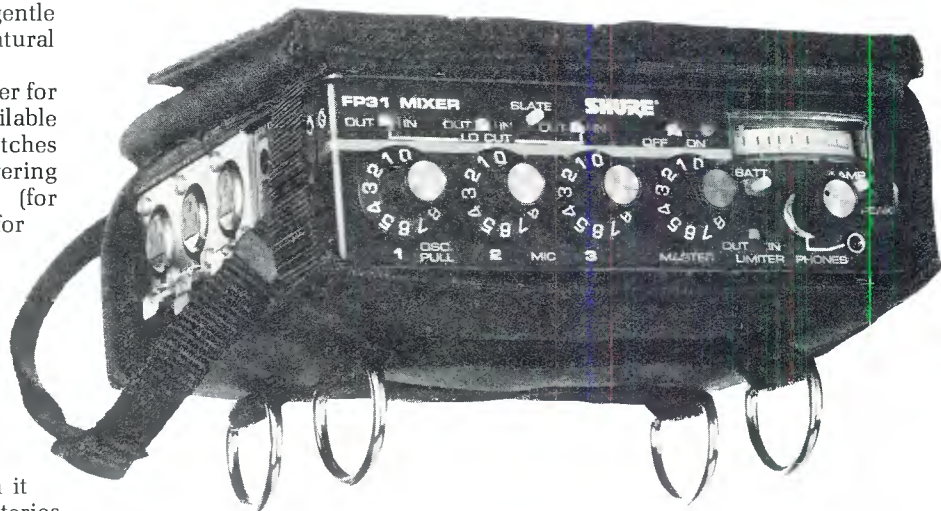
The 600 Ω line level output of the mixer will operate into a dc biased dial-up Telco line. However, the unit's instruction manual warns there may be a slight increase in distortion. A QKT voice coupling unit should be used between the mixer and a dial-up line for best results.

A separate 3.5mm tape output jack is

provided to feed a tape recorder input or other unbalanced aux-level input. This is an important and much needed feature for field mixers.

Two headphone outputs are provided on the FP31, one located on the front panel (for a 3.5mm jack) and another on a side panel (for a 1/4-inch jack). The outputs are fed by a front panel headphone level control. Up to four headphones with impedance values from 8 Ω to 2000 Ω may be used. If necessary, either or both jacks can drive the aux or unbalanced line level input of a tape recorder.

The front panel controls for the FP31 are straightforward. Each of the three input channels has a gain control and low-cut filter in/out switch. A built-in 1kHz oscillator may be ac-



The Shure FP31 remote ENG/EFP audio mixer.





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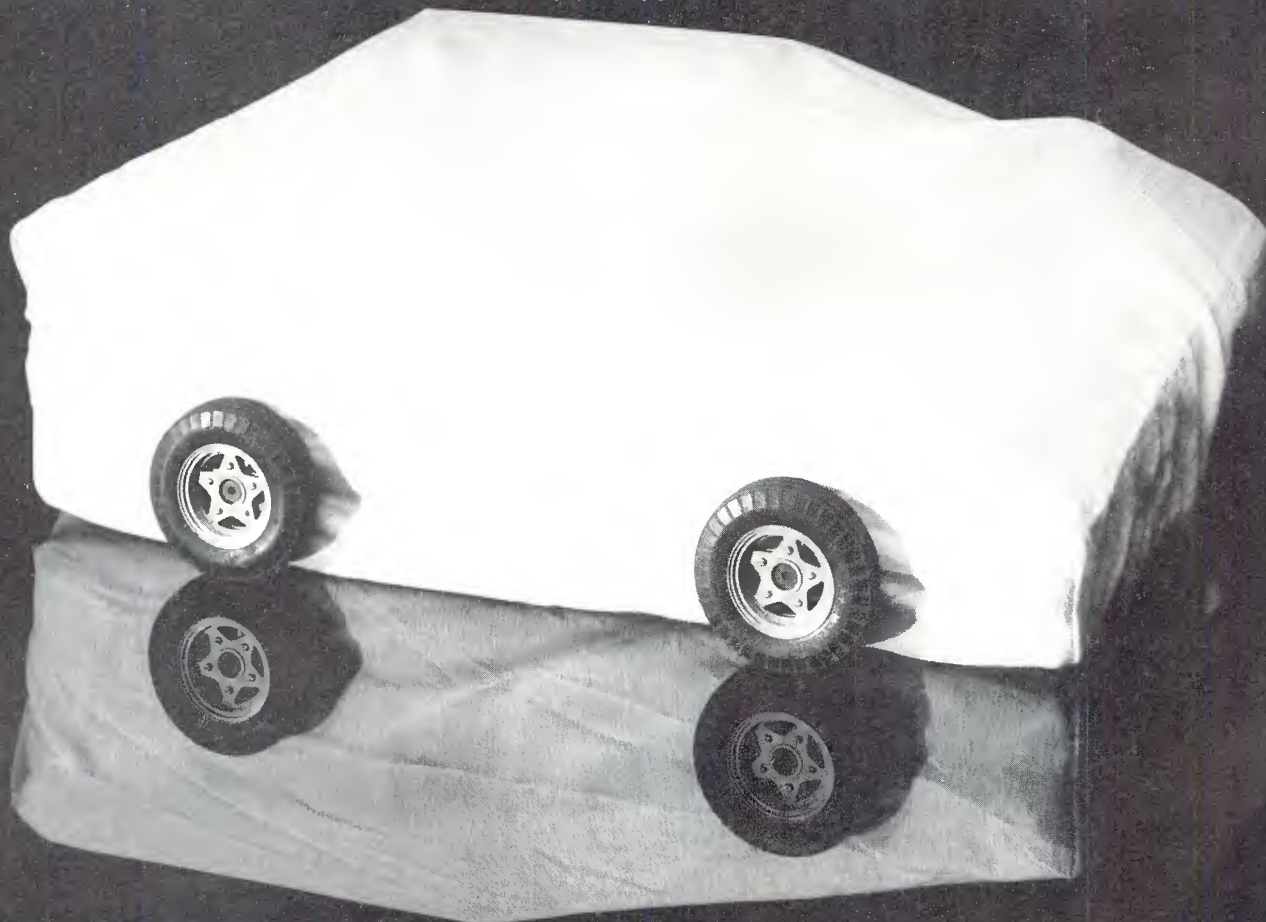
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tivated by a pull-on/push-off switch on the channel 1 level control. The master gain control determines the mixer output level, making it possible to leave the mic level undisturbed when tone has to be set.

A slate button on the front panel activates a 1s 400Hz tone and turns on the slate microphone, which is built into the front panel of the unit. The omnidirectional electric slate mic remains on as long as the button is depressed. This feature is normally used to identify recorded segments. It can also be used as an emergency microphone. The slate mic feeds a dedicated automatic gain control circuit for consistent recording levels.

A peak-responding limiter may be switched into the program line to prevent output clipping because of input overload. The limiter is fast acting (3ms attack, 500ms recovery) with a factory-set threshold of +14dBm. The limiter threshold may be set to another level by the user, if desired, by adjusting an internal trimpot, accessible through the battery compartment.

A peak LED flashes with the operation of the limiter circuit. When the limiter is defeated from the front panel switch, the peak LED will flash when the program output exceeds +12dBm. A pulse stretcher keeps the

LED lit long enough for operators to view transient peaks in the program audio.

The VU meter is factory calibrated for +14dBm output from the mixer with a 0VU indication on the meter. This setting provides about 14dB of headroom. The meter calibration level may be changed by the user by adjusting a trimpot accessible through the battery compartment.

The VU lamp button will illuminate

the meter as long as the button is depressed. The lamp will automatically turn off five seconds after release to limit battery drain.

The battery check button will switch the VU meter input to the power supply for a reading on the condition of the batteries. A reading of 0VU or higher indicates good batteries or an adequate external dc supply voltage. The on/off power switch is also located on the front panel.

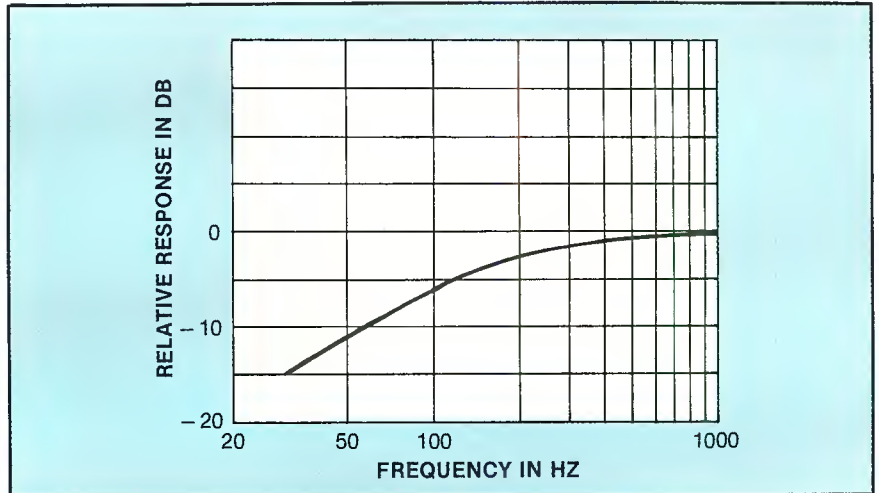
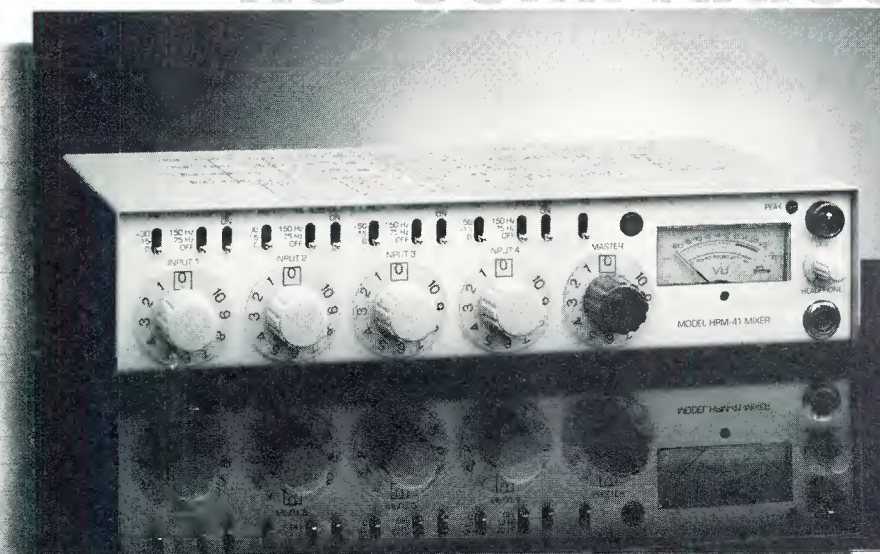


Figure 1: Frequency response curve for the low-cut filter available on each input channel.

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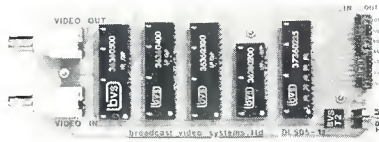
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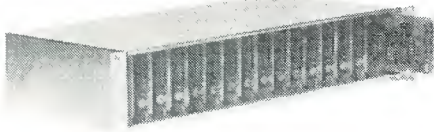
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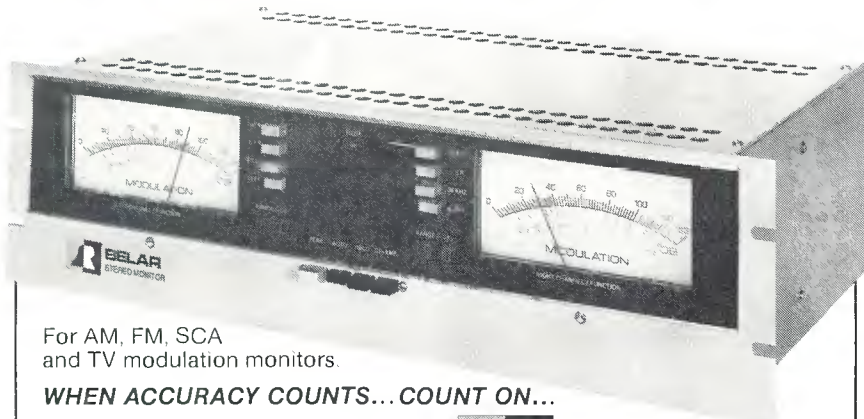


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Power supply

Two standard 9V alkaline batteries power the mixer. The batteries can also supply simplex power for condenser microphones, if used. If A-B powering of microphones is required, a third 9V alkaline battery is added. Specifications call for an 8-hour minimum battery life under normal operating conditions.

The subject of battery life brings up the question of whether the mixer would be more useful on remotes if rechargeable batteries with a built-in charging circuit were included.

The lack of rechargeable batteries is not a concern. At KFVB, we prefer the alkaline batteries commonly used in portable gear instead of rechargeables. For the type of service we require, it is easier to simply give the reporter or engineer a replacement set of batteries.

In any event, we have never done a remote that was long enough to kill a set of alkaline batteries. Recent improvements in alkaline battery design have substantially improved typical battery life.

A problem common to all rechargeables is reliability in the field resulting from the failure of personnel to place the batteries on charge when needed. Most everyone is familiar with the situation where a crew goes out to cover a story only to find that the last user had failed to charge the batteries, leaving the equipment dead in the water.

In addition to the battery supply, the FP31 may also be powered from any 11V to 18V dc source, such as a standard belt pack, automotive electrical system, VTR or wall socket ac supply. In our application, we used a regulated 12.6V dc wall socket power unit.

The mixer supply voltage has an effect on available headroom. I measured a 2.1dB difference between the regulated power supply and two fresh alkaline batteries.

Circuit design

A block diagram of the FP31 is shown in Figure 2. Input signals are routed through a switching arrangement for selection of mic or line levels and phantom mic powering, if used. All sources pass through an isolation transformer before application to the pre-amplifier stage. An active, feedback type gain control is used with each pre-amp, allowing direct input of high level sources without input attenuation. Each input channel feeds the mix bus.

The slate microphone and gain control stage is switched on and off by the slate push-button switch on the front

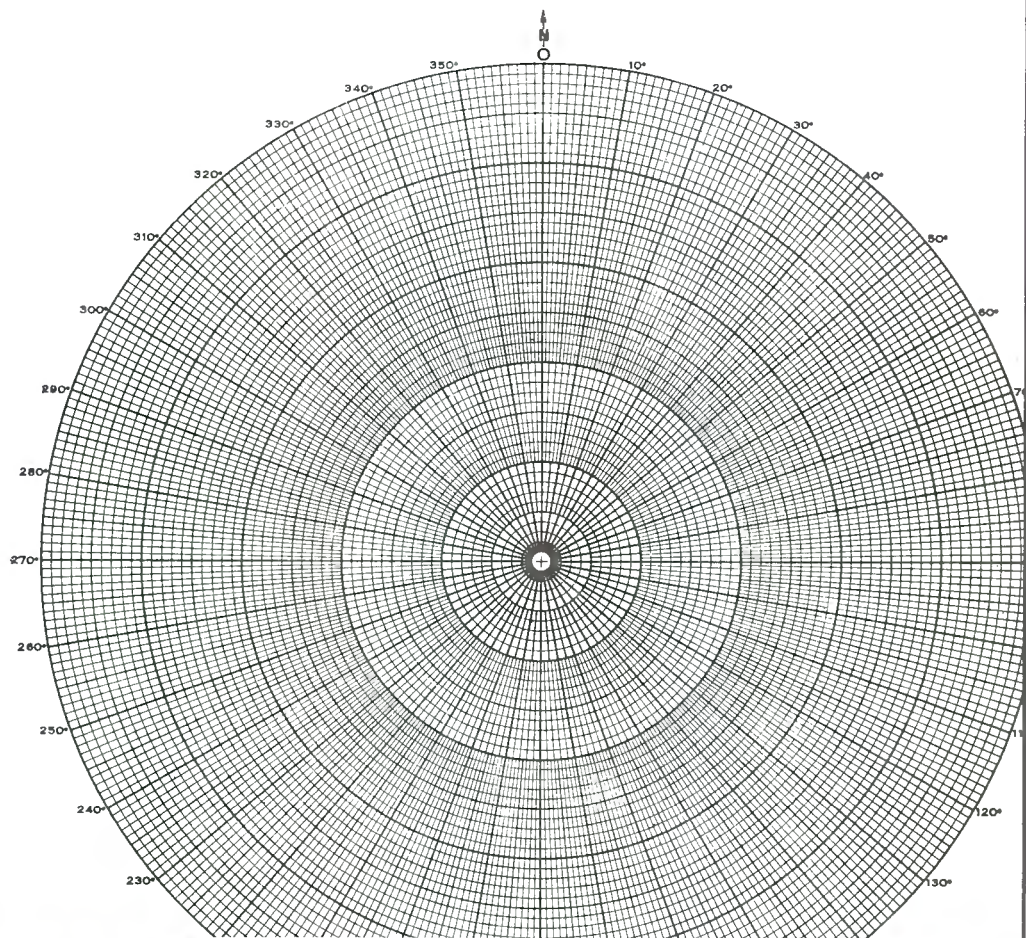
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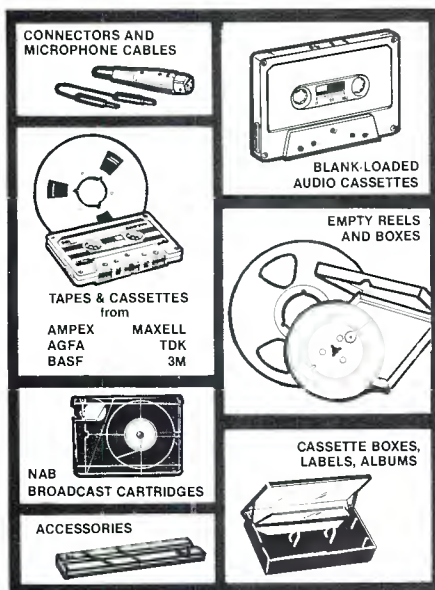
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panel. The 400Hz oscillator is gated on to the mix bus through a 1s timer circuit. The mic remains active as long as the slate button is depressed.

The 1kHz test tone oscillator, when activated from the front panel push-button switch, also feeds the program bus.

A gain-controlled amplifier raises the level of the program bus for application to the line amplifier. The limiter circuit gain control signal is developed using a sample from the line amplifier output. This signal feeds a buffer stage, which is rectified to drive an LED-LDR device placed in the feedback loop of the gain-controlled amplifier. A threshold adjustment for the limiter driver determines the output level at which the circuit becomes active.

A comparator samples the limiter driver output and feeds a buffer amplifier, which powers the front panel peak indicator LED. The input signal for the comparator is switched from the limiter driver to the line amplifier output when the limiter function is defeated.

A VU driver and rectifier feed the front panel meter. A switch in the circuit also allows the battery supply to be checked using the meter. A sensitivity control sets the VU reference output of the mixer.

A dedicated headphone amplifier drives the two headphone output jacks. An input level control allows front panel adjustment of headphone gain.

The two XLR program outputs are transformer-balanced. Separate windings on the secondary provide line level or mic level outputs for each of the XLR connectors. This arrangement gives complete electrical isolation of the two outputs.

Line amplifier protection is built into the FP31. Shorting of either or both outputs—even for prolonged periods—will not damage the output stage. Shorting one output results in a decrease of not more than 8dB at the other output.

RF filtering is provided on all input and output lines, including the external power supply jack.

Power supply circuitry consists of a

PUBLISHED SPECIFICATIONS	MEASURED PERFORMANCE
Frequency Response: 30Hz to 20kHz, ± 2dB	30Hz to 20kHz, ± 0.8dB NOTE: At 10Hz response was down 0.1dB. The high frequency 3dB point was 35kHz.
Total Harmonic Distortion: 50Hz to 20kHz, less than 0.25%	50Hz to 20kHz, less than 0.09% NOTE: Intermodulation distortion was measured at 0.42% (SMPTE 4:1).
Noise: Less than — 129dBV equivalent input noise	Less than — 123dBV equivalent input noise ²
NOTE: 1. The measurements were made using a Sound Technology 1710A analyzer. The mixer was powered by an external regulated 12.6V dc supply. An input signal of — 45dB was fed into channel 1 and the gain controls were adjusted to give + 4dBm (0 VU) output. This resulted in 12dB of headroom. The mixer met the factory specification for 14dB of headroom when powered by a pair of fresh alkaline batteries. 2. Duplicating the factory equivalent input noise (EIN) test was not possible due to the lack of required test equipment. The noise figure shown (— 123dBV) was the limit of measuring capability of the test instrument used. The S/N performance of the mixer, measured using common broadcast techniques, was 70dB below rated output (referenced to 1kHz at + 4dBm line output).	

Table 1. The manufacturer's specifications and measured performance of the FP31 mixer.

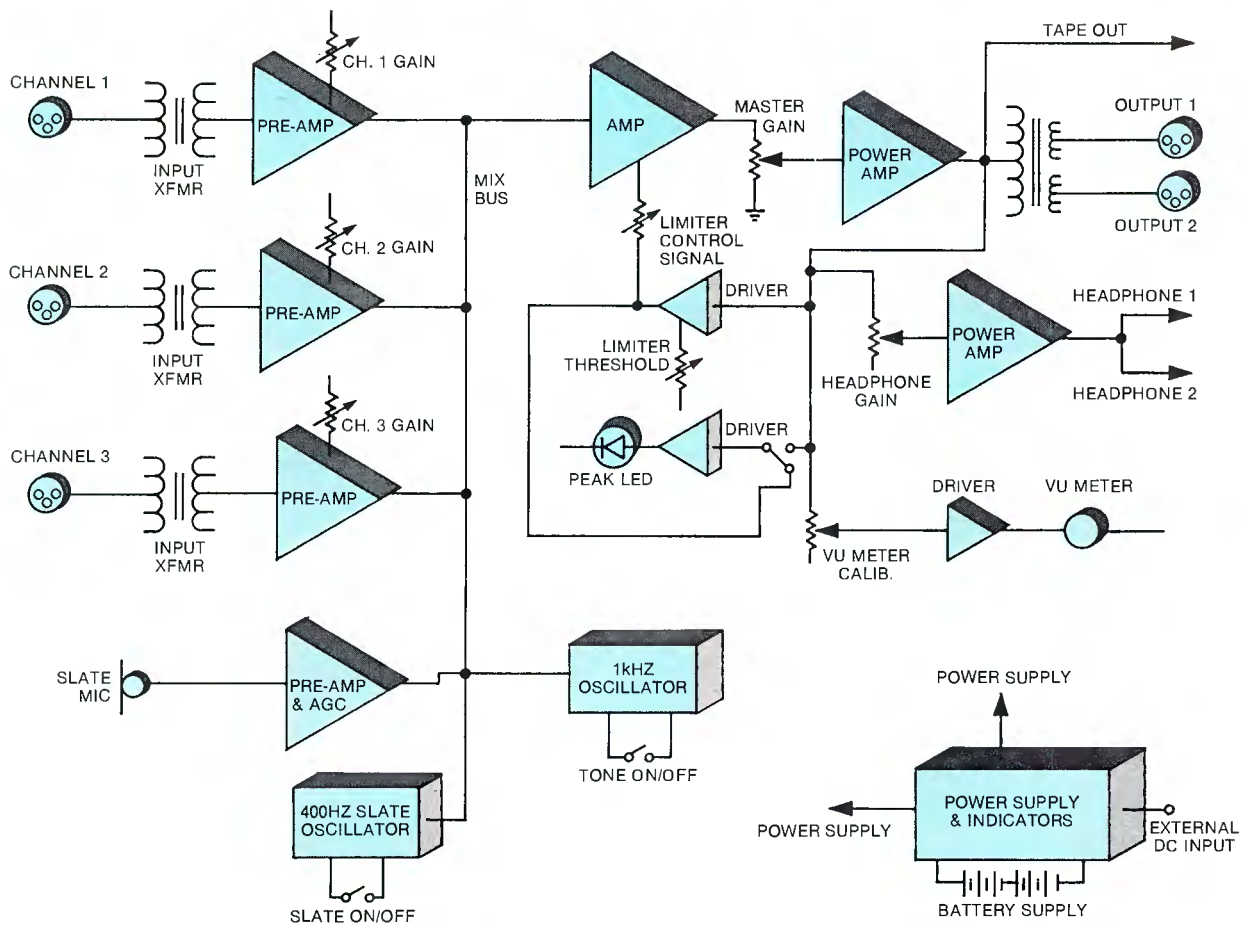


Figure 2: A block diagram of the FP31 remote mixer.

10V regulator, which drives the slate microphone amplifier and oscillator and a power LED control circuit. The green power LED flashes at a 1Hz rate when the power switch is on.

A VU lamp driver and pulse stretcher automatically turns off the meter lamp five seconds after the lamp button is released.

Performance

The FP31 was used for four months as a remote board mixer at the Los Angeles Hall of Administration. The unit was connected to a 5kHz broadcast loop from the hall to our studios for news coverage of board of supervisors meetings. It was also used by reporters to send live and taped reports back to the station when they were at the hall.

The mixer, in operation 24 hours a day for the four months we had it, performed flawlessly. The unit did everything we wanted it to and expected it would.

The design, layout and operational features are well thought out. The placement of knobs and controls is somewhat cramped for use on remote broadcasts, but this concern is outweighed by the versatility of the unit. The mixer is ruggedly built and

should survive the punishment that radio and TV remote broadcast equipment typically receives. Although a "drop test" wasn't performed, I am confident it would have survived better than other field mixers I have used.

The mixer has 14dB of headroom before clipping with a line output level of +4dBm (for an indication of 0VU). Although this probably isn't adequate for symphony broadcasts, it is more than enough for most remote applications.

On remotes, the mixer is generally working into a system or piece of equipment that has no more than 14dB of headroom, such as a portable audiocassette or videocassette recorder, telephone company broadcast loop or wireless ENG system.

The mixer was checked at the KFWB engineering shop for adherence to specifications after being in use at the hall of administration. The unit easily met its published specs (Table 1).

One slight measurement aberration was noted. The LED flasher, used to show power is applied to the unit, causes pulses in the output that can be seen as meter fluctuations when noise measurements are made. The pulses were inaudible on the test

equipment monitor speaker and did not degrade the measurements.

A test was also made for RF susceptibility. A Shure SM57 microphone was connected to the mic 1 input using a 25-foot cable. The mic channel and master gain controls were set for normal voice levels. A 3W hand-held UHF tranceiver was keyed repeatedly next to the microphone, mixer and cable. No adverse effects could be measured.

Conclusion

After evaluating the FP31 mixer for a period of four months, the unit worked reliably and according to specifications. It appears to be ruggedly built and capable of surviving rough field use. The FP31 is well suited for applications requiring a small, portable ENG/EFP mixer.

Editor's note:

The field report is an exclusive BE feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting firm.

In essence, these reports are prepared by the industry and for the industry. Manufacturer's support is limited to providing load equipment and to aiding the author if support is requested in some area.

It is the responsibility of Broadcast Engineering to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement or disapproval by Broadcast Engineering. [:-?=>]]]]



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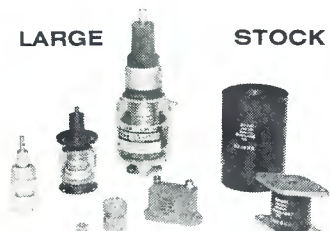
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Editorial
Continued from page 20

On another front, numerous state and local agencies have either established arbitrary standards or are considering the establishment of such standards, without direct correlation to the scientifically based ANSI recommendations. For instance, at least one TV station has been denied a construction permit because of arbitrary community standards.

There is no advantage to the general public in going beyond what is needed to provide a reasonable margin of safety for non-ionizing radiation. In fact, there are disadvantages in so doing, because the cost of goods and services increases—or they become unavailable—without compensation to the public.

The point is that broadcasters must stay involved in the standard-making process. It is in the best interests of the broadcast industry to establish a reasonable standard that will protect the public but not unduly penalize our industry.

Obviously, non-ionizing radiation may present significant health hazards above a certain threshold. The FCC's decision has provided the public with a level of protection that is reasonable and technically sound at a price that the broadcasting community can afford.

But the issue is not dead. We must now wait to see which way the EPA wind will blow. Although we have won the FCC battle, the war to prevent the establishment of arbitrary and unreasonable limits on non-ionizing radiation is still under way.

ⓘ(=⇒))

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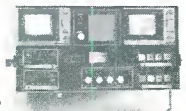



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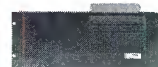


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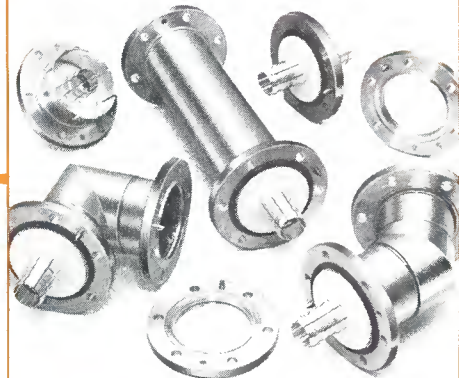
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CORPORATE DATA

CMX Corporation has moved to new facilities located at 2230 Martin Ave., Santa Clara, CA 95050. The new phone number is 408-988-2000.

The first omnidirectional Wavestar UHF antenna, built by **Harris Broadcast Transmission Division**, Quincy, IL, is now transmitting a TV signal from Hartford, CT. Arch Communications' WTIC-TV installed the antenna in September.

A Harris TVED-220, 220kW transmitter, recently installed by Harris on a turnkey basis, generates WTIC's signal. The transmitter, actually two completely independent 110kW transmitters combined in a switchless "Magic T" combiner system, provides total redundancy. WTIC's transmitter is the first to use Varian's new ultra-high efficiency "S" klystrons.

Ikegami Electronics, Maywood, NJ, has announced a 14-camera sale to Tribune Broadcasting Corporation. The cameras will be used by three different TV stations owned by Tribune.

Eight Ikegami HK-322 Triax studio cameras have been delivered to WGN-TV in Chicago. The HK-322 is a state-of-the-art studio camera that incorporates microprocessor controls.

Three additional HK-322 Triax cameras are scheduled for delivery to WPIX-TV in New York City in May. These units will be used for the Independent Network News (INN) telecasts which are carried on numerous channels throughout the country, as well as for WPIX-TV's local productions.

IGM Communications, Bellingham, WA, has completed the installation of two custom controllers with Instacarts at London Weekend Television in London, England.

These systems are for use in two TV audio post-production facilities for LWT productions. The custom controllers were designed and manufactured by IGM for LWT's specific requirements. The instacarts were modified to meet IBA specifications for audio post-production.

Traffic was brought to a standstill on one of London's busiest thoroughfares as a **Solid State Logic** master studio system was hoisted into a fourth floor window at the Oxford

Proper credit

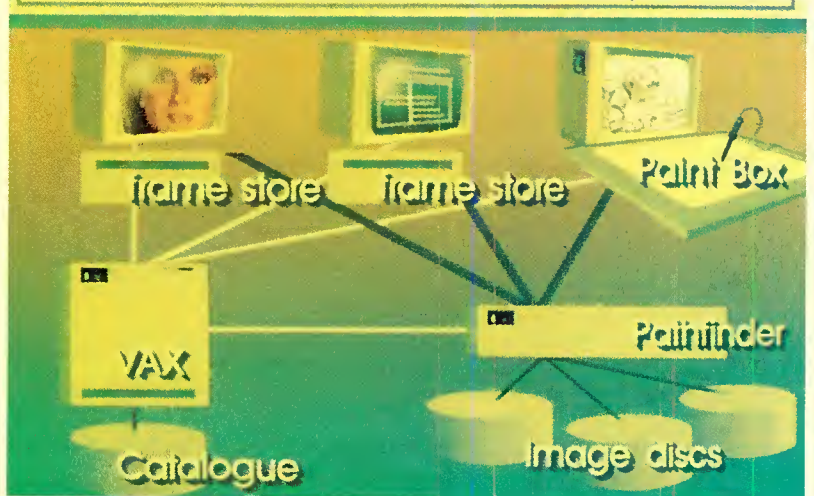
Three photo credit lines in "Color-Mapped vs. Full Color" by David Fabian (BE, February 85) were inadvertently deleted. We regret any misunderstanding that may have resulted. Because each of the graphic items are works of art in their own right, we are repeating them here with the proper credit information.



Courtesy of ColorGraphics Systems, ArtStar II.



Courtesy of ColorGraphics Systems, ArtStar II; a Raphael painting, digitized with the system, then retouched.



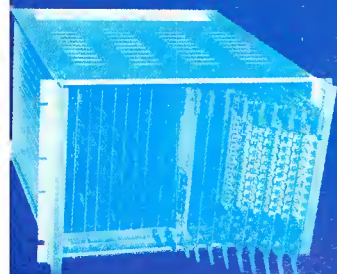
Courtesy of MCI/Quantel, the Paint Box.

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Street complex of AIR Studios. The new console, an SL 4000 E series with 56 channels of Total Recall, is the second SSL System at the London recording studio.

CSI Electronics, Lakeland, FL, has completed the sale of more than 200 FM radio transmitters to China.

The transmitters were purchased by Beijing Broadcast Equipment Factory to enhance the broadcast opportunities throughout the country of China.

Ampex Magnetic Tape Division, Redwood City, CA, has signed a contract with Turner Broadcasting to supply the WTBS Super Station, CNN, CNN Headline News and Turner Cable Radio Network with audio and video recording tape. Under the terms of the agreement, Ampex will be Turner's sole supplier of 1- and 2-inch videotape and sole supplier of ¼- and 2-inch audiotape.

Sansui Electronics, Lyndhurst, NJ, has announced a reorganization of the

company, positioning it to accommodate the company's recent and continuing growth. In the move, present officers of the company are promoted and four new vice presidencies created.

H. Omikawa, previously executive vice president, replaces M. Miyake as the on-site president of Sansui Electronics. Tom Yoda moves from the position of vice president, sales and marketing, to a newly created post of executive vice president. In his new position, Yoda will continue to direct the company's sales and marketing activities but with greater emphasis on planning, while line responsibilities will be delegated to the newly appointed vice presidents.

Hiro Higashimori assumes the position of senior vice president of marketing. Warren Mann, formerly assistant to the vice president, sales and marketing, becomes vice president, sales for home audio and video. Jim Oblak, formerly car audio division manager, becomes vice president, sales and marketing for car audio, and Terry Gibbon assumes the title vice president, operations for credit and EDP.

Hughes Associates, Huntsville, AL, has expanded its operation to include offices in Huntsville, AL; Corinth, MI; Norcross, GA; Raleigh, NC and Morristown, TN.

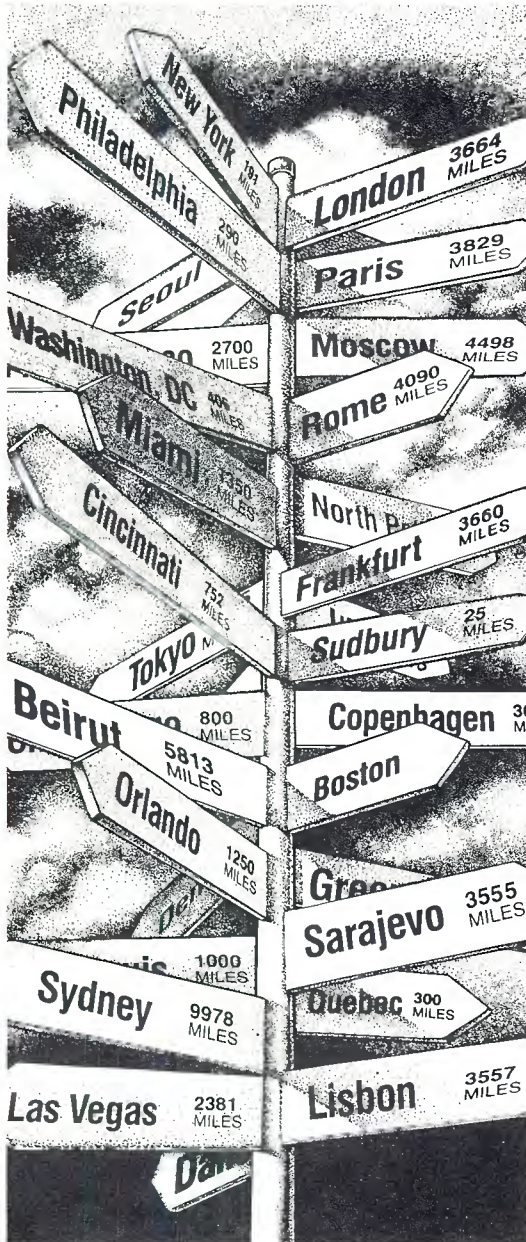
Midwest Communications Corporation, Edgewood, KY, has finalized the purchase of the Communications Systems Division from Midwest Corporation. This concludes the process that began with an initial offer in October 1983, followed by the signing of a purchase agreement on Sept. 14, 1984.

Ampex Magnetic Tape Division, Redwood City, CA, is helping to continue a research project on talking gorillas by supplying Ampex video recording tape for the project.

The Gorilla Foundation, a non-profit organization based in Woodside, CA, was founded in 1976 to preserve gorillas and other ape species, and to study interspecies communications. Under the direction of Dr. Francine Patterson, the foundation is now using American Sign Language to communicate with two lowland gorillas, 13-year-old "Koko" and 11-year-old "Michael."

Ampex's involvement with the project began five years ago. Ampex recording tape and recording equipment are used to record complete records of the gorillas' linguistic development—on a day-to-day basis.

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Acrodyne Industries, Blue Bell, PA, has announced the appointment of two people following the company's recent purchase from Whittaker Corporation, Los Angeles, CA.

Thomas Creighton has assumed the position of vice president of marketing and sales and is responsible for Acrodyne's domestic and international sales. Prior to his appointment, Creighton was most recently with Thomson-LGT, Chatou, France/Stamford, CT, as national sales manager.

John J. Brady Jr., president, CCI, Chattanooga, TN, has announced the appointment of **George M. Cudabac** as national marketing manager. Cudabac will be responsible for all national and international marketing of equipment and software, including establishing a distributor network.

Lawrence Weiland has been named vice president and director of marketing at CMX Corporation, Los Gatos, CA.

Most recently, Weiland was president of Tri-Data, Mountain View, CA.

The Ampex Audio-Video Systems Division, Wheat Ridge, CO, has appointed **Jerry Ayers** to the new position of switcher marketing specialist for the Ampex Switcher Company. Ayers will be responsible for coordination between marketing activity in Wheatridge and field sales offices, customer liaison and other support functions. His area of responsibility will be the United States and Canada.

Sony Broadcast, Hampshire, UK, has announced the appointment of **Mitsuru Ohki** as administration and commercial director. Ohki has worked for Sony Corporation since graduating from Aoyama Gabuin University in Tokyo with a Bachelor of Economics degree in 1966.

JBL, Santa Ana, CA, has hired four engineers to work on the design and development of new professional sound products at the Northridge, CA, plant. **Drew Daniels** has been hired as the applications engineer for JBL and UREI. Daniels previously worked at JBL for several years as a senior research lab technician where he gained experience with laser interferometry and technical photography, time-energy measurements and acoustical testing methods.

William G. Shute, president of Pro Audio General Store, Ocala, FL, an-

nounces the promotion of **David Kerstin** from MidWestern sales manager to vice president of national sales.

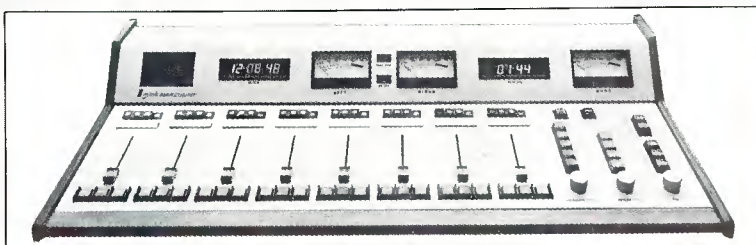
The Board of Directors of Comark Communications, Colmar, PA and Southwick, MA has named **Nathaniel S. Ostroff** to the position of president of the Corporation. Ostroff has served Comark as a vice president and a

director for the last four years. Richard Fiore Sr., a founder of Comark, will continue as chairman of the board.

Gregory A. Green has been named North American sales manager for the Professional Products Division of dbx, Newton, MA. Prior to joining dbx, Green spent four years as director of sales and marketing at Ashly Audio in

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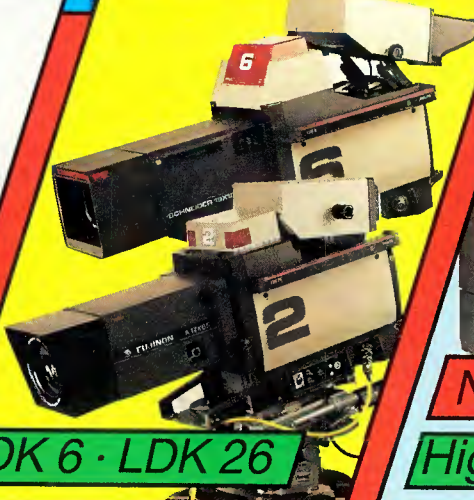
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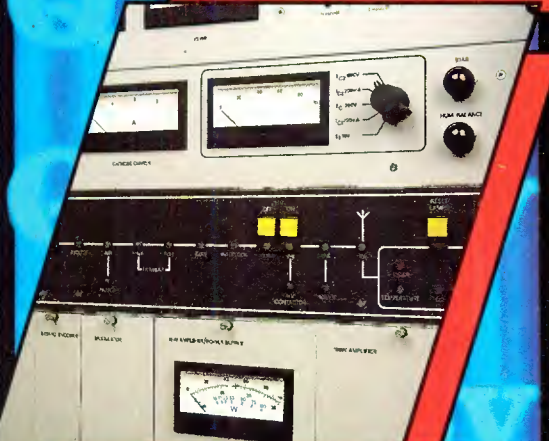
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People

Rochester, NY, where he was responsible for all foreign and domestic sales as well as for setting up the company's financial control and sales tracking systems.

Thomson-CSF Broadcast, Stamford, CT, has appointed **Charles J. Gaydos** national sales manager. Prior to joining Thomson-CSF, Gaydos held several positions with the Broadcast Systems Division of RCA Corporation, including sales representative, manager of teleproduction sales and, most recently, director of marketing services.

Artel Communications Corporation, Worcester, MA, has named **Bruce M. Richardson** as director of product planning. In this capacity, Richardson is responsible for all computer communications product planning and marketing activities.

Gordon Tubbs has been appointed sales manager, Professional Products Division, Ikegami Electronics (U.S.A.), Maywood, NJ. Tubbs will assist in the administration and marketing of broadcast and color CCTV products.

Dolby Laboratories, San Francisco, has announced the appointment of **Kevin G. Dauphinee** as vice president of sales and marketing, and the promotion of **Robert M. Schein** to vice president of Motion Picture Division. Both will report directly to Bill Jasper, president, along with Ioan Allen, now vice president of advanced marketing.

Scientific-Atlanta, Atlanta, GA, has appointed **Clinton E. Ellison** national sales manager for the Optima Division. In his new position, Ellison will be responsible for the sale of Optima cabinets and enclosures in the North America.

IGM Communications, Bellingham, WA, has announced the appointment of **Fred Harkness** as broadcast equipment sales manager. Harkness is responsible for all sales in the United States and Canada of the IGM standard product line.

Richard A. DeBeradinis has been named eastern regional sales manager for CMX Corporation, Los Gatos, CA. DeBeradinis, who will be headquartered in New York City, was formerly eastern regional sales manager of CDL for more than 11 years.

John L. Klecker has been named

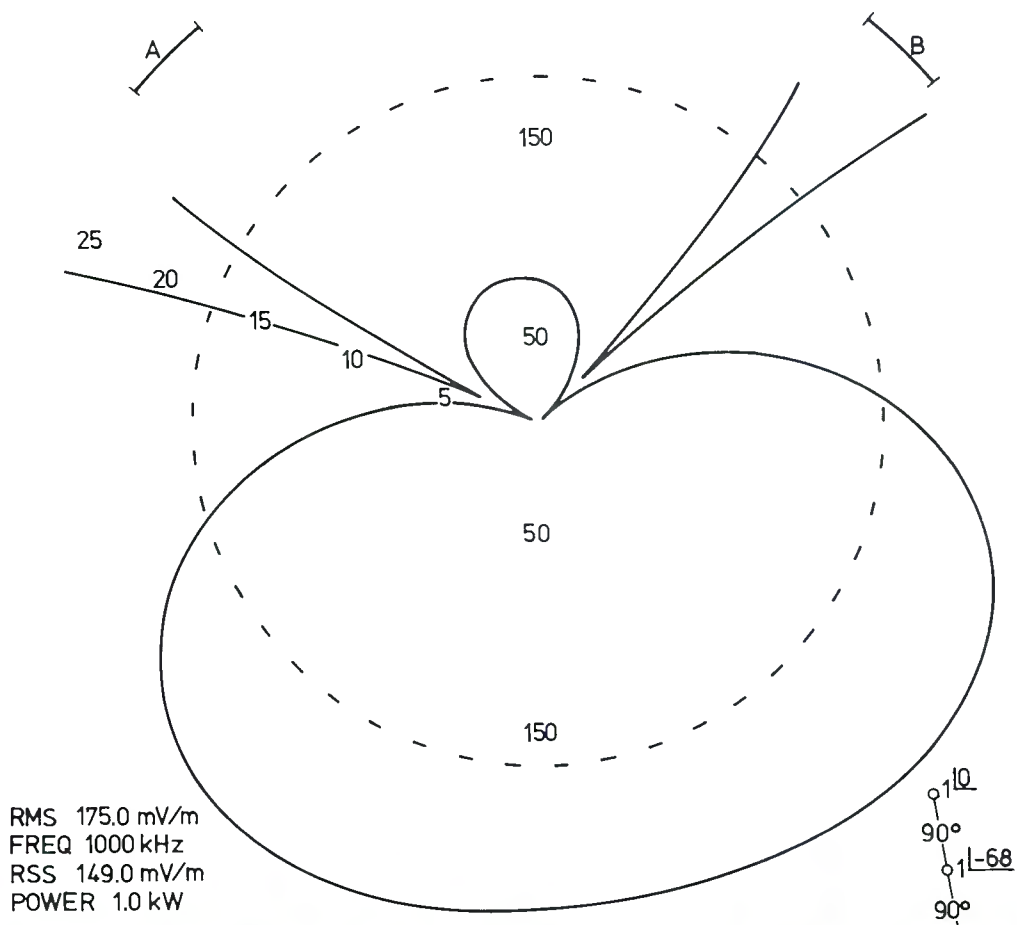
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People

Midwest TV-RF district sales manager for Harris, Quincy, IL. Klecker will serve TV broadcasters in Minnesota, Iowa, Illinois, Missouri, Wisconsin and upper Michigan.

Electro-Voice, Buchanan, MI, has added **David E. Goldschmidt** to its marketing team for broadcast and professional recording.

Shure Brothers, Evanston, IL, has announced the appointment of two new professional product marketing coordinators: **Alan G. Hershner** and **Daniel P. Marchetto**. Hershner's and Marchetto's primary responsibility is to establish and to maintain contact with audio professionals in TV and radio broadcasting, as well as in video and film production. They will be in-

roducing new Shure professional products to the broadcasters, as well as offering support for the existing microphone and circuitry lines.

David Brack has been named mid-Atlantic district manager for MCI/Quantel, Palo Alto, CA. He will report to eastern regional manager David Dever.

Fortel, Atlanta, GA, has announced the appointment of **C. Steve Young** as president. Young has served as vice president, technical operations at Fortel since September 1984. In his role as vice president, Young was responsible for management of all engineering activities.

Dr. Sophie Sa has been appointed executive director of the Matsushita Foundation, New York, a \$10 million foundation established by the Matsushita Electric Corporation of America to fund educational programs in the United States.

As executive director of the foundation, Dr. Sa will be responsible for the administration of the foundation, funding and the establishment of new programs.

Prior to joining the Matsushita Foundation, Dr. Sa was a staff associate with the Social Science Research Council in New York, where her responsibilities included the administration of several of the council's international committees. Previously, she served as administrator and assistant director of the Center for Policy Research, a non-profit research organization with an annual budget of \$2 million.

Lake Systems Corporation, Newton, MA, has announced that **Paul N. Duncan** has been named senior systems representative.

Mycro-Tek, Wichita, KS, has promoted **Gary L. Jack** to the newly created position of service marketing manager. Replacing Jack as field service manager in Wichita is **Scott Hendrickson**. **Richard A. Bailey** has joined Mycro-Tek as vice president of marketing.

Microdyne, Ocala, FL, has announced the appointment of **Stephen R. Benoit** as sales engineer, satellite communications. Benoit will be responsible for the sales of satellite equipment for TV and radio broadcasting, fixed and portable uplinks and teleconferencing.

BASF Systems, Bedford, MA, has appointed **Robert McKinley** video

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People

product manager. McKinley brings an extensive track record in consumer product marketing and sales to BASF's video product area—one of the fastest growing product areas in the company.

TFT, Santa Clara, CA, has announced a change in the company's top management. **Henry Wu**, formerly senior vice president, becomes executive vice president and general manager of TFT's broadcast division; and assumes full profit-and-loss responsibility over that operation.

The president and founder of TFT, **Joseph C. Wu**, will head TFT's new product development and utilities communications marketing efforts.

Jerry E. Smith has been appointed vice president, sales and marketing for the broadcast transmission division of Harris Corporation, Quincy, IL.

Ron Colgan has been named national sales manager for Sharp Electronics Corporation's Professional Products Division, Paramus, NJ. Colgan will oversee sales operations for all four sales regions of the United States and Canada.

COMSAT World Systems Division, Washington, DC, has appointed **Irving Dostis** to director, Advanced Communications Technology Satellite (ACTS) Program at COMSAT Laboratories in Clarksburg, MD. He was also named vice president and assistant director, COMSAT Laboratories. **Lew Norman**, who had been acting program manager, will now assume duties as associate program director.

Moseley Associates, Goleta, CA, announces the appointment of **Arthur Constantine** as manager of U.S. sales. Formerly vice president of sales at Fidelipac Corporation and engineering section manager at CCA Electronics, Constantine will be responsible for all sales of Moseley-manufactured products and systems throughout the United States.

Otari Corporation, Belmont, CA, has announced that **Steve Krampf** has been named vice president, sales and marketing of Otari Corporation.

Tandberg of America (TOA), Armonk, NY, has announced the appointment of **Peter Wellikoff** as vice president of Tandberg's Consumer and Professional Audio Products Divisions. Wellikoff was also made a member of the company's board of directors.

Dr. William O. Mehuron, deputy director of the National Security Agency's research and engineering organization, has joined Ampex Corporation, Redwood City, CA, as corporate vice president of engineering, a newly created position.

At Ampex, Mehuron will be responsible for strengthening and focusing the company's commitment to excellence in engineering and technology throughout the corporation, including the Advanced Technology Division, which remains under the direction of vice president and general manager Michael Felix. Felix is also appointed to the new post of senior scientist for Ampex.

Mark B. Nevejans has been promoted to the position of national sales manager for the Magnetic Tape Division of Agfa-Gevaert, Teterboro, NJ. Since joining the company two years ago, Nevejans has served as sales supervisor for the Atlantic Region for the Magnetic Tape Division and most recently as sales manager for the Atlantic Region.

Al Cervenka has joined Dynair Electronics, San Diego, CA, as systems sales manager, a position established in January. He is responsible for sales of major routing switcher systems, including custom controls, to the communication industry, government and systems contractors.

John W. Patterson has joined Fortel, Atlanta, GA, as national sales manager. Patterson will be responsible for working directly with the regional sales managers to develop new and more innovative distributor sales programs.

Ampex Corporation has appointed **Neil Selvin** to the newly created position of marketing manager, digital video processing. In the new position, Selvin will direct marketing and product management activities for the division's video processing product lines, including the Ampex Digital Optics (ADO) family of products.

John Bloomfield has been named general manager for the Spin Physics division of Eastman Kodak Company, Rochester, NY. Bloomfield succeeds **Bruce C. Burdick**, who has been promoted to the position of director of finance for Kodak's Diversified Technologies group. In his new position, Bloomfield will be responsible for the design, development and marketing of magnetic recording heads, electronic imaging systems and other products for high technology markets.

New Technology Expands Dynamic Range of Vinyl

Designed for broadcast production and on air application, the GSP1000 E Electric Audio Isolator offers the cleanest sound reproduction possible from your separate component turntable. For a live demonstration, **See Our New Isolation Systems at the AES Anaheim, Cal.**



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People

Orban Associates, San Francisco, maker of Optimod and other signal processing products, announces the departure of **Jesse Maxenchs**, marketing and sales manager for broadcast products for the past six years. Jesse has accepted a position at TFT, Santa Clara, CA, as director of marketing. TFT is a manufacturer of microwave STLs, transmitter remote control systems and modulation monitors for radio and TV broadcasters.

William E. Deegan has been named national sales manager for the nova systems, Avon, CT, manufacturer of a line of digital TBCs.

William F. Patton recently joined Dielectric Communications, Raymond, ME, as director of field service and project implementation.

David Buckler has been appointed vice president of sales for the Chyron Telesystems, Melville, NY, manufacturer of sophisticated graphics and titling systems for television.

Swiderski Electronics, Elk Grove Village, IL, has added **Rich Schultz** as rental services coordinator to their team of professional audio/video experts. Schultz's responsibilities will include client contact, scheduling rentals, inventory selection, evaluation of new technology in rental applications and follow-through to ensure complete customer satisfaction.

O'Connor Engineering has appointed **Gary "Kelly" Nelson** to the newly created position of field sales manager. Nelson has more than 10 years of dealer sales experience.

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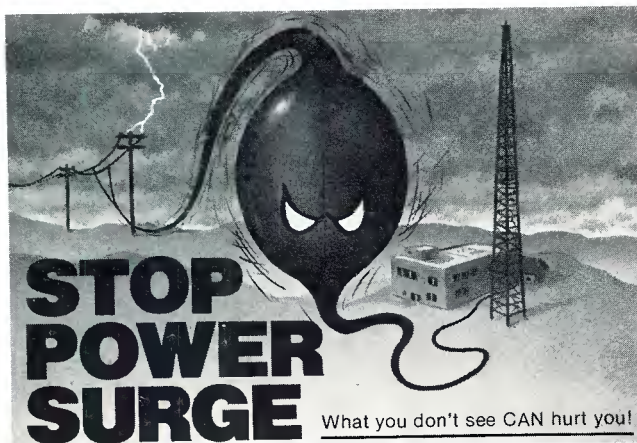
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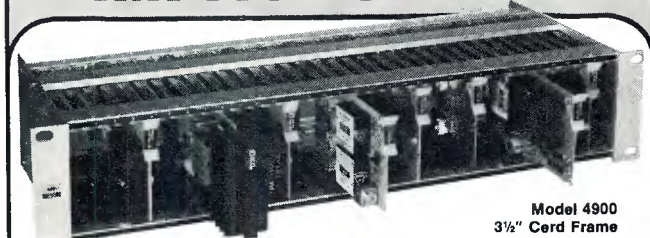
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new products

Weather forecasts

Weather forecasts from Accu-Weather are available on Telemet. The two companies have announced that a number of specifically formatted Accu-Weather forecasts are available on Pocket Quote. These reports detail the upcoming weather for the 20 largest metropolitan areas in the United States, giving high and low temperatures and weather conditions for three days ahead.

Circle (308) on Reply Card

Sequencer

Engel Engineering has announced its model SEQ-1A red, green, blue sequencer. The unit enables the display of RGB on a line scope or an oscilloscope. The sequencer has been designed for use in film to tape color correction suites, computer graphic and animation suites, editing rooms using the new component video switchers and video tape recorders.

Circle (309) on Reply Card

Color palette

Vectrix Corporation has announced an optional 16.8 million color palette for its VX/PC board set. The standard VX/PC board set was designed to provide high resolution color graphics for users of the IBM family of personal computers and compatibles. The standard 2-card set offers a basic color palette of 4096 out of which 512 colors are concurrently displayable at a resolution of 672 x 480.

The option upgrades the standard board set to a color palette of 16.8 million, out of which 512 colors are concurrently displayable at a resolution of 672 x 480. This permits greater functionality for applications such as color matching, textile design, Landsat and medical imaging.

Circle (310) on Reply Card

Peripherals



Chromatics has announced seven new product peripherals for the CX 1500 Colorgraphic Display System. These options include digitizer, mouse, light pen, trackball, 24-function switchbox, Bezel switches and joystick.

Circle (311) on Reply Card

Stereoscope

Leader Instruments has introduced a stereoscope, the LBO-552BH1. It displays left and right channel traces side by side, simplifying channel-to-channel amplitude

comparisons. Designed with studio applications in mind, the Stereoscope is rack mountable and is provided with back-panel XLR input connectors. The graticule has indications for left and right channels and a zero phase angle reference line making the stereoscope an optimum unit for making stereo channel measurements of level, balance, azimuth, separation and phase angle.

Circle (313) on Reply Card

3/4-inch videotape

Ampex Magnetic Tape Division is expanding its line of 197 3/4-inch videotape, with the addition of four configurations. The product was developed to meet broadcast applications, such as electronic news gathering, electronic field production and on-line editing.

The videotape is a 5-minute mini-cassette that will operate in portable and standard-sized videocassette recorders.

Circle (312) on Reply Card

TV demodulator

The Tektronix 1450-1 precision TV demodulator is being upgraded and features a wide bandwidth audio section compatible with BTSC multichannel sound. The audio section of the demodulator has been redesigned to be compatible with the multichannel sound systems used in the United States and Japan. All 1450-1 demodulators will include these multichannel sound capabilities.

For Tek's television broadcasting customers, who already have a 1450-1 demodulator and plan to convert their facility to multichannel sound operation, an upgrade kit called a 1450F20 will be offered.

Circle (300) on Reply Card

Phone line system



DCC has introduced their four telephone line version of the single line TeleClerk. The 4-20M can store 90 minutes of digital speech and handle four independent, interactive telephone conversations at the same time. The system keeps track of where each recorded speech segment is stored with an average search time of only 30ms before playback.

Each of the four telephone lines are connected to an FCC-approved interface and can accept calls automatically or dial telephone numbers from a prepared list. Once the call is answered, whether it is inbound or outbound, the system will start speaking and ask the respondent any type of question that is recorded.

Circle (301) on Reply Card

OUR FM MONITOR DESERVES A SECOND GLANCE.

BUT IT DOESN'T NEED IT.

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

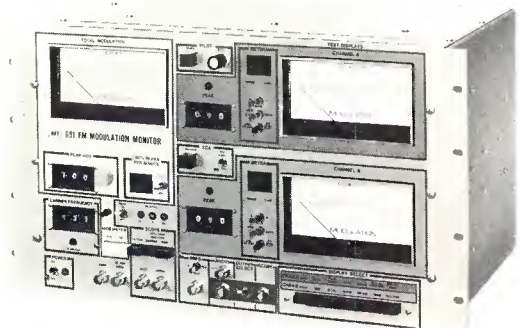
A color-coded system ties together the associated displays, switches, and jacks for a particular function or test. Select your test by pushing a color-coded button and simply read the results on *all* of the indicators. It's as easy as it sounds.

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

The 691 can now be optionally ordered to measure two SCAs. There are many other features . . . write or call for complete information.

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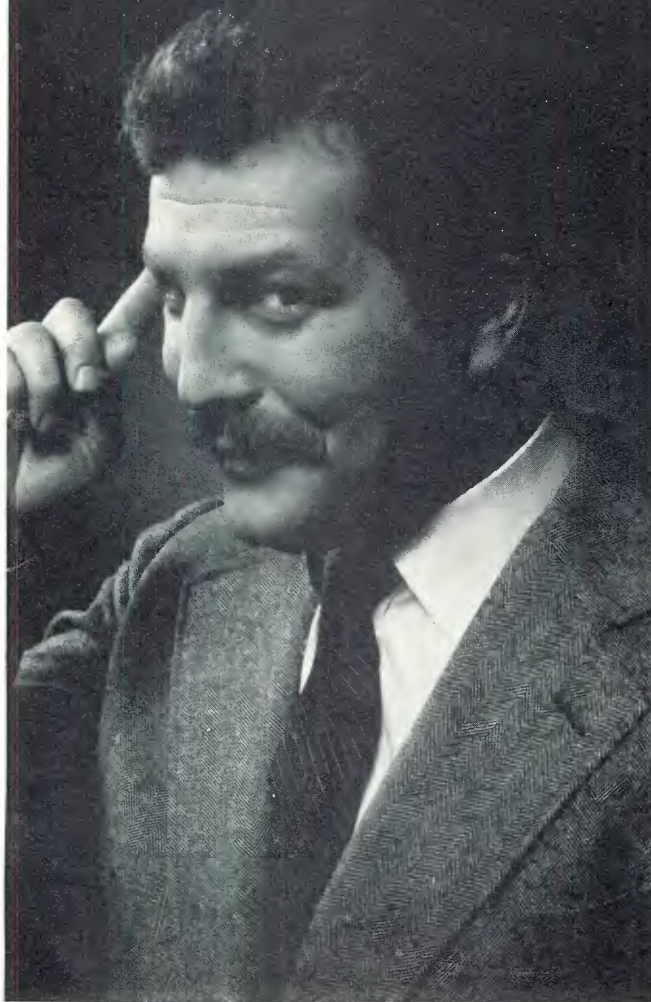
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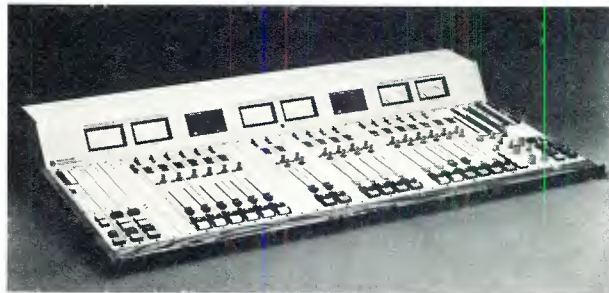
Telephone interface

Gentner's microtel is an ultra-light, battery-operated telephone interface for use in a variety of applications. It consists of a small box with an input for a microphone, a mini-jack input for another source such as a cassette deck, a jack for a headset, a mini-jack for direct output to a tape recorder or similar device and a modular jack for direct connection to the telephone line.

These inputs and outputs enable the user to mix a source with microphone and feed it to a tape recorder or directly down the telephone line. A built-in headset amplifier allows the user to hear sources.

Circle (302) on Reply Card

On-air radio console

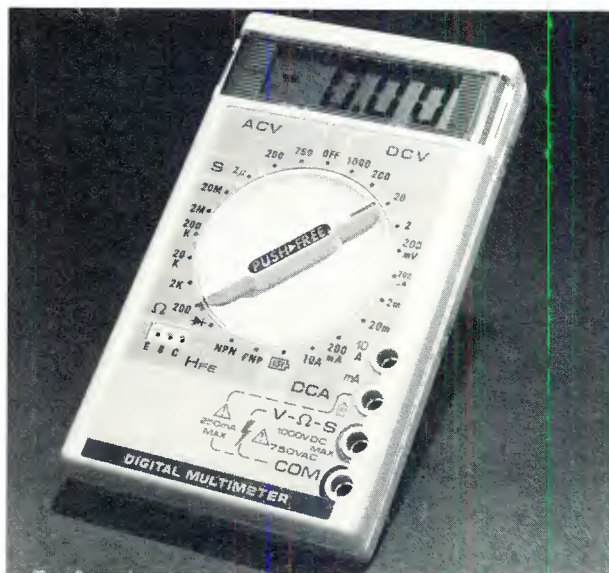


Pacific Recorders & Engineering has announced the series three version of their BMX on-air radio console. The BMX III features three main stereo mix buses, (each with distribution line amplifiers), two telephone mix-minus feeds with a monitor mix and monitor facilities for two separate studios. Independent outputs for the console, host, co-host and guest headphone feeds are provided as well as a stereo cue system with automatic headphone monitor switching.

Each input of the modular console (mic or line) has full and independent remote control logic. Audio and logic interconnection is compatible with the AMX and ABX operations and production consoles.

Circle (303) on Reply Card

Digital multimeter



A miniature hand-held digital multimeter capable of reading eight functions on 22 ranges is available from Spanta.

It offers ac voltage, dc voltage, dc current, resistance,

conductance, HFE transistor test, diode test, battery test, and 300 hours of battery life and overload protection on all ranges.

The Digital Multimeter measures 4.8"x2.8"x0.9" and weighs 7 oz.

Circle (304) on Reply Card

Switch selectable measurement capability

Switch-selectable 50/75Ω (50Ω to 75Ω) measurement capability is available with the Tektronix 496 and 496P portable, high performance, VHF/UHF microprocessor-based spectrum analyzers. This option 07 provides 75Ω with dBmV readout or 50Ω with dBm reference at the push of a button with no need to use adapters. Calibration is provided so that it's no longer necessary for the user to convert the units or to account for external losses in changing from 50Ω to 75Ω. Option 07's frequency range of 5MHz to 1GHz, and 300kHz resolution provides optimal measurement capability for all cable and broadcast measurements.

The analyzers provide portability plus high performance spectrum analysis and measurements in the 1kHz to 1.8GHz range. Their high stability and 80dB dynamic range meet user demands for proof-of-performance measurements, on site or on the bench.

Circle (305) on Reply Card



Attenuators

A series of 33 broadband, high performance attenuators with six continuous-power ratings from 2W to 75W are available from Bird Electronics. The 8300 series of 50Ω fixed attenuators covers a frequency range from dc 4GHz with a VSWR below 1.25, except for the 75W and the 2W units, which cover dc 2GHz. Models 8308 (75W), 8306 (25W), 8305 (15W), 8304 (10W) and 8303 (5W) are rated at a peak power of 3kW with pulses to 5ms wide. They are available with attenuation levels of 3dB, 6dB, 10dB, 20dB or 30dB and have male N input-female N output connectors.

The 8300 series attenuators can be used in tandem for odd dB values, or in connection with Bird's Tenuline high power attenuators (to 4000W) for additional attenuation.

Circle (306) on Reply Card

Measuring instrument case

The portable BA series apparatus case with handle from Alabama Case is available in six sizes. The smallest is 4.72" (W), 5.90" (H), 8.26" (D), while the largest is 13.77" (W), 8.26" (H), 7.87" (D). The vented case body is dark blue green PVC leather patterned laminated steel, while the panels are light silver colored aluminum.

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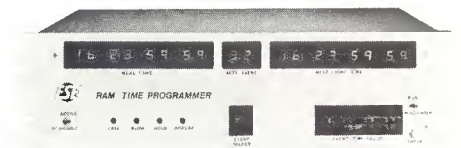
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
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MAINTENANCE ENGINEER, KAWA, a northern Minnesota PBS station seeks individual having experience maintaining VTRs, cameras, switchers and VHF transmitters. Must possess an FCC General Radiotelephone license. Send resume, professional references, salary history and expectations to Jim Landes, KAWA, Box 9, BSU, Bemidji, MN 56601. Closing date—May 15, 1985. 4-85-11

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DIRECTOR. The State University of New York College at Plattsburgh seeks a Director of Instructional Engineering and Maintenance. Must have a Bachelor's Degree (preferably in EE) and 5 years experience as assistant or CE of a TV Station or equivalent. Excellent benefits. Send resume and three letters of reference to: Dr. Ann Hasting, Assistant Vice President, c/o Ms. Mayerlyn Miller, Director of Personnel/Affirmative Action, Kehoe Administration Building, Box 913, State University of New York, Plattsburgh, NY 12901. Closing date for applications: April 30, 1985. An Equal Opportunity/Affirmative Action Employer. 4-85-11

TELEVISION MAINTENANCE ENGINEER. Naval Audiovisual Center, Washington, D.C. Electronic technician, GS-856-9, \$21,804 Pa. Federal Civil Service status required. Must be experienced on 1/2" VCR, 3/4" U-Matic, TK-76, DXC-6000 cameras. Send SF-171 to Consolidated Civilian Personnel Office, Bldg. 200, WNY, Washington, D.C. 20374, Attn: Carmen Reimer. 4-85-11

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ASSISTANT EXECUTIVE DIRECTOR for Engineering and Operations. Fifteen years' experience in broadcast engineering; or, ten years' experience in broadcast engineering and a bachelor's degree in Electrical Engineering. Experience must include five years in a supervisory position. First Class or General Class FCC license is required. Salary range, \$30-40,000. Send resume to: Ray Sullivan, Personnel Administrator, KET, 600 Cooper Dr., Lexington, KY 40502-2296. EEO employer M/F/H. 4-85-11

CHIEF ENGINEER for the School of Cinema-TV at USC. Perform highly complex work in installation, maintenance and modification of TV equipment and systems. Supervise studio, field and post production engineering efforts. Act as Project Director regarding studio facilities planning, construction and systems design. Min. Req: degree or related experience, current FCC license. Solid knowledge of Ampex and related equip., must be able to repair and modify video and audio equipment. Salary commensurate with qualifications. Send resume and letter to Rita Stafford, Personnel Adm., School of Cinema-TV, University of Southern California, Los Angeles, CA 90089-2211. USC is an Affirmative Action/Equal Opportunity Employer. 4-85-11

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- 2) In electronic circuit design with emphasis in micro-wave and TV broadcasting equipment.

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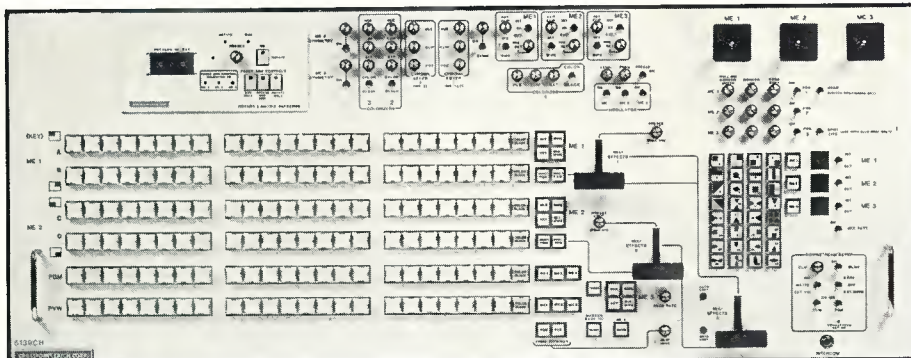
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