BROADCAST engineering®

November 1984/$3

Station maintenance

- TV test measuring
- Maintaining the transmitter
- New troubleshooting column

Embarrassing questions to ask audio console salespeople

Sometimes it pays to ask questions. If the subject is audio consoles, asking difficult questions can be very revealing in comparing one console to another. Here are some of the questions that make most console salespeople squirm.

Is the console "human engineered"? Does the console have an esthetically "professional" appearance? Is the layout well defined and uncluttered? Are controls large? Do they fit the hand? Are they well labelled and lighted? Do they provide adequate visual feedback to affirm the position of the control? Is console nomenclature permanently engraved?

Easy to service? Are all components readily accessible and isolated for individual servicing? Are op-amps in plug-in sockets? Are there service loops in the wiring harness? Are extender boards provided? Are all wires uniquely numbered and referenced to your system documentation?

How responsive is the service department? Can they provide a history of fast, efficient customer service? Are they confident enough to furnish a complete list of customers for you to call?

How easy is installation? Is the console completely assembled and ready to install? Are installation points readily accessible? Are all program inputs and outputs uniquely transformer isolated?

How about specifications? Are the manufacturers' published specifications consistent and easily understandable or mired in the game called "specsmanship"?

How good is reliability? Do all modules receive three levels of testing? Does the total system receive 4 levels of performance verification? Do both the modules and system receive extensive burn-in?

Is the console backed by a 5-year, all-inclusive warranty? (*Only* ADM answers "yes" to that one.)

ADM and only ADM answers all of these questions with a full, no weaseling, resounding "YES"! The only question remaining is, when would you like to talk to us about a new audio console?

For facts about our complete product line, contact ADM Technology, Inc., 1626 East Big Beaver Road, Troy, Michigan 48084. Phone (313) 524-2100. TLX 23-1114.

ADM VP 1603 Post Production Console.

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BROADCAST ENGINEERING

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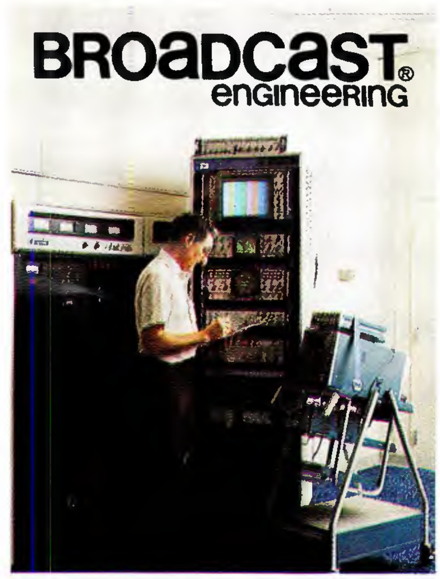

The cover this month shows a Harris TV-30H, 30kW high-band TV transmitter undergoing performance testing at the company's manufacturing facility at Quincy, IL. Regular, thorough maintenance is vital to the proper operation of any radio or TV station. **BE**'s maintenance issue examines the procedures and test equipment needed to keep the station running. Inspecting and observing the equipment regularly will prevent many, perhaps most, problems. *(Photo courtesy of Harris.)*

Coming events

Nov. 13-14
Society of Broadcast Engineers Seattle Chapter annual meeting, Seattle

Nov. 29-30, Dec. 5-7
Continuing education courses, "Lightning Protection," and "Hazardous Radio Frequency Radiation," George Washington University, Washington, DC

Dec. 5-7
Radio-Television News Directors Association (RTNDA) International Conference and Exposition, San Antonio, TX

Jan. 9-11
Fiber-optics workshop, University of Central Florida, Lake Buena Vista, FL

Jan. 13-16
Pacific Telecommunications Council Annual Conference, Honolulu

NEXT MONTH
- Annual broadcast technology forecast: 1985
- 2nd annual state-of-the-industry research report
- IBC conference replay

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Zworykin receives Emmy posthumously

The Trustees' Award of the National Academy of Television Arts and Sciences was given posthumously to Dr. Vladimir K. Zworykin for his pioneering work in television and electronics that spanned more than 70 years.

Robert R. Frederick, president of RCA, accepted the Emmy at the academy's annual dinner Sept. 11, in New York.

Previous winners have included Brig. Gen. David Sarnoff of RCA; William Paley and Dr. Frank Stanton of CBS; Leonard H. Goldenson of ABC; newscasters Edward R. Murrow and Walter Cronkite; and Dr. Peter Goldmark of CBS.

Dr. Zworykin, who died in 1982 at age 92, had been associated with RCA and its research and development activities since 1929. A prolific inventor, he held more than 120 U.S. patents on developments ranging from automobile products to medical applications to television itself, which exists to a large extent because of his creative efforts in the 1920s and 1930s.

His conception of the first practical TV camera tube for picture transmission, the iconoscope, and his development of the kinescope picture tube formed the basis for almost all important later advances in the field.

For a period of years after 1954, Dr. Zworykin assumed, in addition to his continuing responsibilities at RCA Laboratories, the direction of a Medical Electronics Center at the Rockefeller Institute in New York. Until his death, Dr. Zworykin remained active in research aimed at the application of electronics in medicine and the life sciences.

But it was not until he teamed up in 1929 with another Russian immigrant, Gen. David Sarnoff, later president and chairman of RCA, that his TV work got the management and financial backing that enabled Zworykin and the RCA scientists to develop television into a practical system.

As a result of Zworykin's research efforts, important devices such as various forms of secondary emission multipliers and image tubes were developed and perfected. The "Snooperscope" and "Sniperscope"—important military developments in World War II—were practical applications of research on infrared image tubes.

Zworykin's intensive study of electron optics directed his interest to the electron microscope. His guidance of the evolution of the electron microscope from a laboratory curiosity to an instrument employed in hospitals and research institutions throughout the world has had a strong impact on the advancement of both the biological and physical sciences.

Six companies win Emmys

More than 450 engineering industry professionals from leading electronics companies based in Switzerland, Japan, Great Britain, France and the United States attended the seventh annual National Academy of Television Arts and Sciences Engineering Awards ceremony held in New York.

John Cannon, academy president, presented six Emmy Awards for distinguished achievement in the science of TV engineering. The winners were:

Continued on page 134

BROADCAST ENGINEERING

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FCC update

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

Docket 80-90: status report

At the NAB-NRBA Radio Convention and Programming Conference in Los Angeles in mid-September, FCC officials and communications lawyers provided insights into possible developments in the FCC's omnibus FM rulemaking in Dockets 80-90 and 84-231.

James McKinney, mass media bureau chief, announced that a listing of new FM allocations should be released this month. Ray LaForge, chief of the FM branch, estimated that applications for the new facilities could be accepted as early as the first quarter of 1985. LaForge said he hoped all applications can be processed within a 3-year period.

However, this will be possible only if the number of applications does not exceed the 5000 now anticipated. McKinney said that lotteries would have to be used to decide between competing proposals if the commission is deluged with applications.

Washington attorneys Erwin Krasnow and David Tillotson advised broadcasters they should wait until the FCC adopts its report and order announcing application procedures before developing an "80-90" strategy.

Although not disagreeing with this approach, Lawrence Behr, a consulting engineer, stressed in a post-session interview that it would be advisable for potential applicants to verify the suitability of transmitter sites at this juncture. Once the FCC announces its new assignments, Behr said, there will be a mad scramble to obtain engineering and legal assistance, and it will be difficult to meet filing deadlines.

The panelists agreed that there will be no significant deviation from the originally proposed 684 assignments. This is because only a small number of counter-proposals were received, and community selections will be made by a computer. These selections will be based on the same criteria used to generate the original list of 684 proposed assignments.

Existing broadcasters were advised they should begin now to plan on how they will deal with the new 80-90 assignments. Stations operating below maximum permitted power and height limitations were urged to file proposals to upgrade their facilities as soon as possible. Once the new Docket 80-90 channel assignments are made, these assignments, even if unoccupied, will have to be taken into account in planning for future facilities changes. In this connection, Tillotson said there still might be time to gain approval for a site change before the 80-90 assignments become a reality.

Even if the FCC moves quickly to complete its channel assignment plan, it will be several years before any new stations actually come on the air as a result of Docket 80-90. Delays in application processing are inevitable regardless of how many new applications are filed or processed. If there is a glut of proposals, as many expect, processing will not begin until lottery procedures are adopted.

Implementing lottery procedures may take more time than anticipated, however, because a question exists as to whether the FCC has sufficient legal authority from Congress to decide FM comparative cases through lotteries.

It was made clear during one of the 80-90 convention sessions that it may be difficult for non-minority, non-female applicants to win any of the newly allocated FM frequencies. This is because the FCC's comparative criteria awards significant comparative credit to minority and female applicants. Broadcasters were advised to include minorities and women in their 80-90 plans for this reason, and to make sure legitimate legal structures are developed—and implemented—to ensure that such advantages can be sustained.

Stricter LPTV standard upheld

The commission has upheld staff rulings denying reconsideration of actions returning as unacceptable for filing LPTV applications that failed to include lottery preference certifications or that omitted minor technical exhibits.

The standard for acceptability for full-power TV applications is whether the proposal is "substantially complete" at the time of filing. Further, in the case of both TV and radio applications, the commission has been liberal in permitting correcting amendments up to the "B" cut-off date.

With low-power TV service, however, the commission established a different standard in 1982 when its current LPTV rules were adopted. LPTV applicants must file "complete and sufficient" proposals initially or face dismissal with no opportunity for reinstatement.

The commission has used its stricter standard to justify the return of thousands of LPTV applications that have not been letter perfect. This is the principal means by which the backlog of more than 10,000 LPTV applications has been reduced.

In the cases recently decided, the commission upheld its stricter standard. It said allowing resubmission of returned applications, even with minor corrective amendments, would substantially delay processing LPTV and TV translator applications.

Construction requests denied

In line with the Mass Media Bureau's earlier warnings, the FCC has denied requests of two Oklahoma TV permittees for additional construction time.

The commission said that construction was not prevented by causes beyond the permittees' control and that there were no other matters which warranted additional time. In both cases, the outstanding construction permits were canceled and the call signs for the stations deleted.

It should be noted that in both cases the extension applications were second requests after original equipment arrangements fell through. After three years, the permittees were no nearer to completing construction than when their first extensions were granted.

In related action, the commission recently denied a permittee's *first* extension application because construction had not commenced during the

Continued on page 135

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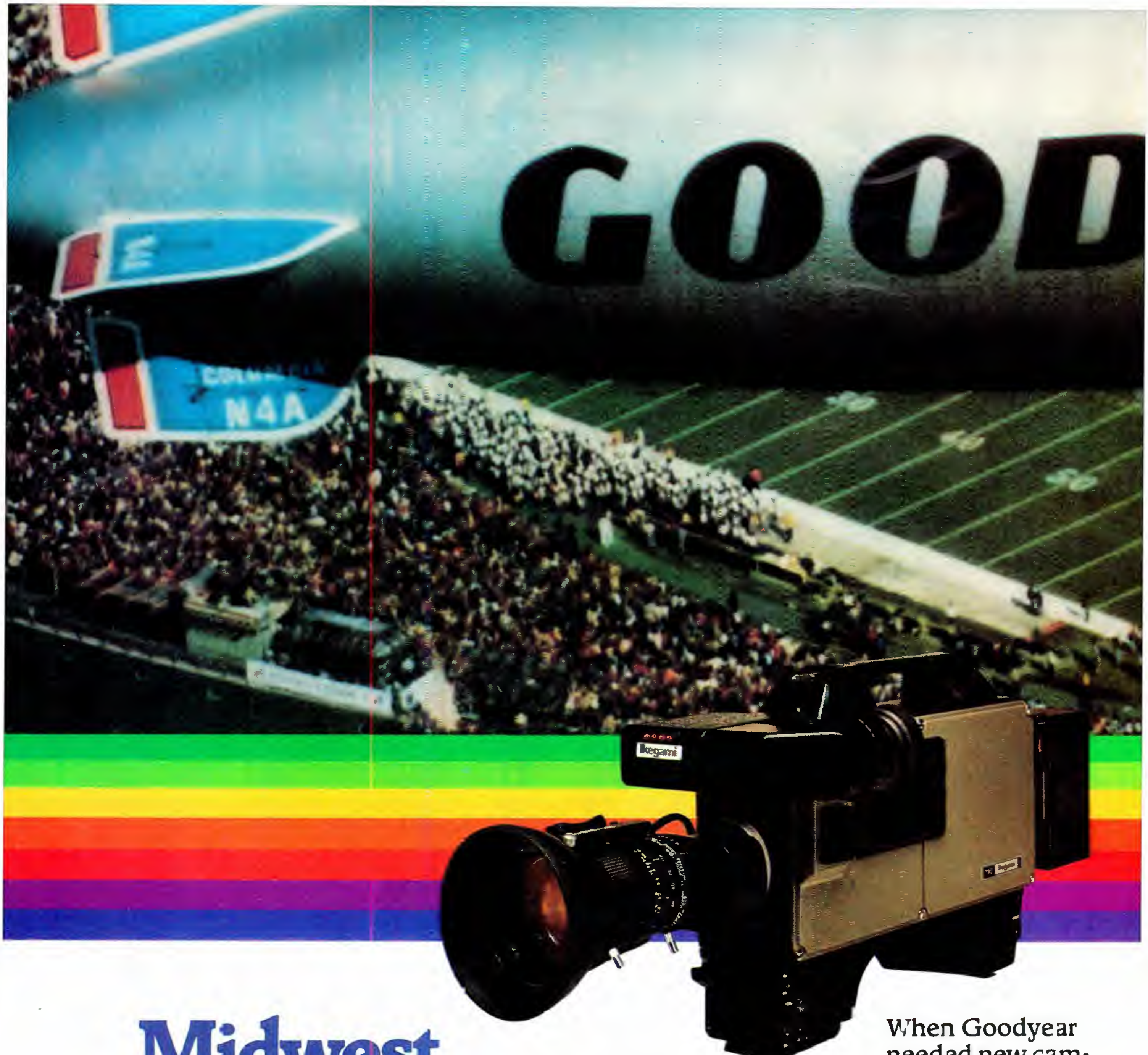

Midwest and Ikegami put Goodyear on top of the action

When Goodyear needed new cameras for their fleet of airships, they contacted the company with over 20 years experience in meeting the needs of the communications industry . . . Midwest Corporation. To keep Goodyear on top of the action, the obvious choice was Ikegami's HL-79.

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Ikegami HL-79, Midwest ensured that Goodyear would continue to rise to the occasion. The next time you see a sporting event covered by a Goodyear Blimp, chances are that you are seeing Ikegami performance first hand.

With our unique systems approach we at Midwest can custom design and supply anything from mobile units to teleproduction systems with Ikegami cameras as the basic ingredient. And with Ikegami, you can depend on our systems to produce top quality results under the most adverse conditions.

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Circle (7) on Reply Card

By Joseph B. Sainton, principal engineer, Continental Electronics Mfg. Company, Dallas

Editor's note:
This is the second article in a series dealing with converting an AM station to stereo. Last month examined general transmitter considerations for stereo conversion. This month examines the causes of Incidental Phase Modulation (IPM) in a transmitter.

The source of IPM will vary from one transmitter type to another, as will the level. Different transmitters require different corrective measures to reduce IPM to an acceptable point.

Generally, the newer transmitters that use tetrode power tubes exclusively will generate higher levels of IPM than older transmitters using triodes. The reason is that careful neutralization is a prerequisite for stable triode operation, and low IPM results from careful neutralization.

On the other hand, tetrode tubes operating in the standard AM frequency band do not require neutralization for stable operation. But because the screen grid is seldom a perfect isolating shield between the plate and control grids (because of constraints on the amount of screen bypass capacitance that is used), variations in RF plate voltage during amplitude modulation can cause a detuning—or phase modulation—of the grid circuit at the modulating rate.

This condition can be prevented either by neutralizing or maintaining the screen grid at cathode RF potential. The latter can be provided by heavy capacitance bypassing or by direct connection of the screen grid to the cathode. Either of these solutions, however, preclude the use of screen or plate modulation. In the Continental Type 316F 10kW transmitter, for example, there is no modulation applied to the power amplifier stage and the PA screen grids are heavily bypassed, which minimizes IPM.

The 317C 50kW transmitter, on the other hand, is screen modulated and requires neutralization to reduce IPM. Plate-modulated transmitters with tetrode power amplifiers using concurrent plate and screen modulation will also require neutralization. This is true whether the modulation is applied by a Class B push-pull modulator or by a pulse width modulator.

The level of IPM that seems to be attainable—based on the stereo systems installed by this company—gives about 35dB of midband separation and about 20dB to 25dB separation at 7.5 kHz, depending on the stereo system. Some transmitters have achieved 40dB of midband (1kHz) separation and more than 30dB at 7.5kHz, as have some older plate modulated transmitters.

Reducing IPM

Optimizing the transmitter for stereo operation first involves reducing IPM to its lowest possible level. This can be done with a spectrum analyzer or with a stereo modulation monitor. When using a spectrum analyzer, adjust the transmitter tuning controls to minimize the phase modulated (PM) sidebands. This is best done with a modulating frequency of about 1kHz because the harmonic distortion is usually low at midband frequencies and 1kHz is high enough to resolve easily on most spectrum analyzer displays.

Maintain the modulating test tone at about 90% to keep the PM sidebands at the highest level and not masked by sidebands generated because of AM distortion products. Modulation at 100% is not a good idea because the AM distortion products will come up rapidly if negative peak modulation exceeds 100%, either by accident or by modulation monitor error. It is good practice to always have the modulation envelope under observation on an oscilloscope.

Ninety percent modulation at 1kHz will rarely produce more than 1% or 2% harmonic distortion, which will keep the distortion sidebands down 35dB to 40dB below the 1kHz fundamental sidebands. This will allow resolution of PM products down to 35dB to 40dB. The midband stereo separation will generally be 3dB to 6dB better than the level of the highest PM sideband.

For example, if the highest PM product is down 30dB at the midband, separation will range from 33dB to 36dB. The separation measured at higher audio frequencies will depend not only on IPM, but also on whether the sum and difference (L + R and L – R) signals undergo equal time delays through the transmitter.

Because the L + R and L – R time delays are never exactly equal, the stereo exciter will have provisions for equalizing the audio time delays. In some cases, there will be a greater delay through the RF channel (L – R) than through the mono (L + R) channel. The delay circuits must be capable of switching into either the main or subchannel.

The antenna system load to the transmitter can have a significant effect on stereo separation and distortion. Of primary concern are the magnitude of the sideband VSWR and the symmetry at frequencies 10kHz above and below the carrier frequency. Optimize the stereo performance of the system on a dummy load (if one is available) and then trim the stereo generator's high frequency equalization controls when operating on the antenna.

If the station operates with different *day* and *night* antenna patterns—of if plans call for using the same stereo exciter on two different transmitter types—the exciter should have the capability to select separately adjustable day and night (or transmitter 1-2) equalization circuits.

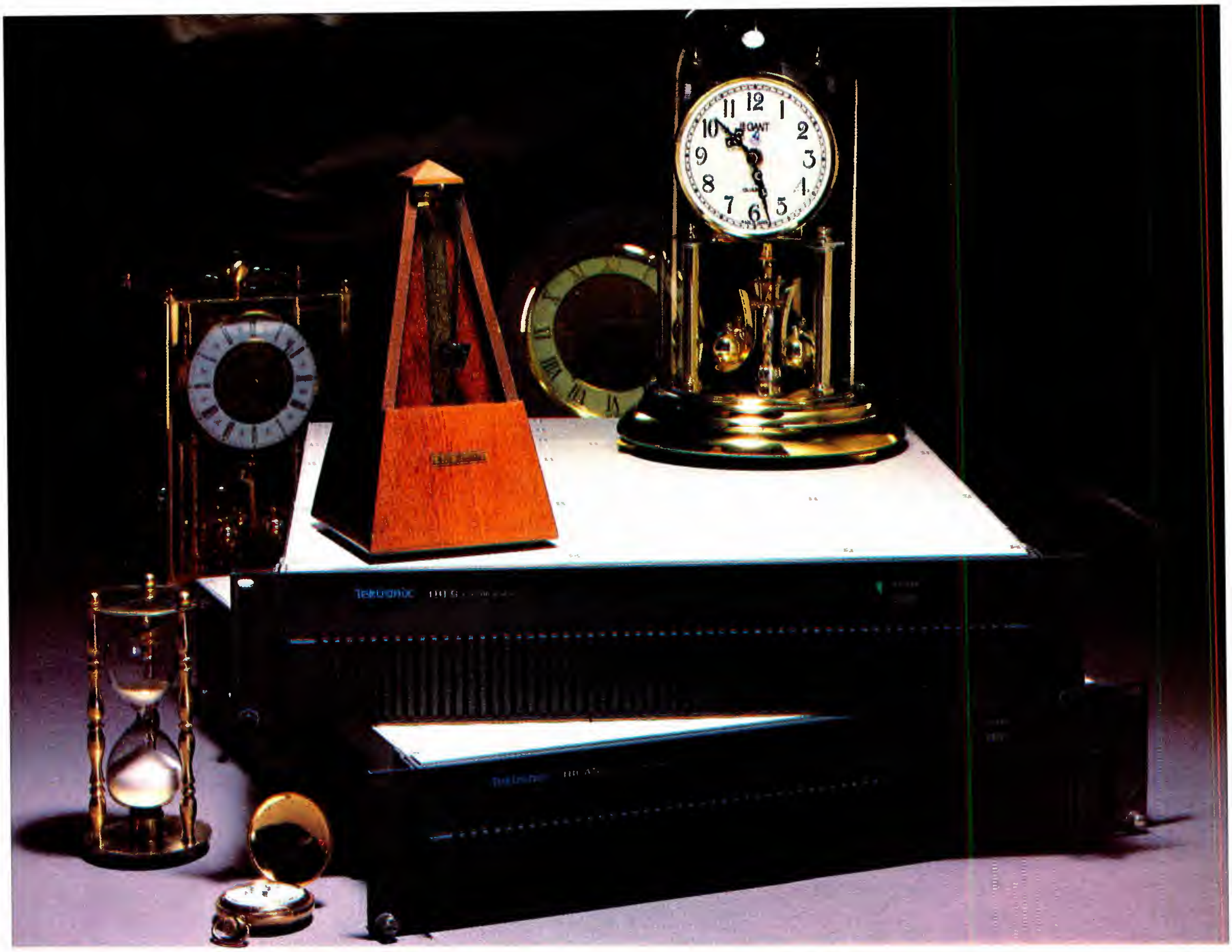
For transmitters that are modulated in the final amplifier stage, plate tuning and neutralization will significantly affect stereo performance. For transmitters using low-level modulation, the tuning of interstage coupling circuits in the exciter will generally control stereo performance.

Initial adjustments can be made either with a spectrum analyzer or a stereo modulation monitor. Stereo systems that are supplied with a companion stereo modulation monitor will have a subchannel (L – R) demodulator built into the unit. This L – R detector will, of course, also demodulate any incidental phase modulation that is present during monaural transmission.

The average level of IPM relative to mono modulation can be measured by comparing the levels of L + R (mono) and L – R as read on the modulation monitor. For example, if 100% envelope (L + R) modulation produces a reading of 10% L – R modulation, then the average level of IPM is 20dB (ratio of 100% to 10%) below 100% modulation. Some monitors can increase the L – R meter circuit gain in 10dB or 20dB increments for resolving very low levels of IPM.

Make the initial transmitter ad-

Continued on page 134



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Satellite update

By John Kinik, satellite correspondent

NBC satellite network

The NBC Satellite Network, which is scheduled to be in full operation in January, will usher in the Satellite Era in the commercial broadcasting industry. NBC has signed a contract with Comsat General to provide the complete network, operating in the Ku-band, and including satellite transponders, earth terminals, a network management system and system maintenance, for a 10-year period.

Comsat General has in turn selected Satellite Business Systems and RCA to provide satellite transponders, and Harris Corporation as the supplier, installer and maintenance contractor for the earth terminals. The network management system is a joint project involving NBC, Comsat and Harris, with each organization to operate a portion of this system from facilities in New York, Washington, DC, and Florida, respectively. Comsat's contract includes the responsibility for end-to-end performance of the network, in terms of both communication performance and availability.

Tables 1-4 summarize the key technical characteristics of the NBC Satellite Network.

Satellite	Orbital position (Deg. W.L.)	Transponder number	Bandwidth (MHz)	Transponder power (W)	Use
SBS-3	95	6 or 9	43	40	"A" Network ("Red") (Initial release)
		9 or 6	43	40	"B" Network ("Green") (½- to 1-hour delay) East, Central, and Mountain time zones
		1 or 3	43	20	"C" Network (2-3 hour delay) Pacific time zone
		3 or 1	43	20	News inserts and updates; commercials
		5	43	20	Occasional use (pre-empts other Comsat traffic)
SBS-2*	97	5 transponders	43	20	Occasional weekend use (Sports)
RCA-K1 (January 1986)	77	4 transponders (Replace SBS-3 transponders 1,3,6,9)	54	40	Occasional weekend use (Sports)
RCA-K2	87	(Backup satellite for RCA-K1 satellite)			

*SBS-2 acts as backup for SBS-3 transponders 1, 3, 5, 6, 9.

Table 1. Space segment.

Video S/N ratio	Availability (% of Time)
56dB	99.0
54dB	99.9
46dB	99.99

Table 2. Network link performance (end to end).

Switching Information	• One single channel per carrier (SCPC) channel, with 128Kbps of information, from New York and Burbank, CA, on each of two transponders. 128Kbps comprised of: 56Kbps—command and control 56Kbps—future use 9.6Kbps—switching synchronizing signal
Status Information	• SCPC channel from each affiliate terminal is transmitted on a time division multiplex (TDM) basis. A single RF frequency is time-shared. • All affiliate terminals are polled every 10 seconds.

Table 3. Network Management System.

Continued on page 135

Strictly TV

by Carl Bentz, television editor

'Oh look! It has begun!'

This line from "My Fair Lady," just one of the movies that will be enhanced by the transformation of TV transmissions to stereo sound, points out the race (to which the line refers) starting in the TV industry.

WNBC, New York, originally planning to air a stereo "Tonight Show" on Aug. 3, moved its trial transmission to July 26 to beat the July 28 Olympics opening ceremony transmission by KABC, Los Angeles.

On a more substantial basis, two stations regularly scheduled programming in stereo—one PBS affiliate and one commercial station. The PBS station, WTTW, Chicago, took part in the tests to determine an industry standard. Although WTTW has converted its equipment for the Zenith/dbx system, the station was involved in development phases of the Telesonics system that was proposed to the EIA.

It is also interesting to note that PBS has reinstituted its engineering committee in Washington. The purpose is an effort to assist affiliates who express a desire to go stereo.

As noted in the August **BE,** PBS does have a large archive of stereo material and has a distribution system in place to provide stereo network feeds to all stations. Receiving up to four channels of audio information does require the use of the digital audio transmission equipment (DATE) units, which not all stations have, and which reportedly are not currently available. The revival of interest may prompt licensing of the decoder to a manufacturer.

The commercial station that began regular transmissions is WTIC-TV61, Hartford, CT. Not only was it the first station in the New England area to go full stereo, it was the first station in that area to be licensed for an EIRP of 5MW. The gala inaugural telecast dedicated the station to the memory of the late Governor Ella T. Grasso. Following several years of planning, WTIC was designed for stereo from the ground up.

Information on the cost of conversion has been provided from two stations that have looked at the new format. One is a commercial, the other a PBS affiliate.

San Diego

Chief engineer John Weigand, KFMB-TV8, recently assessed his station's status and estimated costs for the change. Weigand suggests he will need in the neighborhood of $300,000. The CBS station will need changes in the studio and transmitter areas, with some alterations in the microwave link from Television City in Hollywood to San Diego.

In the studio, the Dynair routing switcher will need to be extended to full 2-channel status at a cost of $15,150. It will need two additional System 21 audio frames, two power supplies, eight audio input cards, a control card and various interconnect cables and connectors. The Grass Valley 1600-4T switcher will require retrofitting at $14,500. The purchase of two stereo record/playback and three play-only cart machines will run approximately $17,500. The station's two ACR-225 TV cart systems will need modification at a cost of $15,000 each.

Other items include a TV stereo audio processor (Orban Optimod 8182A), $5000; a TFT 720 stereo modulation monitor, $8500; and one stereo audio board for master control at a cost of about $6000.

At the transmitter, an RCA TV stereo FH transmitter retrofit would be necessary. Presently not available, RCA indicates that if there is a demand, the retrofit will be engineered and available in the first quarter of 1985. The retrofit, at a cost of about $18,500, consists of an exciter add-on and cavity modification for extra bandwidth. The package will not include a modulation monitor, so KFMB would purchase that item separately. At this point, Weigand says the traplexer situation is uncertain.

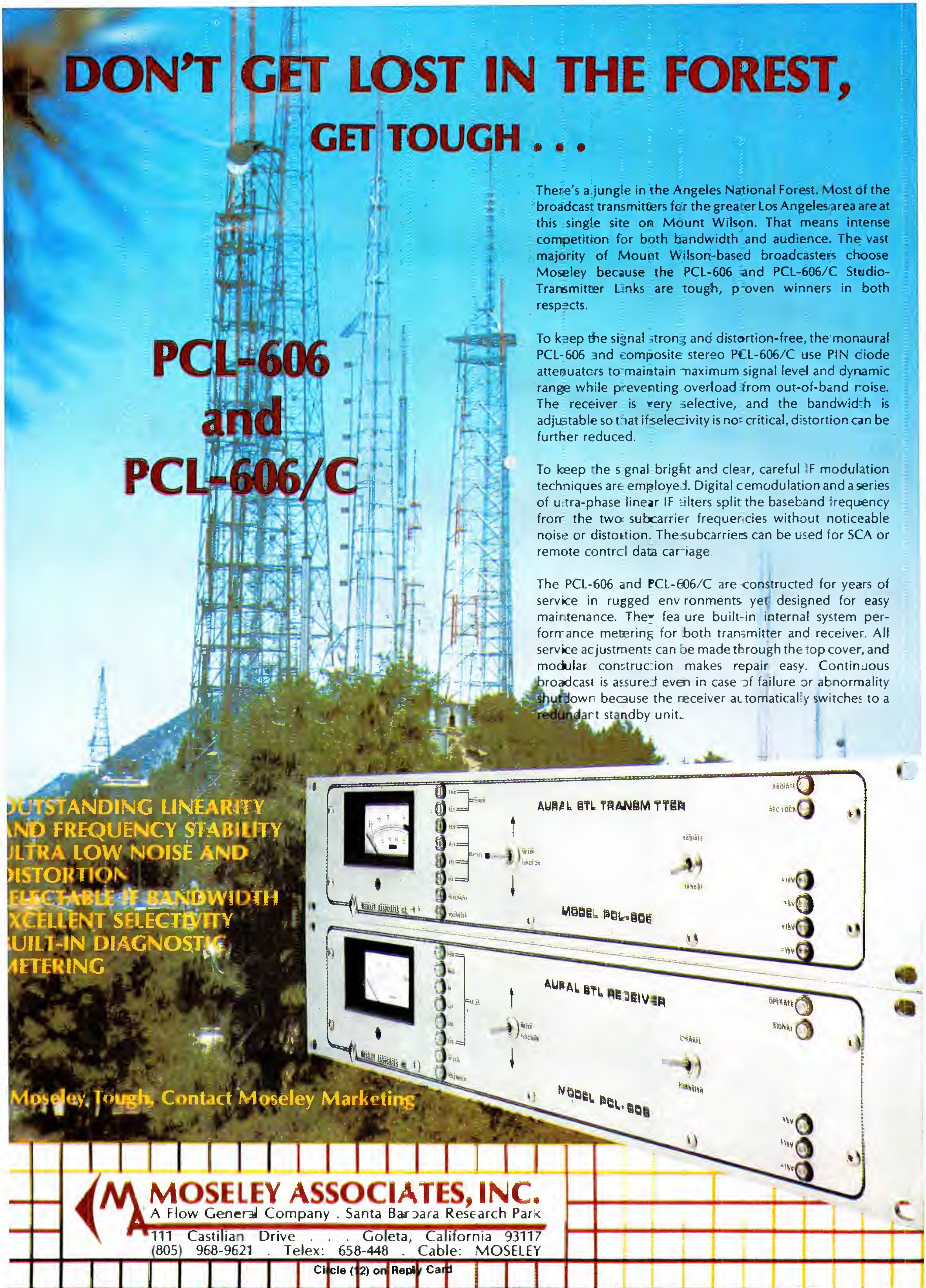
Routing switching at the transmitter is also in need of updating with additional second audio channel output cards. One will be for the transmitter input. If network transmission remains routed as at present, a second will be required for network. A third will be needed for proper monitoring. Second-channel input cards will be specified for all program audio inputs. The cost of 10 or 11 cards will total about $5000.

Linking KFMB by microwave to Television City will require work on the links. The path from Television City to Mt. Wilson will need an additional subcarrier receiver and transmitter module in the Farinon 13GHz equipment. In Path 2, Mt. Wilson to Mt. Soledad, the present M/A-COM MA-2B equipment will not provide an adequate S/N rating when adding the new audio subcarrier. Injection levels would have to be reduced from their present value to prevent moire, and then sync buzz would become a problem. A new link is suggested for that segment of the overall path.

From St. Soledad to the studio and back will require no additional material, as the existing equipment already has an unused audio channel in both directions. A Terracom work microwave receiver switcher will require second-channel audio capability. A small auxiliary audio switcher could be controlled by the Terracom logic, if Loral Corporation is not able to supply the additional hardware.

Weigand also suggests that questions should be asked if the network will pay for stereo transmission if the station chooses a network satellite feed alternative to telco lines. He cautions telco stereo-quality lines might not be available in some areas.

Looking at the satellite alternative, Weigand expects that network distribution, using the proposed CBS earth station, could deliver second or third audio channels directly to the studio at a cost of $150,000. All CBS affiliates across the country have this option. Signal quality could be improved noticeably and the intercity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link could be eliminated, conveying a better public image.

Kansas City

Chief engineer John Long, at KCPT-TV19, Kansas City, MO, has considered the station's current facilities and determined that many items need to be replaced entirely.

In master control, a Grass Valley 1600-4S is under consideration at $53,500. One ITC stereo cart recorder/player and two 3-spot players will total $11,665. An existing Ampex AVR-2 has a stereo head, but four vintage Ampex quadruplex machines will probably be replaced.

After much consideration, Long believes that eight fully equipped VPR2B machines would handle the production activities that the station is forecasting, at a total cost of $564,880. Two Sony BVU-200As are stereo capable, but he feels that two, more up-to-date BVU800 machines would be wise. Combined with two framestores and monitoring, an additional $51,960 is required.

Also at the studio location, one DATE decoder for each network feed in simultaneous use will run $11,000 each. The modulation monitor will approximate $6000. Additional audio DAs, patch bays and audio processors are as yet undetermined, but stereo monitors and speakers will be $2100. Modification to the Image Video routing switcher system in hardware, software and PROMS will be $14,450.

On the way to the transmitter, the Collins MVR-6 microwave will need additional subcarrier modules, costs undetermined. At the transmitter site, a wideband audio board will be needed at $850. The stereo generator will add $8000. For monitoring, $500 should cover speakers and a 2-channel amplifier, but a modulation monitor will figure in the $6000 range. As at KFMB, no determination has been made for the traplexer or notch and harmonic filters. Retuning of klystrons will be required, but should be labor-only costs, while some additional audio DAs will add a relatively insignificant amount to the total.

The total for Long's assessment of KCPT is $750,000. RF plumbing between the transmitter and antenna will be extra. Because the current transmitter is well dated by its circuitry, if KCPT decides to go to stereo broadcasting, the overall investment could be more than $1 million, if a new transmitter becomes part of the conversion.

Is now the time to convert?

The question remains on the viability of financial outlays required for stereo. At the Summer '84 Consumer Electronics Show in Chicago, all receiver manufacturers showed new receivers with integral stereo decoding or converter attachments that provide stereo through an existing hi-fi system. Both RCA and Motorola have since provided press kits on their new models that are reported to be in stores now.

The decision to make the move is perhaps a no-win situation. If a consumer is offered a stereo receiver, but there are no transmissions in the area, why should the consumer put out the extra cash? On the other hand, if the station is contemplating the expense of conversion, is it logical if there are no receivers in use?

Finally, are we, as an industry, prepared to do the extra work to provide some worthwhile stereo programming? It will take more than talk shows, the news, movies and MTV to make it work. At the same time, some new approaches to handling audio will be needed to be successful at creating the psychoacoustic effect that is desired.

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Maintaining the bottom line

A broadcast engineer's most basic job requirement is equipment maintenance. It is also, however, an art that faces an uncertain future. Except for a few bright spots, the outlook for an influx of new talent into the broadcast maintenance field can only be described as gloomy. Our industry has let this situation develop. And our industry has the power to reverse it, if we so choose.

The broadcast industry lives on technology. It thrives on electronic gadgets. Without competent engineering support, however, the electronic tools of the trade are of little value. It is strange, then, that we do not ensure that young engineers are brought into the industry to maintain hardware.

Where will radio and TV engineers come from? Will they come from colleges and universities? Probably not, especially when you consider what broadcasting pays most of its maintenance personnel. The glamour of the Silicon Valley usually looks much more alluring.

Will they come from electronics trade schools? Some will. Many more find, however, that broadcasters keep lousy hours and that the chances for significant career advancement are not very good either. The aerospace industry often makes a more "logical" choice.

New engineers will, instead, come mostly from here and there. They will work in the business because they like broadcasting, not because they're going to make any money at it.

So, now that we've found the people, how do we train them? Not in apprenticeship programs because few—if any—exist. Not in industry-sponsored applied technology schools because none exist. Not through the FCC because it has said, "no, thank you" to the whole business of technical certification.

Most engineers of the next generation will learn about practical equipment maintenance the same way the last generation learned: M.I.T—the Midnight Institute of Technology. You learn quickly when it's midnight and the only thing you can get the transmitter to do is light "fault" lamps. At least that's the way it is supposed to work.

All maintenance engineers probably have their favorite story about the first night on the job when they really found out what it meant to work in broadcasting. We suspect that much more luck and skill is involved in making it through the novice stage.

There are a number of things that our industry can do and should do to correct this situation, such as sponsoring hands-on maintenance workshops at various locations around the country. But being realistic, we don't hold out much hope for the establishment of such programs.

Without question, the best vehicle for ensuring the technical competence of new station personnel is the Society of Broadcast Engineers Certification Program. It is well-run and well-respected in the industry. It is a fitting replacement for the First Class FCC license, and in many ways better than the old license.

The exam program tests an applicant on the practical areas of station operation that an engineer must deal with on a day-to-day basis. The certification program, coupled with regular chapter meetings held all across the country, are the closest thing the broadcast industry has (and ever did have) to an apprenticeship program for maintenance engineers.

This issue of **Broadcast Engineering** focuses on station maintenance because we feel that good maintenance practices are sadly lacking at too many stations. Major broadcast equipment manufacturers that we have talked with have expressed concern at the lack of technical expertise (or even good common sense) of an alarming percentage of engineers in the field.

Far too many broadcast managers—in an effort to protect their bottom-line—have skimped on equipment maintenance salaries, supplies and test equipment. The laws of physics eventually catch up with everyone, however, and those stations that have not paid their maintenance dues will reap an expensive harvest.

We urge broadcasters, therefore, to look closely at the importance that the maintenance engineers have to their overall station operation. If maintenance engineers are going to other jobs because of money and fringe benefits, perhaps it is time that management re-evaluates the scale of payment for those skills.

And to keep those skills refined, national engineering conventions, factory training courses and SBE-sponsored seminars should be regular items on the maintenance engineer's agenda.

The equipment that broadcasters use is becoming increasingly complex, and this hardware requires competent technical personnel to keep it running. The need has never been greater for trained engineers. Our industry must look seriously at this issue, if for no other reason than to protect the bottom line.

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Maintenance:

Equipment failures can damage productivity, station image and advertising revenues. When that's at stake, good maintenance is good business.

By Jerry Whitaker, radio editor

Staying on the air

"We're off the air!"

No other single statement chills a broadcast engineer more. Pandemononium by the air staff, program director and station manager follows. They ask the engineer, "What's wrong with the transmitter, and how long until we're back on the air?"

The next stop in the mad race is the transmitter site. Probably one of the most nerve-racking experiences engineers face is the moment just before they open the door to the transmitter room, fearing what they might find inside.

"Did the PA tube take a dive, or did the power controller burn up? Maybe it's the remote control system. I hope it's just a blown fuse. What if the antenna has problems? I hope it's not the IPA because we don't have a spare."

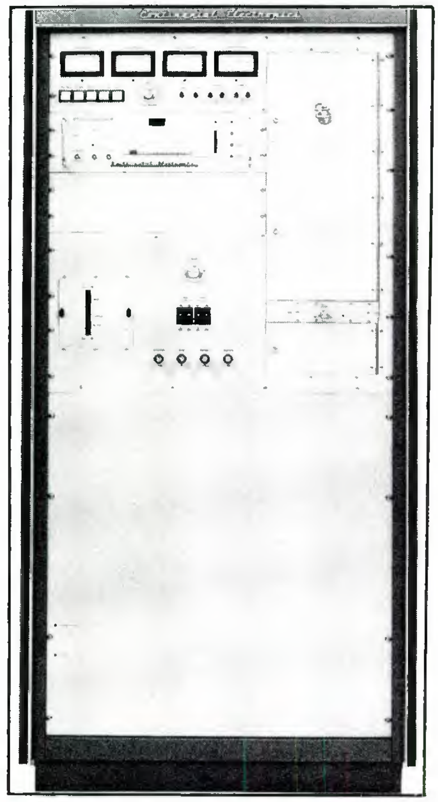
An equipment failure at a radio or TV station is generally just cause for an instant crisis. All gear in the transmission system, from the cart machines and microphones to the antenna, must work 24 hours a day, 7 days a week, without fail. Every link in the broadcast chain is important, but the transmitter itself is most important. Studio equipment may occasionally fail—and the operators will complain loudly about it—but you can circumvent the problem.

For this reason, the greatest concern on the part of most enginering personnel is keeping the transmission system, particularly the transmitter, in good working order.

Unfortunately, the heart of the broadcast station's technical plant is often located apart from the studio, on some out-of-the-way tract of land or on a mountain top that takes a half-day to reach. It becomes too easy to ignore the transmission gear until a problem occurs. The weekly transmitter inspection visits allow the engineer to give the system a quick "once-over" look, but there is no substitute for walking past the box every day. Engineers who have worked on a particular piece of transmission equipment for any length of time acquire a feeling for how well the unit is working. They know what the blowers should sound like, and what meter readings are normal—not by reading the meters individually, but by one glance at the front panel. They know when the PA tube needs replacement, and when there's still some life left in it. They know when the transmitter needs retuning, and when to leave well-enough alone. They know the unit's strong points and weak points.

A Harris engineer conducts performance measurements on a TV-30H transmitter. No responsibility is more important, or basic, than equipment maintenance. The **BE** Station Maintenance issue examines maintenance topics and some of the equipment needed to perform maintenance work. (Photo courtesy of Harris.)

The only way to gain this knowledge is to know the transmitter—and instruction manual—forward and backward, and to work with the equipment on a regular basis. This translates into a thorough maintenance program. Such an effort can be expensive and time-consuming, but the rewards always outweigh the cost. It is always cheaper to maintain a machine than fix it after it fails.



The front panel of the transmitter can tell a great deal about what is going on inside. Make a complete check of all operating parameters before you try any troubleshooting. (Photo courtesy of Continental Electronics Mfg. Co.)

Establish a maintenance program

Inspecting and maintaining the equipment will prevent many—perhaps most—problems in a transmission system. The unit's performance history is also important in order to identify and analyze operational trends.

The front panel of the transmitter will tell a great deal about what is going on inside the unit. Record all of the front panel meter readings at regular intervals in the maintenance log, in addition to the positions of critical tuning controls. This information provides the engineer with a history of the transmitter's operation.

A complete visual inspection of the transmitter on a regular basis is an important part of any maintenance program. Component problems can often be spotted at an early stage by regular inspection of the equipment. Carefully inspect all resistors for signs of overheating, electrolytic or oil-filled capacitors for signs of leakage and feed-through capacitors and other high voltage components for signs of arcing. Also check all high voltage RF capacitors right after signoff for excessive heating.

Transmitting capacitors—mica, vacuum and door-knob types—should never run hot. They may run warm, but generally only because of thermal radiation from other components, such as power tubes, in the circuit. An overheated transmitting capacitor is often a sign of incorrect tuning, and should be investigated as soon as possible.

Check all power supply components—transformers, reactors, high voltage rectifiers and transient suppression devices—for overheating. Remember to discharge all capacitors in the circuit with a grounding stick before touching any component in the high voltage section of the transmitter. You must also confirm that all primary power has been removed from the transmitter before any maintenance work begins.

Special precautions must be taken with transmitters that receive ac power from two independent feeds. Typically, one ac line provides 208V 3-phase service for the high voltage section of the system, and a separate ac line provides 120Vac power for low-voltage circuits. Older transmitters or high-power transmitters often have this arrangement. Therefore, check to see that all ac power is removed before you begin maintenance work.

Check modulation transformers and reactors—if used—for excessive heating, and inspect any oil-filled transformers for signs of leaks.

Examine coils and RF transformers for any signs of overheating. Such components—operating in a well-tuned transmitter—will rarely heat appreciably. If you notice discoloration on several loops of a coil, consult the factory service department to see if this is normal. Pay particular attention to variable tap inductors, often found in AM transmitters and phasors. Closely inspect the roller element and coil loops of such inductors for signs of overheating or arcing.

Regularly check all fans and blower assemblies for proper operation. Most transmitter instruction manuals include a suggested maintenance schedule for these devices, which you should follow closely. Include in your inspection all other portions of the air handling system, such as air intake assemblies, filters and grills. This work is important because dirt particles—or *microdust*—can collect on the surfaces of the blower cage, blades and ducting, resulting in a significant reduction in air flow.

Cleaning is a large part of the proper maintenance routine. A shop vacuum and clean brush are generally all you need. Use isopropyl alcohol and a soft, clean cloth for cleaning high voltage insulators. Cleaning serves a greater purpose than just keeping the transmitter looking nice. You can inspect each component as you clean and see if there are any changes.

Further, cleaning is important to proper cooling of the various components in the system. Dust and dirt of sufficient thickness can create a thermal insulator effect that prevents proper heat exchange from a device into the cabinet.

Clean relay contacts—including high-voltage or high-power RF relays— as often as needed to keep the current-carrying points free of pitting or discoloration. Experience will tell what devices need to be cleaned, and how often. Inspecting certain relays will show you if operators are using the proper procedures to change transmitter or antenna patterns.

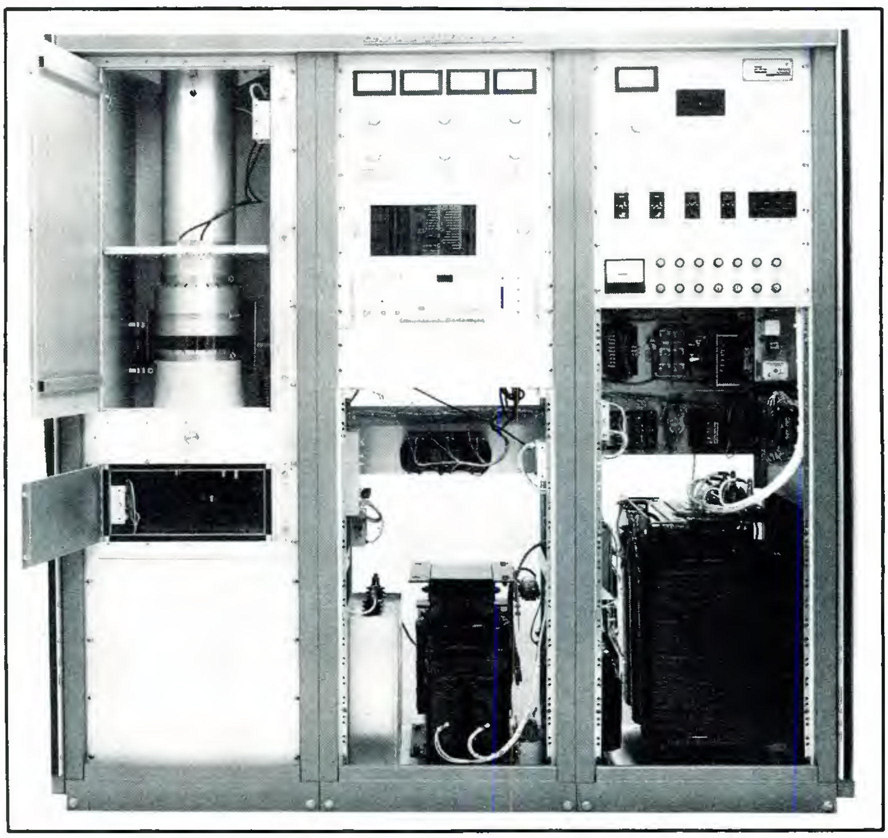
For example, a high voltage relay that should never be changed in the "hot" condition should not show signs of arcing between contact points. Evidence of such arcing would indicate that the operators were violating established procedures by making "hot changes" from one mode to another.

Check the tightness of wires and connections from time to time, particularly those that may be subjected to vibration. Tightness of connections is critical to the proper operation of high voltage and RF circuits. Also inspect barrier strip and printed circuit board contacts for proper termination. Although it is important that all connections be tight, be careful not to over-tighten. The connection points on some components, such as doorknob capacitors, can be damaged by excessive force.

Plug-in power tubes must be seated firmly in their sockets and the connections to the anodes of the tubes must be tight. Once in place, don't remove a tube assembly for routine inspection unless it is malfunctioning. You can create problems by removing a tube or other component unless you are extremely careful. As a general rule of thumb, if a tuned cavity assembly is set up and working properly, leave it alone.

Whenever a tube is removed from

Check resistors, particularly high-power units, regularly for signs of premature wear because of excessive heating.



Regularly clean and inspect the transmitter. A comprehensive maintenance program will result in a reliable system and keep the transmitter looking brand new for years. (Photo courtesy Continental Electronics.)

TASCAM
M-520
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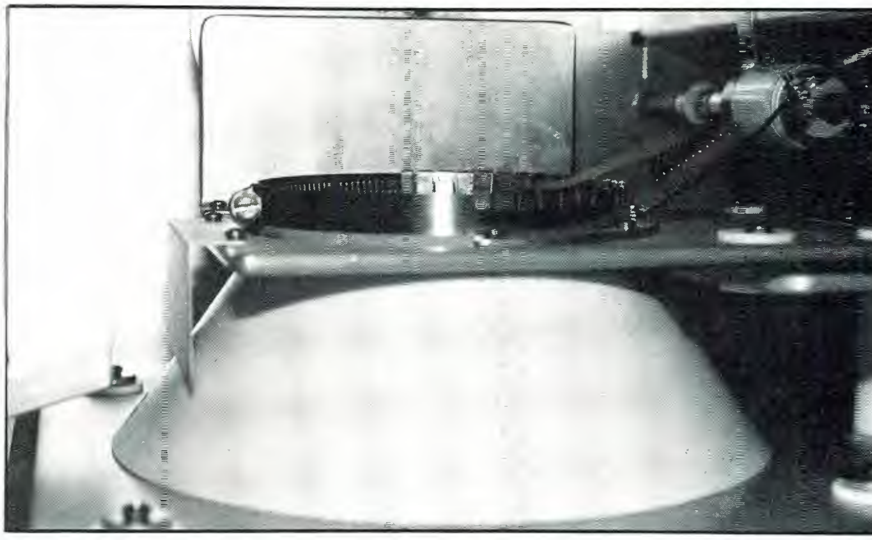
its socket, carefully inspect the fingerstock for signs of overheating or arcing. Keep the socket assembly clean and all connections tight. If any part of a PA tube socket is found to be damaged, replace the defective portion immediately.

In many cases, the specific fingerstock ring can be ordered and replaced. In other cases, however, the entire socket must be replaced. This type of work is a major project, and an inexperienced engineer should consider calling a consultant to help on the project. Replacing a damaged socket should be done immediately, because a bad socket can often damage or even ruin a PA tube. A defective socket can set up high circulating currents within the tube, cause a loss of stage neutralization or contact hot spots between the fingerstock and the tube contact rings. Such hot spots can actually weld a part of the fingerstock to one of the tube contact rings.



Check transmitting capacitors—mica, vacuum and door-knob types—right after sign-off for abnormal heating. Discharge all high-voltage lines with the grounding stick before touching any transmitter components.

Troubleshooting procedures

Problems will occur from time to time with any piece of equipment, and so you must be ready to handle whatever may come up. The best way to prepare for a transmitter problem is to know the equipment well. Study the transmitter design and layout. Know the schematic diagram and what each component does. Examine the history of the transmitter by reviewing old maintenance logs to see what has failed in the past.

When a problem occurs, the first task is to keep the transmitter on the air. If a standby transmitter is available, the solution is obvious. If the station does not have a standby, you will need to think quickly to minimize downtime and keep the unit running until midnight, when repairs can be made.

Most transmitters have sufficient protective devices so that it is impossible to operate them with serious problems. If the transmitter will not stay on the air on normal power, try lowering the power output and see if the

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trip-offs are eliminated. Failing this, most TV transmitters have driver outputs that can be connected to the antenna on a temporary basis, thereby bypassing the final amplifiers—provided, of course, the failure is in one of the PA stages.

FM stations can use the output of their exciter to drive the antenna, bypassing the entire transmitter, if needed. Operating the station on an FM exciter or TV visual and aural drivers can give better coverage than you might think. Most FM exciters will deliver a minimum of 20W output and TV visual and aural driver power outputs are usually rated in the hundreds of watts. Either of these signals fed into a high-gain antenna at a good location will provide a usable signal over a fairly wide area.

When presented with a problem, proceed in a calm, orderly manner to trace it down. Many failures are simple to repair if you stop and think about what's happening. Often the best troubleshooting work can be done by pulling the schematic diagram and pouring a cup of coffee. (It also helps to take the phone off the hook!)

Examine the last set of transmitter readings, and make a complete list of meter readings in the failure mode. Note which overload lamps are lit, and what other indicators are in an alarm state. With this information assembled, you can often identify the cause of the failure. Looking over the available data and the schematic diagram for 10 to 15 minutes can often save hours of trial-and-error troubleshooting.

When checking inside the unit, look for any changes in the physical appearance of components in the problem area. An overheated resistor or leaky capacitor may be the cause of the problem, or point to the cause.

Devices never fail without a reason. You should try and piece together the sequence of events that led to the problem. Then the cause of the failure, not just the more obvious symptoms, will be corrected. When working with direct-coupled transistors, a failure in one device will often cause a failure in another, so check all semiconductors in the vicinity of one found to be defective.

In higher power transmitters, look for signs of arcing in the RF compartments. Loose connections and clamps can cause failures that are hard to locate. Never rush through a troubleshooting procedure. A thorough knowledge of the theory of operation and history of the transmitter is a great aid in locating problems in the RF sections.

Do not overlook the possibility of tube failure when troubleshooting a transmitter. Tubes can fail in peculiar ways, and substitution is the only real practical test on most power tubes used in modern transmitters.

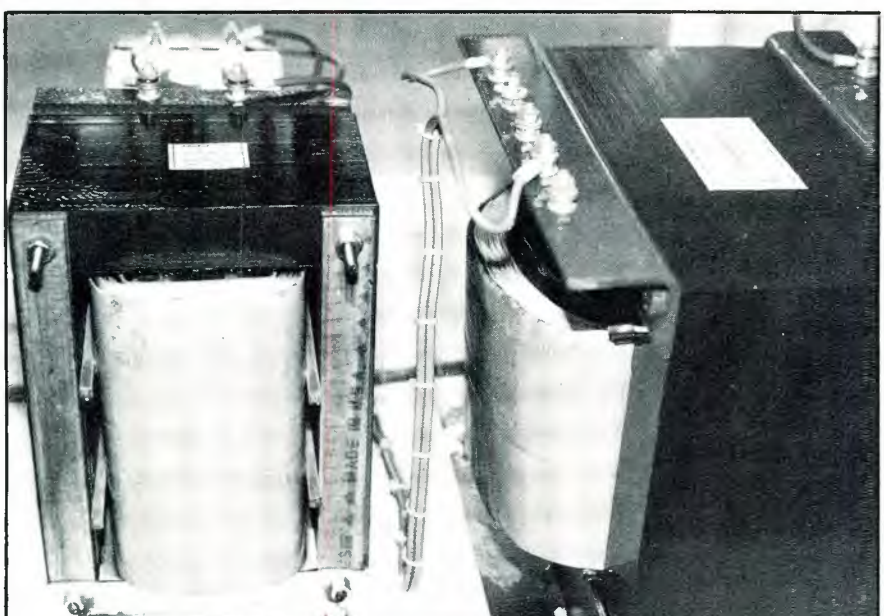
Study the transmitter's control ladder so you can identify interlock or fail-safe problems. Most newer transmitters have excellent troubleshooting aids built in to help you locate problems in the control ladder. Older transmitters, however, often require a moderate amount of investigation before you can identity problems.

A common problem with transmitting equipment is the random trip-off, with no apparent cause or damage. Although these are generally attributed to overvoltage spikes from the power company, they can also be caused by problems within the transmission system itself. Possible explanations include: sensitivity of the overload relays set too high; arcing in the RF compartments; antenna or transmission line troubles; interelectrode tube shorting; automatic frequency control (AFC) instability; tuning of various stages on the threshold of de-tuning, especially in the case of doublers and triplers; a defective or intermittent remote control system; dirty relay contacts; loose connections in the control ladder; or capacitors that intermittently short under high levels.

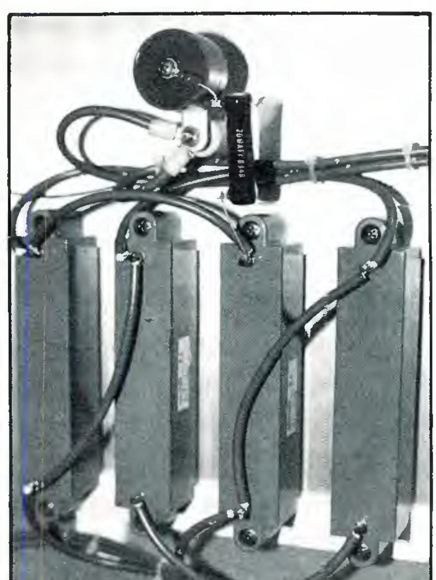
If the random trip-off is found to be caused by a problem within the transmitter, often the only way to locate the trouble is through the process of elimination. Determine all the possible causes and check each one until you find it.

Factory service engineers are available to aid in troubleshooting transmitting equipment, but such services do have their limits. No factory engineer can fix a transmitter problem over the phone. The factory can suggest areas of the system to investigate and relate the solutions to similar failure modes, but the station engineer is the person who does the repair work. If you know the equipment, and have done a good job of analyzing the problem, the factory can help.

When calling the factory service department, have the following basic items: First, the type of transmitter and the exact failure mode. The service department will need to know the meter readings before and after the problem, and whether any unusual



Inspect oil-filled transformers just after sign-off for signs of overheating or leaking. Because of the high voltages and currents found in transmitter high-voltage sections (as shown above) check all connections for tightness.



Keep all high-voltage components, such as this rectifier bank, clean of dust and contamination that might cause short-circuit paths to ground.

Our new lavalier mic makes <u>everyone</u> look good. Introducing the SM83.

People in news broadcasting have been using the same lavalier mic for a long time. But our new Shure SM83 is out to change all that. It's just what everyone has been asking for in an omnidirectional condenser microphone.

On-camera talent like the SM83 because its electronics provide for a dip in the mid-range, giving both male and female voices a smoother, more natural sound. And unlike its Japanese counterpart, the SM83 unplugs from the battery pack for easy storage.

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

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

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

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

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

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

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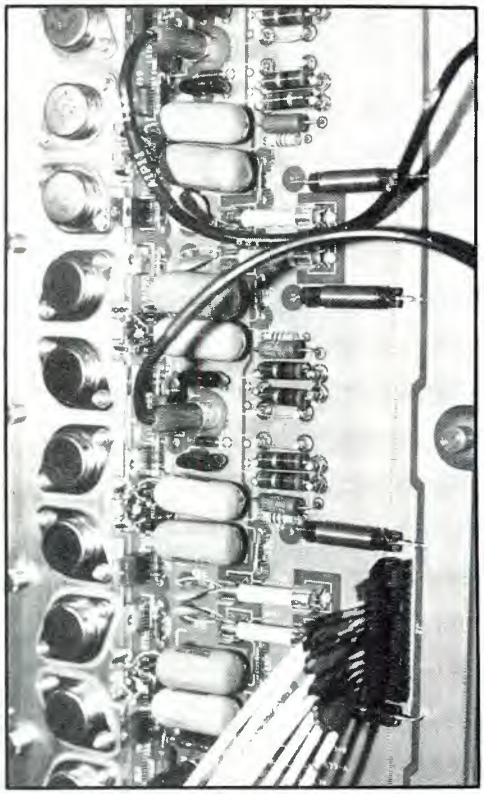

Power semiconductors are being used increasingly in transmission equipment today. For this reason, closer attention must be given to incoming ac line voltage transients, grounding and air filtration at the transmitting site.

circumstances preceeded the failure.

For example, it would be important for the factory to know that the failure occurred after a brief power outage, or during an ice storm.

Second, list what you have already tried to correct the problem. All too often the factory is called *before* any repair efforts are made. The service engineer will need to know what happens when the high voltage is applied, and what overloads may occur.

Third, have the transmitter diagram and layout sheets. A thorough knowledge of the transmitter design and construction allows you to intelligently converse with the factory service representative.

Preventing problems

After solving a problem, examine what can be done to prevent the failure from occurring again. You can often avoid a repeat by installing various protection devices or consulting the factory for updates to the equipment. If the transmitter is several years old, the factory service department can detail any changes that may have been made in the unit to provide more reliable operation. Many of these modifications are minor and can be incorporated into older models with little cost or effort.

These modifications could include items such as changing a variable capacitor in a critical tuning stage to a vacuum variable for more stability; installing additional filtering in the high voltage power supply; replacing older technology transistorized circuit boards with newer IC and power semiconductor PCBs; improving the overload protection circuitry; or adding protection against transient overvoltages in various stages of the transmitter.

(Transient overvoltage protection is an important aspect of the design of any transmitter plant. The causes and effects of high voltage spikes on broadcast equipment is being covered in a series of reports in **BE.** See "The Effects of ac Line Disturbances, Part 3," page 78.)

The environment in which the transmitter is operated in an important factor in improving the system's reliability. Proper temperature control must be provided for the transmitter to prevent *thermal fatigue* in semiconductor components and shortened life in vacuum tubes. Thermal fatigue occurs in semiconductor power devices because of differential expansion and contraction of the individual parts of the device itself (the silicon pellet, solder and case.) Some semiconductor manufacturers have been able to predict the actual number of


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thermal cycles that their devices will be able to withstand without failure.

For example, RCA's RC-5258 NPN power transistor has a life expectancy of nearly 2 million thermal cycles from ambient temperature to 50°C above ambient. At 100°C above ambient, however, the number of thermal cycles possible before device failure drops to about 40,000. At 150°C above ambient, the number of thermal cycles is only 800. Removing heat from semiconductors is vital to the long-term survival of these devices.

Entending tube life

Power transmitting tubes are probably the most expensive replacement part that a system will need on a regular basis. With the cost of new and rebuilt tubes continually rising, engineers must do everything possible to extend tube life.

Inspect each new tube as soon as you receive it for any cracks or loose connections (in the case of devices that do not socket-mount). Also check for any inter-electrode short circuits with an ohmmeter. Once these preliminary checks have completed, store the tube in a safe place.

Tubes must be seated firmly in their sockets to allow a good, low resistance contact between the fingerstock and the contact rings. After a new tube—or one that has been on the shelf for some time—is installed in the transmitter, it should be run with filaments for at least 30 minutes, after which *plate voltage* may be applied. Drive (modulation) should next be slowly brought up (in the case of AM or TV visual transmitters). Residual gas inside the tube may cause an inter-electrode arc (usually indicated by the transmitter as an overload) unless it is burned off in such a warm-up procedure.

An accurate record of performance should be kept on each tube. Shorter than normal tube life could point to a problem in the transmitter itself. Many engineers wonder what type of average tube life can be expected in a particular transmitter. But with the many variables in operation possible (including filament voltage, ambient temperature, RF power output, frequency of operation, etc.), it is difficult to say with any amount of accuracy what to expect in the way of tube life. The best estimate of life expectancy in a particular transmitter at a particular location comes from on-site experience. As a general rule of thumb, however, if a station is not getting at least 12 months service out of a power tube, something is wrong.

Possible problems include improper transmitter tuning; inaccurate panel meters or external wattmeter, resulting in more demand from the tube than is required by the station license; poor filament voltage regulation; insufficient cooling system air flow; and improper stage neutralization.

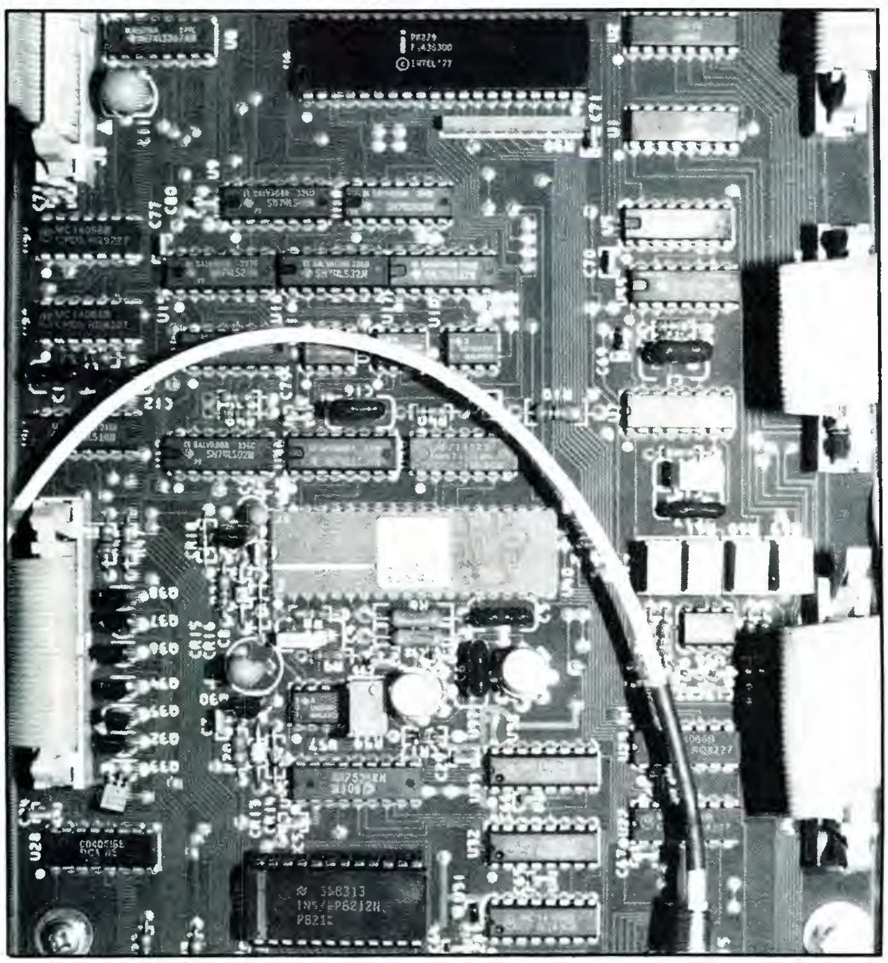
Once the transmitter is operating properly, the major determining factors of vacuum tube life are cooling system performance and filament voltage management.

To accurately adjust the filament voltage, you need a *true-reading rms voltmeter*. Make the measurement directly from the tube socket connections. Use a true-reading rms meter instead of the most common *average-responding rms meter* because the former can accurately measure a voltage, despite an input waveform that is not a pure sine wave (as would be the case in an SCR-regulated filament supply). The front panel filament voltage meter is seldom a true-reading rms device. (Most are average-responding meters.)

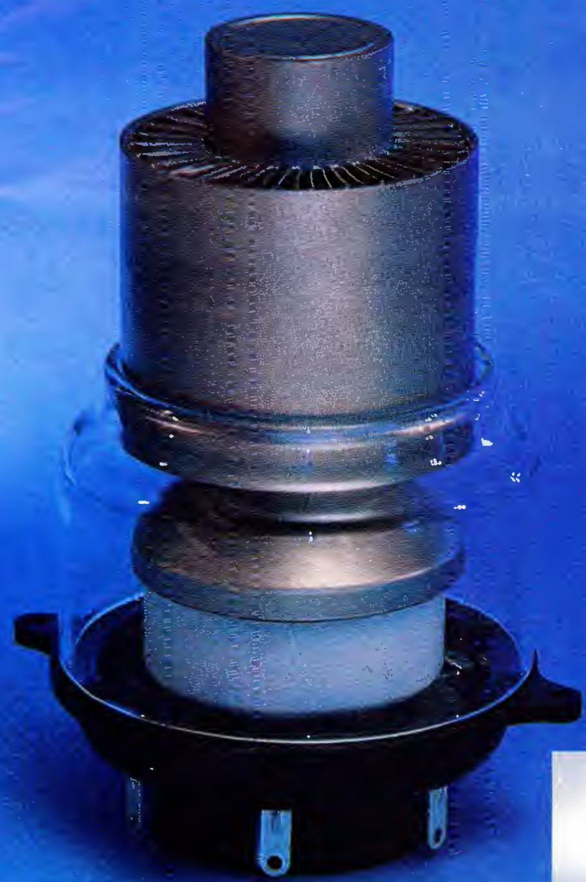
Long tube life requires filament voltage regulation. Many transmitters have regulators built into the filament supply. Older units without such circuits can often be modified to provide a well-regulated supply by adding a ferroresonant transformer or motor-driven auto transformer. A tube whose filament voltage is allowed to vary along with the primary line voltage will not achieve the life expectancy possible with a tightly regulated supply. This problem is particularly acute at mountain top installations, where utility regulation is generally poor.

To extend tube life, some engineers leave the filaments on at all times, not shutting them down at sign-off. If the sign-off period is three hours or less, this practice can often be beneficial. Filament voltage regulation is a must in such situations, because the primary line voltages may vary substantially from the carrier-on to carrier-off value.

By accurately managing the PA filament voltage, you can extend tube life considerably, sometimes to twice the normal life expectancy. For maximum tube life, operate the filament at its full-rated voltage for the first 200 hours. After this *burn-in period*, reduce the filament voltage—by about a tenth of a volt per step—until power output begins to fall or until distortion begins to increase.



The rows of relays and shunt resistors common in the control/overload circuits of older transmitters are being replaced by integrated circuit logic gates and microprocessor chips. These high-tech designs have allowed additional features to be built-in to transmission equipment.



When the FCC changed the rules, EIMAC was prepared for continuing HAM operations.

The FCC changed the allowable output power for linear amplifiers in amateur radio service. Hams can now run at 1500 watts PEP into an antenna. EIMAC was right there to meet requirements with its 3CX1200A7 tube.

Low-cost replacement for small spaces.

RF cabinets of many linear amplifiers currently use the EIMAC 3-500-Z tubes. The new 3CX1200A7 for design takes size into consideration and, by design, is recommended as a single, low-cost replacement for a pair of EIMAC 3-500-Z tubes for new amplifier designs.

General Specifications

The EIMAC 3CX1200A7 is a high-mu, compact, forced air cooled triode for zero-bias class AB2 amplifiers.

- 2.9″ dia × 6.0″ long
- Plate dissipation: 1200 watts
- Glass chimney SK-436 available
- Standard EIMAC SK-410 socket available

More information is available on the new EIMAC 3CX1200A7 tube from Varian EIMAC, or any Electron Device Group worldwide sales organization.

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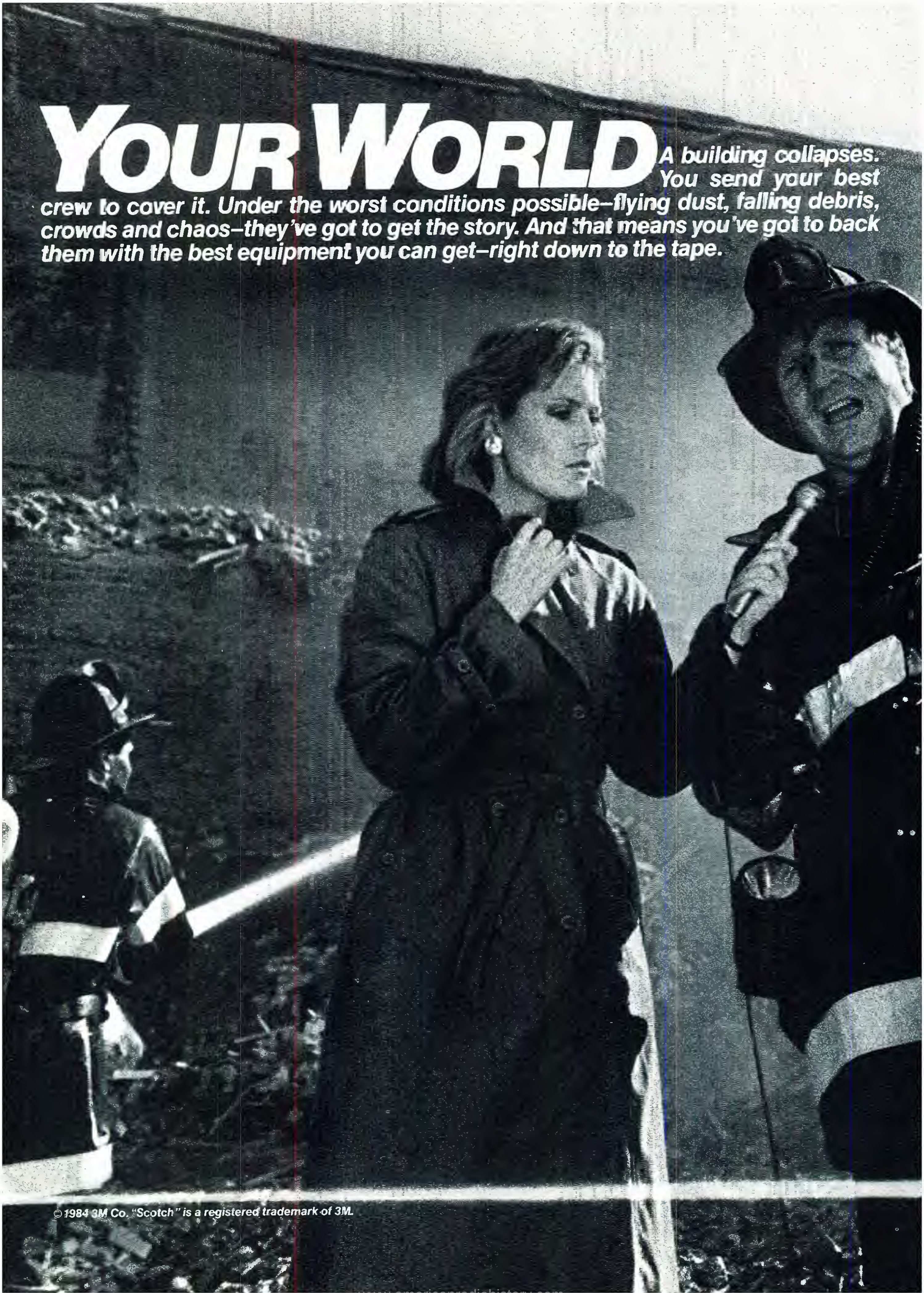
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At this point, raise the filament voltage about two tenths of a volt. Long-term operation at this voltage level can result in a substantial extension in the usable life of the tube. In any event, do not operate the tube with a filament voltage that is at or below 90% of normal. (Some tube manufacturers put the minimum level at 95%. At regular intervals, about every three months, check the filament voltage and increase it if power output begins to fall or distortion begins to rise. The filament voltage should never be increased to more than 105% of normal.

When it becomes necessary to boost the filament voltage to more than 103%, it's time to order another tube. If you replace the tube while it still has some life remaining, the station will have a standby that will perform well as a spare.

Why tubes wear out

A tube wears out when the filament emission is inadequate for full power output or acceptable distortion levels. Three primary factors determine the number of hours a tube will operate before reaching this condition: the amount of carbon originally processed into the filament: the quality of the tube vacuum; and the filament temperature.

The maximum amount of carbon that can be burned into the filament assembly is limited by the increased fragility that results from high carbon processing levels. The carbon concentration is also limited by the reduction in filament temperature below that required for adequate emission at the rated filament voltage that occurs with high carbon percentages.

The residual vacuum level affects tube life because the *decarburization rate* (the rate at which carbon is burned out of the filament assembly) is a function of the partial pressures of the active gases, primarily oxygen compounds, reacting with the carbon. Good vacuum processing and proper *gettering* in the tube results in the lowest residual gas levels.

The decarburization rate is closely related to the filament operating temperature. This temperature is determined by the power to the filament and, therefore, is controllable by proper filament voltage management.

These various factors taken together determine the wear-out rate of a tube. Catastrophic failures because of interelectrode shorts or failure of the vacuum envelope are considered abnormal and are usually the result of some external influence.

Spare parts

A key aspect of any successful broadcast equipment maintenance program is spare parts. Having adequate replacement components on hand for the transmitter is important not only for the repair of equipment failures, but in identifying those failures as well. Many parts—particularly in the high-voltage power supply and RF chain—are difficult to test under static conditions. The only real way to check the component is to substitute one of known quality. If the system returns to normal operation, then the substituted component is defective. Substitution is also a valuable tool in troubleshooting intermittent failures caused by component breakdown under peak power (or modulation) conditions.

Substituting a new component for a suspected part can save time when troubleshooting. With some components, it is cost-effective to simply replace a group of parts that may include one defective component because of the time involved in gaining access to the damaged device.

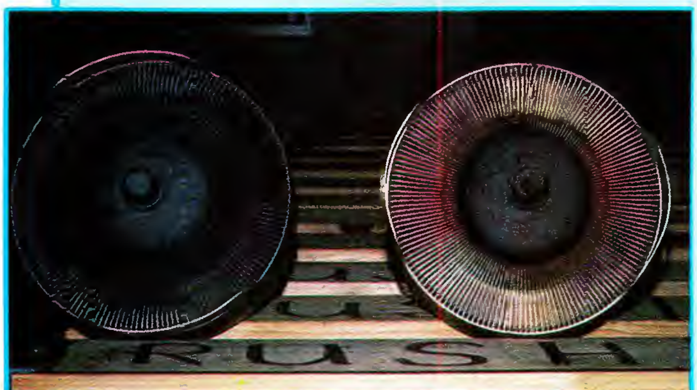
For example, Figure 1 shows an FM transmitter PA stage that includes a group of three doorknob capacitors in

the grid circuit (C36-A-B-C). A failure was experienced with this transmitter in which the system would overload (final plate and screen) whenever high voltage was applied. An examination of the PA circuit showed that C36-A had failed. (In fact, I found pieces of the capacitor spread around the PA input compartment!)

Because of the construction of the capacitor group in the grid circuit, all three parts had to be removed to replace the defective component. Because the doorknob capacitors used for C36-A-B-C are relatively inexpensive, I replaced all three, eliminating any concern that one of the other parts—which did not show outward

Death of a tube

Examining a power tube after removing it from a transmitter can tell a great deal about how well the transmitter-tube combination is working. Whenever a power tube fails prematurely, study it to determine if an abnormal operating condition exists within the transmitter. (Photos and information courtesy Econco Broadcast Service.)



Two 4CX15, 000A power tubes with anode heat dissipation patterns. The tube on the left shows excessive heating due to a lack of PA compartment cooling air or excessive dissipation due to poor tuning. The tube on the right shows a normal thermal pattern for a silver-plated 4CX15, 000A. Nickel-plated tubes do not show signs of heating because of the high heat resistance of nickel.

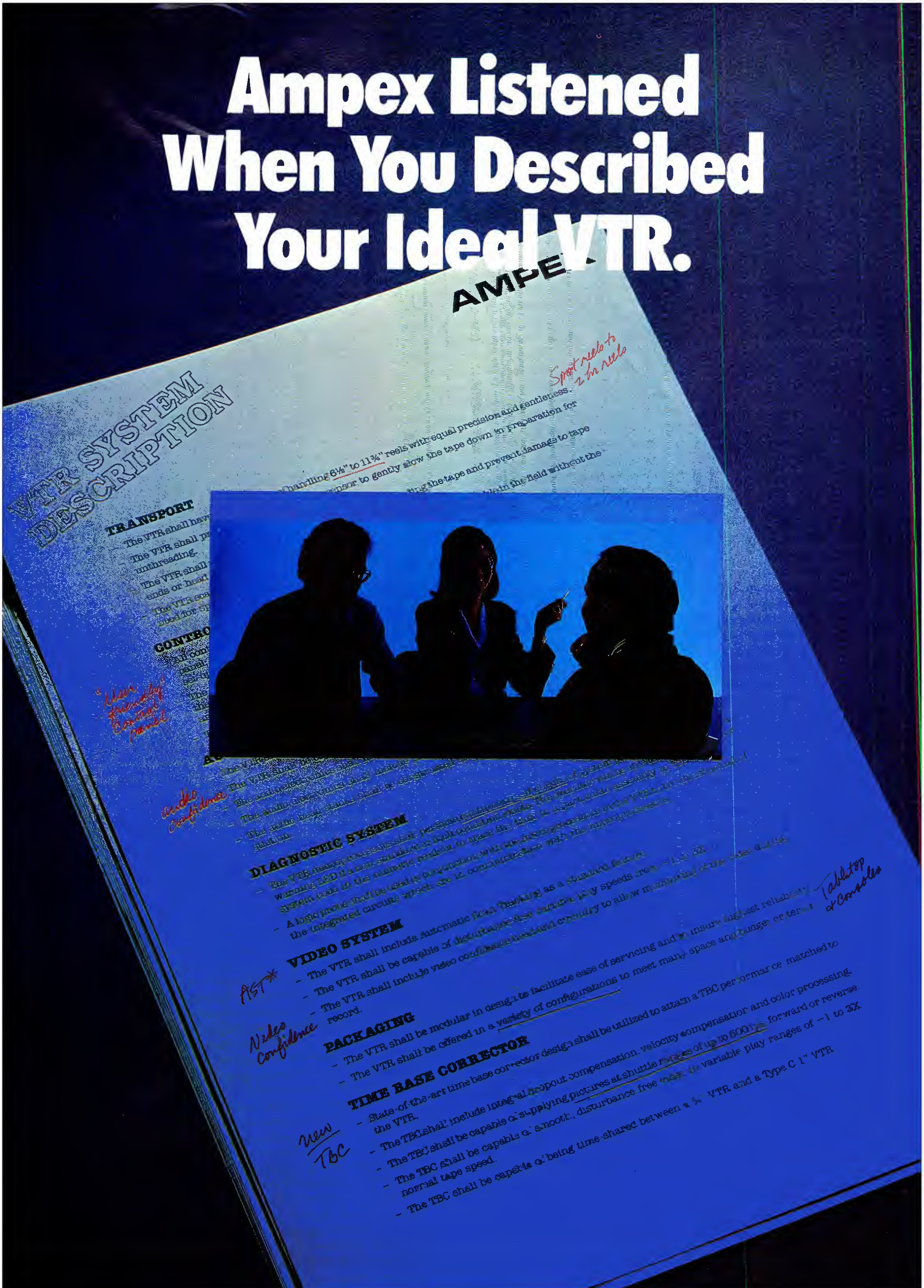
Base heating patterns on two 4CX15, 000A tubes. The tube on the left shows evidence of excessive heating due to high filament voltage or lack of cooling air. The other tube shows a typical heating pattern with normal filament voltage.

A 4CX15, 000A PA tube showing burning on the handle bands of the device where the plate strap makes contact. If possible, make the plate contact below the handle bands, as they are made of cold-rolled steel and are not the best conductor of RF energy.

The stem of a 4CX15, 000A which had gone down to air while the filament was on. Note the blue and yellow deposits of tungsten oxide formed when the filament burned up. The grids are burned and melted because of the ionization arcs that subsequently occurred. A failure of this type will trip overload breakers in a transmitter and is indistinguishable from a shorted tube in operation.

A 4CX5, 000A with burning on the screen-to-anode ceramic. Exterior arcing of this type generally indicates a socketing problem, or a condition external to the tube.

A 4CX10, 000D that was subjected to cruel and unusual punishment. Because all of the contact surfaces are burned and overheated, the tube probably continued to operate after it lost the cooling air. If only the anode were overheated, a loss of antenna coupling would have been suspected. It is also conceivable that this tube was in a fire.



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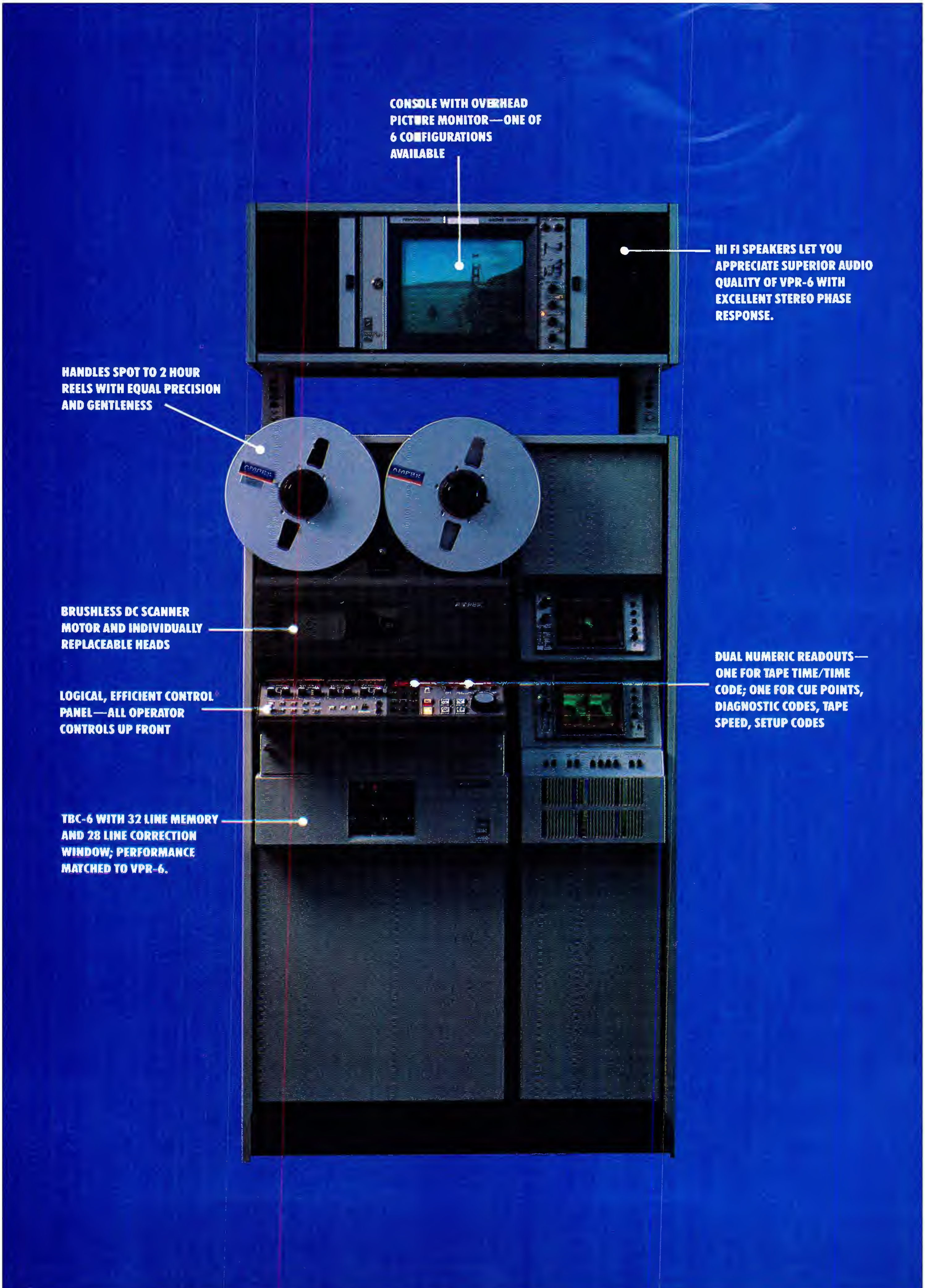
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When hundreds of users worldwide told us what they wanted in a one-inch VTR, we listened closely and then designed and built it. It's our new VPR-6, the easiest VTR to operate, service and maintain of any in its class. And it's in the price/performance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

design of our reliable and proven VPR-80. We also eliminated most wire harnesses in favor of more reliable 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 to quote price and delivery for any model in any world standard, and watch his face light up!

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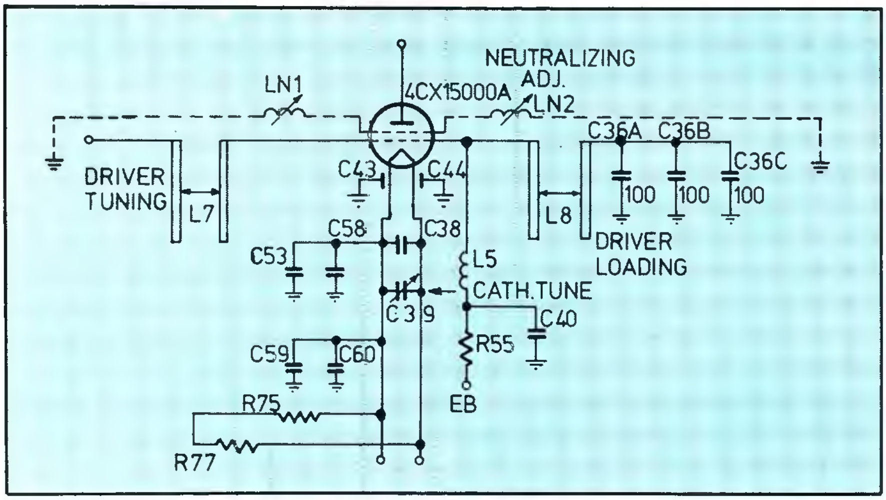


Figure 1. The PA input stage of an FM transmitter. Because of the construction of the *driver loading* capacitor assembly (C36-A-B-C), it may be cost-effective to replace all three capacitors in the event of a problem with the unit.

signs of failure—may have overheated or otherwise been damaged during the fault condition.

The manufacturer's factory service department can often advise a station on the recommended spare parts to stock. Obvious candidates for the spare parts inventory include components that are not available locally, such as special transistors or integrated circuits. A complete set of spare tubes should also be on hand. The past history of the transmitter is often useful in determining the spare parts requirements of a particular piece of equipment. Compile a list of every part that failed in the past from the station's maintenance log when considering spare parts requirements.

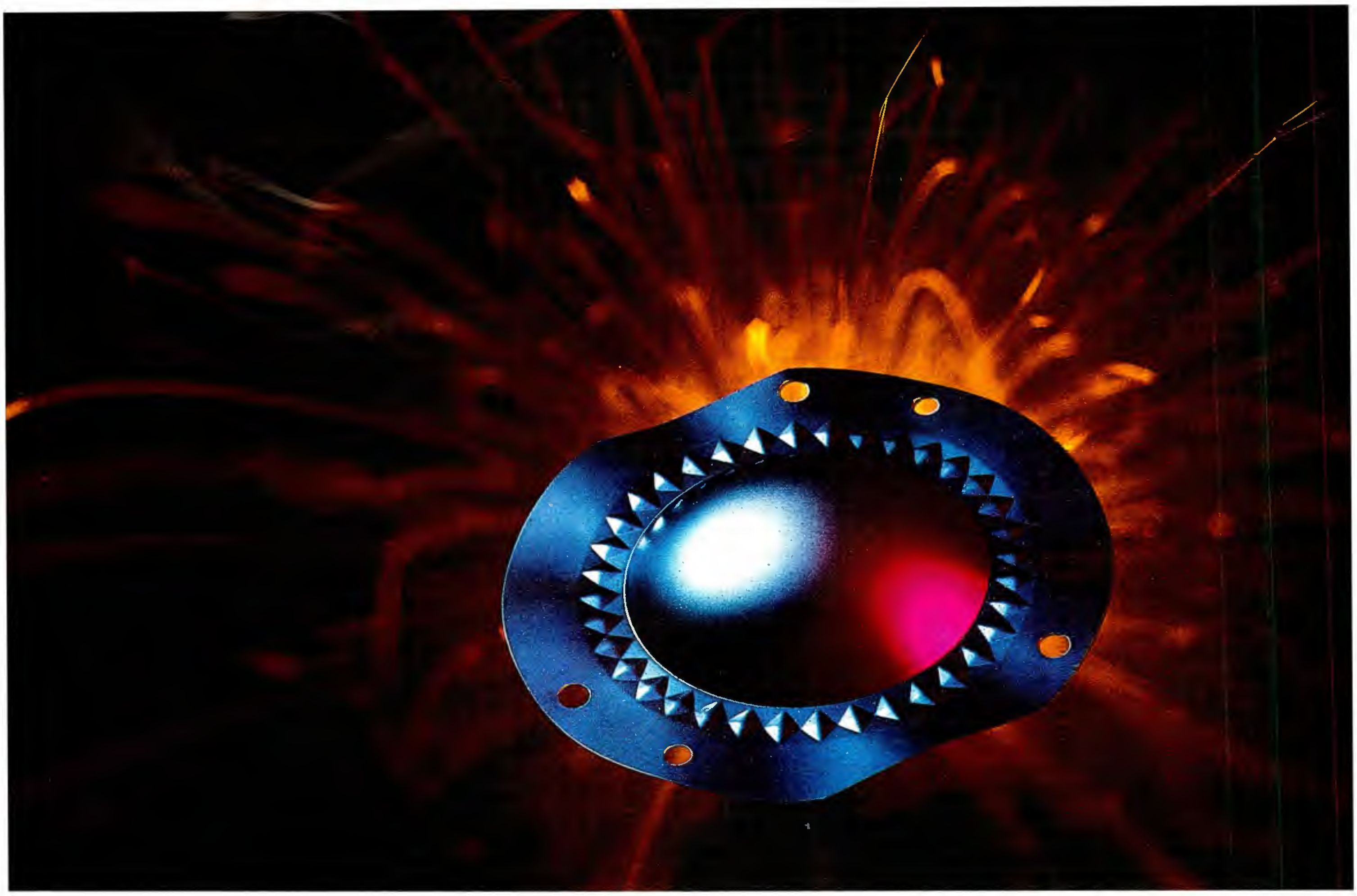
The quick fix

There is no such thing as a *quick fix* with transmitting equipment. Think out any problem and allow ample time to repair it. It makes little sense to rush through a transmitter repair job in order to get the system back on the air if another failure occurs right after the engineer walks out the door. Careful analysis of the cause and effects of the failure will ensure that the original problem is solved, not just its obvious symptoms.

If temporary repairs must be made in order to return the transmitter to a serviceable condition, do it and finish the job as soon as the needed replacement parts are available. There is nothing more irritating than to start working on a transmitter and find that someone had done a quick-fix job on it in the past and had never bothered come back and do the maintenance the right way. A quick fix isn't that fast, and it seldom fixes the problem for any length of time.

Editor's note:
Because equipment maintenance and troubleshooting is important to all broadcast engineers, **Broadcast Engineering** has launched a new monthly column this month dedicated to practical troubleshooting techniques. The first column, which examines the mechanics of VSWR and some of the causes of VSWR overload indications on broadcast transmitter, begins on page 122.

Information in the section dealing with power tube failure was provided by Econco Broadcast Service, Woodland, CA.



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BE proof, Part 4

Tuning in to the future

Although broadcasting's high-tech future has arrived, it is not always put to work day to day. The BE proof program is designed to foster a spirit of technical excellence that will prepare broadcasters for present and future marketplace pressures.

By Jerry Whitaker, radio editor

When we started the **BE** proof program, our goal was to propose a set of performance objectives for FM radio stations to match the capabilities of today's source and transmission equipment. We have been actively seeking comments from industry leaders and engineers in the field on the effort.

Our proof is not designed to replace the FCC-required equipment performance measurements (EPMs), which fulfill an important function by setting minimum levels of acceptable performance for FM stations. Our program, instead, is designed to help broadcasters meet the challenges that threaten their domain.

Unprecedented competition from alternative programming sources and new technologies challenge the broad-

(Photos courtesy Ben Weiss, KLSI, Kansas City, MO (left and center), and Tektronix, Beaverton, OR.)

cast industry. Stations can only compete with these services by delivering to their audiences top-quality programming through top-quality transmission systems.

The **BE** proof objectives (outlined in the August, September and October issues) are geared to maximum station performance, not minimum performance requirements, as the FCC's EPMs are.

The **BE** proof program began with FM radio, and will expand to other services (AM and TV) in future issues.

Survey results

Along with the first article in August, we included a post card questionnaire for reader comments on the proposal. The results of the questionnaire have been encouraging and show the need for such a program.

In a significant statement about how broadcasters view the FCC's EPMs, 85% of the people returning our form said that they felt the current equipment performance measurements were inadequate to evaluate the technical performance of FM radio stations today. A total of 92% said an industry group—such as the NAB, NRBA or SBE—should study the EPM question.

We asked readers in the August questionnaire if they agreed or disagreed with the concept of the **BE** proof program. By a wide margin (92%) respondents agreed with the basic goals of the program. Further, 89% said the performance objectives were about right. It is interesting to note that more respondents felt the performance objectives were not stringent enough (9%) than too stringent (2%).

We are considering implementing a program of voluntary certification of outstanding facilities as part of the **BE** proof, and our survey showed support for the concept. Eighty-one percent of the respondents said they would be interested in participating in a certification program.

> Technical excellence in broadcasting is a full-time effort that demands careful attention to all links in the broadcast chain. The **BE** proof program provides guidelines to help engineers measure their systems against the capabilities of current broadcast equipment.
>
> The performance objectives for the **BE** proof program may look tough, and they do describe superlative FM fidelity. They are, however, achievable.
>
> The basic measurement procedures and performance goals are shown on page 48. Additional information on the test procedures may be found in the September **BE,** page 22.
>
> Next month we will provide readers with a test results reporting form to use with the **BE** proof.

The program would be based on the honor system. After completing the **BE** proof testing procedures, a station would send in the measurement results. The data would be checked against our established guidelines. If a station complied, it would be mailed a certificate. The certification would be good for one year.

Complete results of the **BE** proof questionnaire are shown in Table 1, with these precentages showing market size distribution of the returns:

- Top 25 markets—19%
- 25 to 50 markets—16%
- 50 to 100 markets—16%
- Below top 100 markets—49%

A good distribution exists between large market and small market stations in the questionnaire response rate.

Because of the nature of post card questionnaires, the results are not a scientific analysis of industry opinion. The survey does provide useful information and insight into how a portion of the industry feels about proof of performance standards.

Reader comments

Space on the questionnaire form allowed respondents to comment on the program concept and performance goals. Of the written comments received, 90% were positive about the proposal. Some of the comments:

"The **BE** proof program is the best idea in ages. We are in the process of building an FM station, and we would be interested in participating in a certification program when construction is completed."

"I disagree with your program because smaller-market and independent stations with small budgets may not be able to afford to meet the new 'high-tech' standards dictated by the larger markets. The cost of equipment has already gone out of sight."

"The **BE** proof is an idea whose time came 10 years ago!"

"Someone must pick up the ball, now that the FCC has dropped it."

"The program is a great idea. My problem is getting the equipment to do it. How about an article to station owners on the importance of buying and maintaining good test equipment. They think that if the station sounds OK, then we don't need any test equipment."

"Your figures are more realistic than the FCC's proof because you do not disable the processing chain. The concept of the **BE** proof is similar to a program being implemented by stations in our corporation."

"I'm lukewarm about your program. If the FCC's rules aren't enough, those concerned stations will set their own levels to suit their perceived needs. Stations that care already do that."

"With the various types of audio available to consumers, FM (and AM) radio stations must be as clean as possible in order to compete. For that reason, I agree with the **BE** proof program."

"I like your program, but I think it hasn't gone far enough. The noise figures should be about 10dB better than you are proposing. It is an improvement, though, over the 1930 FCC standards."

"The program is a good idea. I've always thought that the FCC's measurements were very outdated. Modern equipment can do so much better, and therefore, higher standards should be set. Let's get going!"

"I am in favor of the **BE** proof. We need procedures including measurements through the processing equipment, to rate studio and transmission equipment. A program such as this is long overdue."

"The idea is a good one, if it can be pulled off. Quality control is the name of the game in all forms of media. We need to strive for perfection."

Continued on page 53

Performance objectives

- System in stereo mode.
- Input signals applied to console line input(s) used for most program sources.
- System output sampled and demodulated at transmitter antenna output.
- All processing and EQ left in line and adjusted as usual.
- Operating level defined as 0VU or equivalent at console.

Frequency response
Conditions

- AGC voltages switched off, not simply bypassed. Unfortunately, not all processors provide this feature. In such cases, use the *bypass* mode.
- Any convenient modulation level between 50% and 100%.
- Input level as required to maintain reference modulation level.
- Response error expressed as input level deviation required to maintain reference modulation level, compared to the 75μs characteristic for non-Dolby stations or 25μs characteristic with Dolby encoding.

*Superior performance**

- ± 1dB 30-15,000Hz
- ± 0.5dB 50-15,000Hz
- ± 0.2dB 100-10,000Hz

*Excellent performance***

- ± 2dB 30-15,000Hz
- ± 1dB 50-15,000Hz
- ± 0.5dB 100-10,000Hz

*Superior performance is the first proposed **BE** spec representing the maximum performance capability of a state-of-the-art FM stereo facility.
Excellent performance is the second proposed **BE spec. Although it is tighter than the FCC numbers, it is attainable by almost any properly engineered station with typical equipment.

Distortion
Conditions

- AGC switched on, input levels as required to produce specified console levels. De-emphasis in.

Superior performance
at standard operating level

- THD = 0.3%, 30-7500Hz
- IMD = 0.3%, 60Hz & 7kHz, 4:1 at operating level + 10dB
- THD = 0.5%, 30-7500Hz
- IMD = 0.5%, 60Hz & 7kHz 4:1

Excellent performance
at standard operating level

- THD = 1% 50-7500Hz
- IMD = 1% 60Hz & 7kHz, 4:1 at operating level + 10dB
- THD = 1.5% 50-7500Hz
- IMD = 2% 60Hz & 7kHz, 4:1

Audio clipping
Conditions

- Same as for distortion tests except that the input level is increased until left/right channel clipping is observed on an oscilloscope at the indicated test frequencies.
- Clipping level is defined as that level above operating level (0VU) required to produce visible clipping as the input level is increased.

Superior performance

- 30-5000Hz + 15dB

Excellent performance

- 50-5000Hz + 10dB

Composite clipping
"A" conditions

- Composite output of the monitor demodulator viewed on an oscilloscope with the transmission system in the stereo mode (and 19kHz pilot on).
- Clipping level is defined as that level above operating level required to produce visible clipping of the *total* waveform.

Superior performance

- 15dB at 1kHz

Excellent performance

- 10dB at 1kHz

"B" conditions

- Switch pilot off, view waveform clipping as defined above.

Superior performance

- 10dB at 7.5kHz
- 5dB at 15kHz

Excellent performance

- 10dB at 7.5kHz

Noise
Conditions

- Measured at each stereo audio channel output with all processing equipment in the line and adjusted for normal operation.
- Noise level is referred to the output level produced by an input signal at 0VU at the console.

Superior performance

- – 60dB, 30-15,000Hz unweighted, de-emphasis in.

Excellent performance

- – 56dB, 30-15,000Hz unweighted, de-emphasis in.

Separation
Conditions

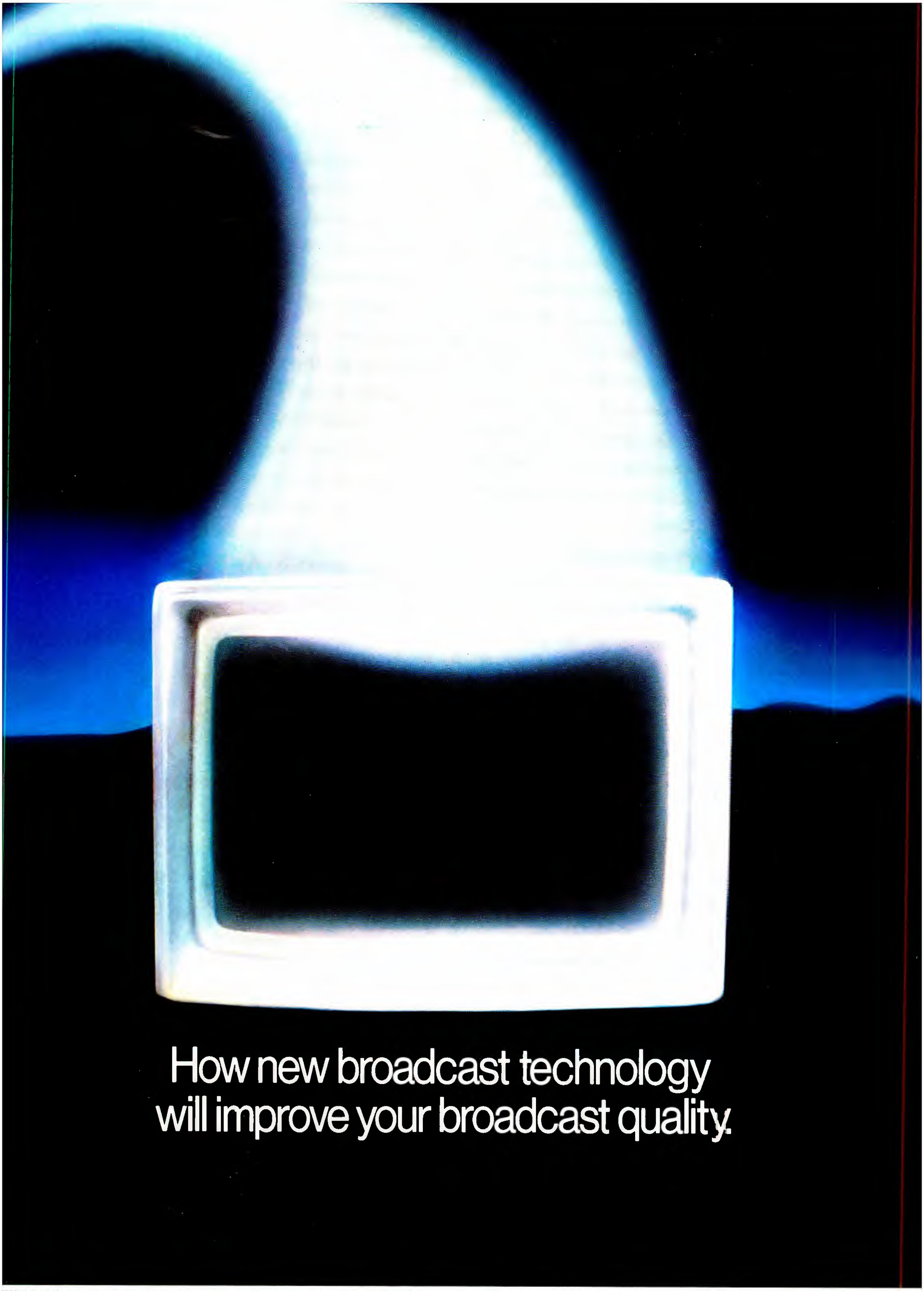
- Measured at each stereo audio channel output with all processing equipment in the line and adjusted for normal operation.

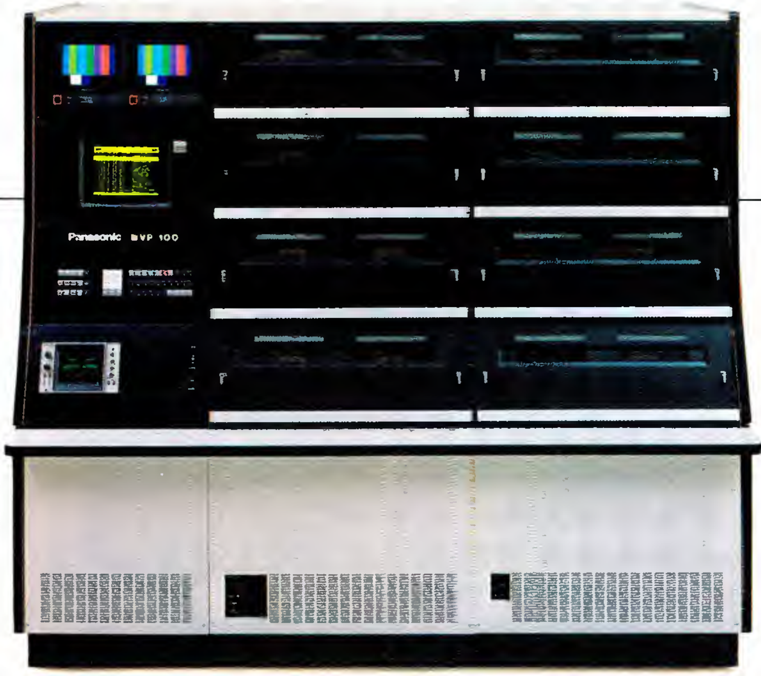
Superior performance

- 40dB, 400-15,000Hz
- 30dB, 30-400Hz

Excellent performance

- 36dB 400-15,000Hz
- 30dB 50-400Hz


How new broadcast technology
will improve your broadcast quality.



Only from Panasonic. Automatic, continuous, reliable broadcasting.

It's the MVP-100 and it will revolutionize your station. Because it lets you program in advance, and automatically air, everything from news spots to commercials to station IDs. Even complete program-length material. All with YIQ quality, time-code accuracy and computer-controlled reliability. At a lower operating cost than conventional cart machines. Its recorders, spot players, and up to 24 modular transports operate independently. So the MVP-100 can even be programmed to override a breakdown the moment broadcast continuity has been interrupted to virtually eliminate dead air.

Panasonic Broadcast Systems.

Panasonic broadcast components can enhance any broadcast system. Not only will we make your images look better with advanced M-Format technology, we'll make it easier for you to originate, produce and broadcast them.

Panasonic Broadcast Systems. Watch us improve your broadcast quality.

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Canada: (416) 624-5010

Panasonic
Industrial Company

Continued from page 48

Proof Program

BROADCAST engineering

Questionnaire

1. Type of **facility:** ☐ AM ☐ FM ☐ TV ☐ Other

2. Your **job category:**
   ☐ Technical ☐ Operations ☐ Management

3. Are **current** FCC equipment performance measurements **adequate** to evaluate the technical performance of FM radio stations today?
   ☐ Yes ☐ No

4. Do you feel an **industry group**, such as the NAB, NRBA or SBE, should **study** the question of station equipment performance measurements?
   ☐ Yes ☐ No

5. Do you agree or disagree with the **concept** of the **BE** Proof program?
   ☐ Agree ☐ Disagree
   Please explain: ______________________

6. Are the **BE** Proof equipment performance **objectives**:
   ☐ Too stringent ☐ About right ☐ Not stringent enough

7. Would you be interested in **participating** in a **BE** Proof **certification** program, if implemented? ☐ Yes ☐ No
   If yes, would you **participate** in the program within:
   ☐ Four months ☐ Eight Months ☐ One year
   Please comment on the **BE** Proof idea: ______________________

SURVEY RESULTS:

1. Type of facility:
   AM 12% **FM 35%** **TV 14%** **Other 5%** **AM-FM 34%**
2. Job category:
   Technical 84% **Operations 7%** **Management 9%**
3. Are current FCC equipment performance measurements adequate to evaluate the technical performance of FM radio stations today?
   Yes 15% **No 85%**
4. Do you feel an industry group, such as the NAB, NRBA or SBE, should study the question of station equipment performance measurements?
   Yes 92% **No 8%**
5. Do you agree or disagree with the concept of the **BE** proof program:
   Agree 92% **Disagree 8%**
6. Are the **BE** proof equipment performance objectives:
   Too stringent 2% **About right 89%** **Not stringent enough 9%**
7. Would you be interested in participating in a **BE** proof certification program, if implemented?
   Yes 81% **No 19%**
8. If yes, would you participate within:
   4 months 26% **8 months 22%** **1 year 52%**

Table 1. Results of the **BE** proof questionnaire that ran in the August issue.

"Using telephone lines, there is no way to meet your performance objectives. No matter how much I would like to participate in the program, I cannot."

"Everyone in radio engineering—who knows the field—agrees that the FCC should have raised its EPM standards years ago. Now it's up to us."

To comment on the **BE** proof program, write to the Radio Editor, **Broadcast Engineering,** P.O. Box 12901, Overland Park, KS 66212.

Canon in Action at the 1984 Olympics

The world saw the Games through Canon Lenses.

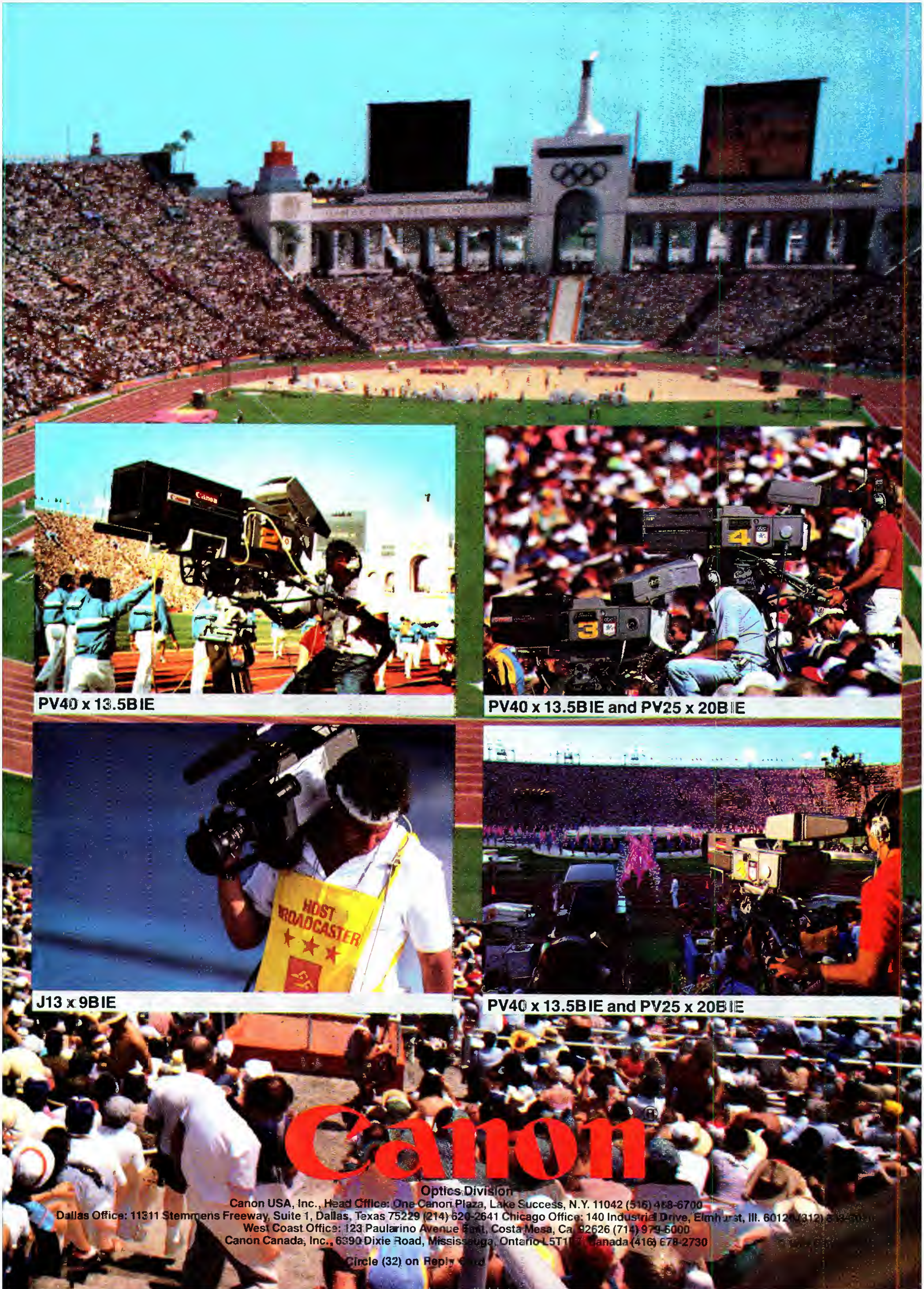
For 16 days during the summer of 1984, the world saw the Games of the XXIIIrd Olympiad through Canon TV lenses.

From a crane high above the Los Angeles Coliseum, a Canon PV 40 x 13.5 was able to show the spectacle of the Games unfolding, and with its awesome 40X reach, isolate a single athlete on the field.

At venues throughout Southern California, a total of 135 Canon lenses captured every aspect of those rare moments that are now sports history. ABC cameras were equipped with Canon PV 40 x 13.5, PV 25 x 20 and PV 18 x 12 lenses. A Canon J20 x 8.5 was used on ABC's Super Slo-Mo camera, while a Canon J25 x 11.5 was shooting aerial pictures from the Goodyear® blimp. ENG camera operators used the Canon J13 x 9BIE and the incredible new J18 x 9BIE for the extra reach that brought us face-to-face with the competitors.

Canon broadcast lenses were also the choice of many independents on the scene in Los Angeles, because Canon's proven performance and reliability assured them of getting the shots they needed at this once-in-a-lifetime event.

If you watched the 1984 Olympics, you've already seen the most spectacular demonstration of Canon TV lenses we could possibly arrange. But we'll be happy to do another just for you.



PV40 x 13.5BIE
PV40 x 13.5BIE and PV25 x 20BIE
HOST BROADCASTER
J13 x 9BIE
PV40 x 13.5BIE and PV25 x 20BIE
Canon
Optics Division
Canon USA, Inc., Head Office: One Canon Plaza, Lake Success, N.Y. 11042
Dallas Office: 11311 Stemmens Freeway, Suite 1, Dallas, Texas 75229 (214) 620-2641 Chicago Office: 140 Industrial Drive, Elmhurst, Ill.
West Coast Office: 123 Paularino Avenue, Costa Mesa, Ca. 92626 (714) 979-6000
Canon Canada, Inc., 6390 Dixie Road, Mississauga, Ontario
Circle (32) on Reply

Developing a TV measuring program

Do you take steps to guard against equipment failure at your station or do you wait for a breakdown to occur?
Maintaining technical logs can point out problems before major catastrophes and technical fiascos occur.

by Carl Bentz, television editor

When the FCC reduced regulation for TV broadcasters, the first-class license was reduced to a general operator license.

More recently, the commission relaxed rules for technical engineering records as well. No more tedious logging of transmitter parameters once every three hours and notes on anomalies during the broadcast day.

However, many chief engineers continued to maintain the log procedures. Why? Technical logs, if properly kept and used, can provide valuable clues to possible problems or breakdowns. The trick is to obtain the correct information and to interpret the data accurately.

Such an operation log generally includes (per 73.1820):

- sign-on and sign-off times
- daily tower light inspection times and status
- EBS tests, received and transmitted
- operating parameters taken at 3-hour intervals, noting readings before any adjustments and any corrective action taken.

Some of the operating parameters:

- constants for determining dc input power to the aural final amplifier (voltage and current) if an indirect determination is used
- RF transmission line meter readings for visual and aural (if direct

Continued on page 68

Automated monitoring systems for TV

The first automated monitoring system available in the United States was the Tektronix 1980 ANSWER system. System software revisions have kept its capabilities current. The system uses vertical interval signals to watch the input of demodulated off-air video. A CRT terminal allows you to communicate with the equipment and to request readings, such as that to request readings, such as that in Figure 1.

A CRT display of the contents of each VI line tells you how things stand. Preset parameter limits form references for the system. If a parameter is found out of tolerance, an alarm is sounded, and a report is printed for the engineering file (Figure 2).

The report includes hard copy waveform plots of complete lines or an expanded segment to assist in problem diagnosis, as in Figure 3. Both NTSC and PAL standards systems are available.

As VI text, data and caption transmissions become more prevalent, it may be necessary to use one line for all of the test signals. In such a case, the terminal controlling the ANSWER unit could converse with a TEK

Continued on page 62

19-OCT-81 13:20:11		PAL APPLICATION PROGRAM	
SYNC AMP ERROR		11.99 %	CAUTION
BURST AMP ERROR		10.94 %	CAUTION
BAR AMP ERROR	-	1.01 %	
BAR TILT		0.11 %	
P/B RATIO	-	0.20 %	
2T PULSE RING		0.40 %KF	
C/L DELAY	-	16.00 NS	
DIFF GAIN	-	0.80 %	
DIFF PHASE	-	1.10 DEG	
DIFF LUM		2.40 %	
C/L GAIN	-	0.83 %	
C/L CROSSTALK	-	0.07 %	
LOW FREQ. ERROR		1.32 %	
S/N RATIO(WEIGHTED)		66.19 DB	
APL		50.00 %	

Figure 1. Report generated at user's request or at prescheduled times.

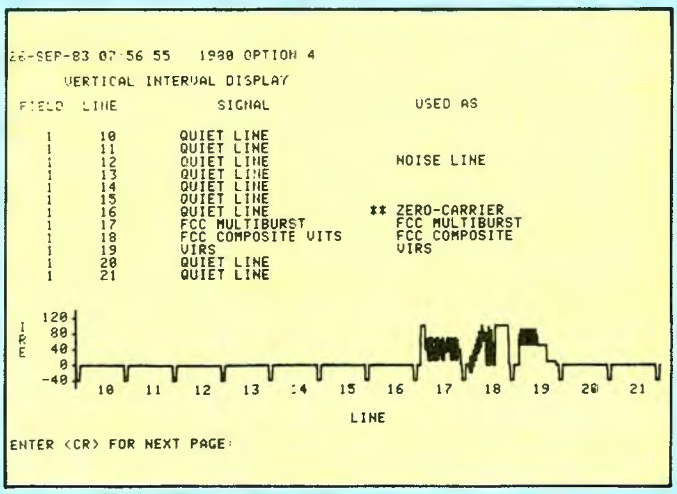


Figure 2. Vertical interval line assignments and display.

STARRING MOLECULAR FUSION BINDING AS THE OXIDE BOND THAT CONQUERED TIME.
PRODUCED WITH EPITAXIAL™ OXIDES FOR BRIGHTER CHROMA & ENHANCED SIGNAL TO NOISE. PLAYED AND REPLAYED WITH NO SIGNAL LOSS.
AND CO-STARRING THE TOUGHEST SHELL IN THE BUSINESS.

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Circle (33) on Reply Card

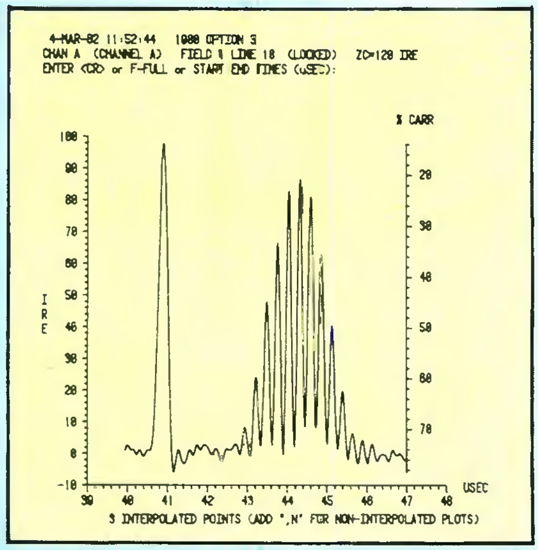


Figure 3. A graphed line may be expanded for closer analysis.

Continued from page 56

1910 digital signal generator, and coordinate the test sent with the test expected by the monitoring system.

In addition to digitally produced test signals, external signals may be inserted into the VI through the 1910.

Circle (300) on Reply Card

Marconi Instruments offers a product line with similar features. The TF2914A insertion signal analyzer uses VITS information to aid check signal quality. Under manual or automatic control, 24 measurements are displayed on a digital readout. You can select five signal sources. Three dc inputs allows other signals to be checked. Two models serve 525- or 625-line applications.

A TF2915 data monitor enables the unit to do limit comparisons, auto parameter scanning and executive control functions. The TF2917 data selector provides an interface between the measurement equipment and a data terminal for remote logging and conversation with the system. Serial ASCII and parallel bcd outputs interconnect to printers and modems.

The TF2923 digital generator completes the Marconi package, with VITS and full field signals. Insertion of teletext, source ID or caption information for the VI is done through two external inputs.

Circle (301) on Reply Card

Philips Test and Measuring Instruments' PM 5578M NTSC unit makes 21 TV signal measurements. Out-of-tolerance checks, A/D conversion and display with ASCII coded data outputs result from each of the VITS-based measurements. Auto or manual selection of five sources is included. Three external inputs serve measurement of parameters not handled by the instrument.

Hard-copy reports may be obtained from two different printer products. For automated logging, a PM 5579 print-out interface is required to drive a teletypewriter. A small format printer for simple and quick hard copies operates without an additional interface.

The test signal source is the PM 5576A generator, which produces NTC7-specification signals. The generator may be reprogrammed on an internal matrix board.

Circle (302) on Reply Card

Rohde & Schwarz also uses an automatic TV test system in the model UPKF. As many as 16 system checkpoints may serve as inputs to the system for manual or auto VI monitoring.

A data terminal, for remote or local control of the UPKF through the UPCF TV data processor, also interrogates storage registers in the equipment, which hold the results of previous test. VITS generator and inserter SKF are used with the UPKF system with models for nearly all TV standards, including NTSC and PAL.

Circle (303) on Reply Card

Thom CAT, from Thomson-CSF, stands for Thomson Computer-Aided Test system, and it includes a sampling analyzer to work with a programmable digital signal generator. Conversation with these two rack-mount units is accomplished through a standard Apple II computer system. A keyboard and video display are standard features.

For hard copy, an optional printer may be interfaced to the computer unit. Up to 13 different test signals are generated. The capability is not limited to CCIR or SMPTE test signals, making up the typical list of bar charts, multiburst, ramps, staircase, sine² pulse, etc. Any type of user-designed signal may be programmed through the Apple system.

Circle (304) on Reply Card

Over 200 broadcasters bought the Harris Medalist audio console in its very first year! Here's why.

Wide input switching flexibility. Transparent audio performance. Choice of attenuators. Adaptability to any application. Excellent cost/benefit ratio. Broadcasters across the country cite these as major reasons for choosing the new Medalist dual stereo audio console over all others.

Switching Flexibility
Input selectors switch *after* the mic preamp, allowing intermix of mic and other types of sources on any channel. The Medalist also gives you six selector positions each for headphone and speaker monitoring.

Superb Audio Quality
Harris engineering makes the Medalist remarkably transparent. The Signal-to-Noise ratio of 95 dB beats the competition by 10 to 20 dB, and is typical of the Medalist's outstanding performance.

Linear Or Rotary: Take Your Pick
Harris gives you a choice—two styles of linear and two styles of rotary attenuators. Intermix rotary with linear if you like, to suit *your* station's particular needs.

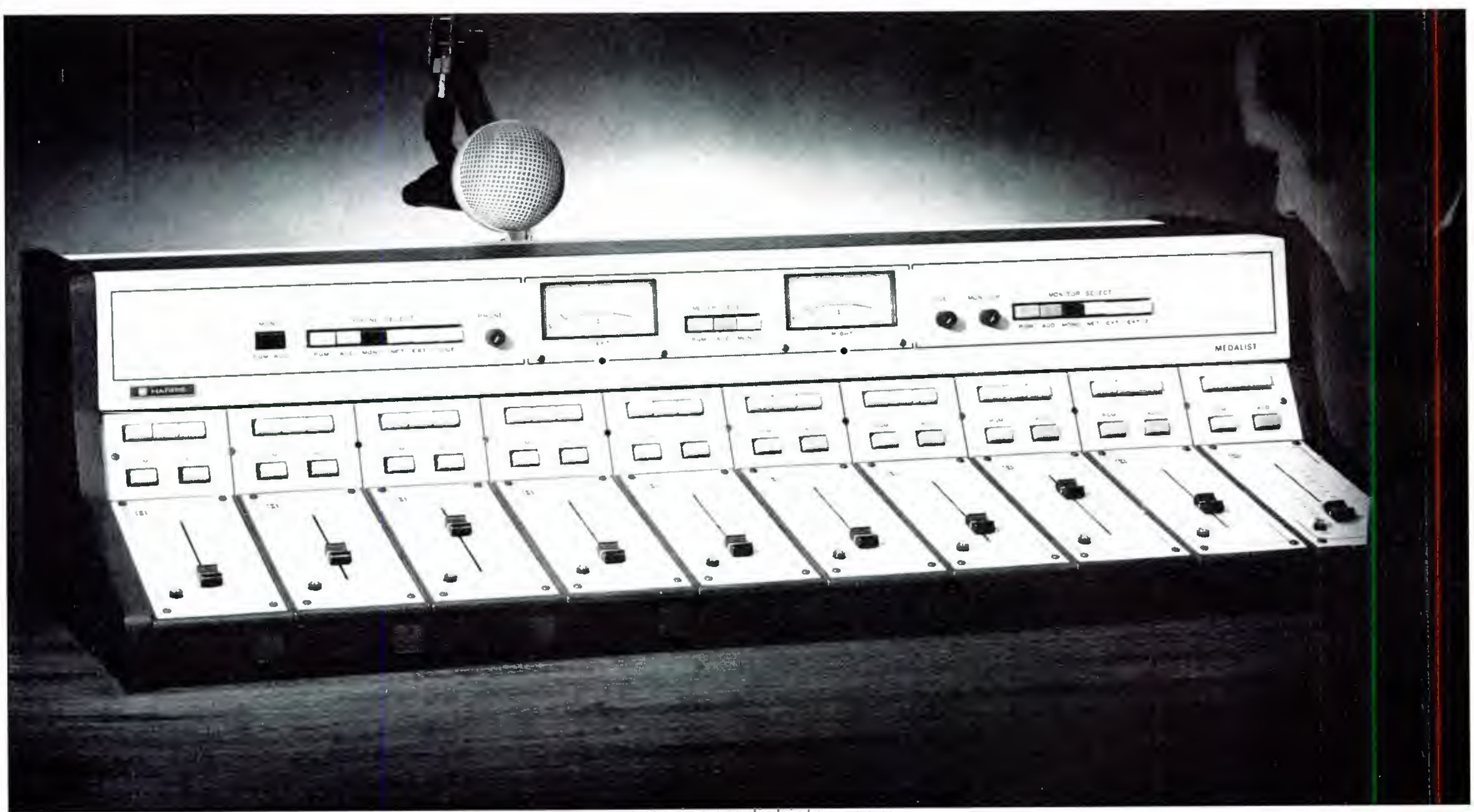
Easy To Install...Easy To Maintain
The barrel terminals on the input and output circuits connect quickly and surely. Additional preamps and program amp interconnect with plug-in ribbon cables. Also, you can change attenuator modules—even while you're on the air—in about the time it takes to cue up a record.

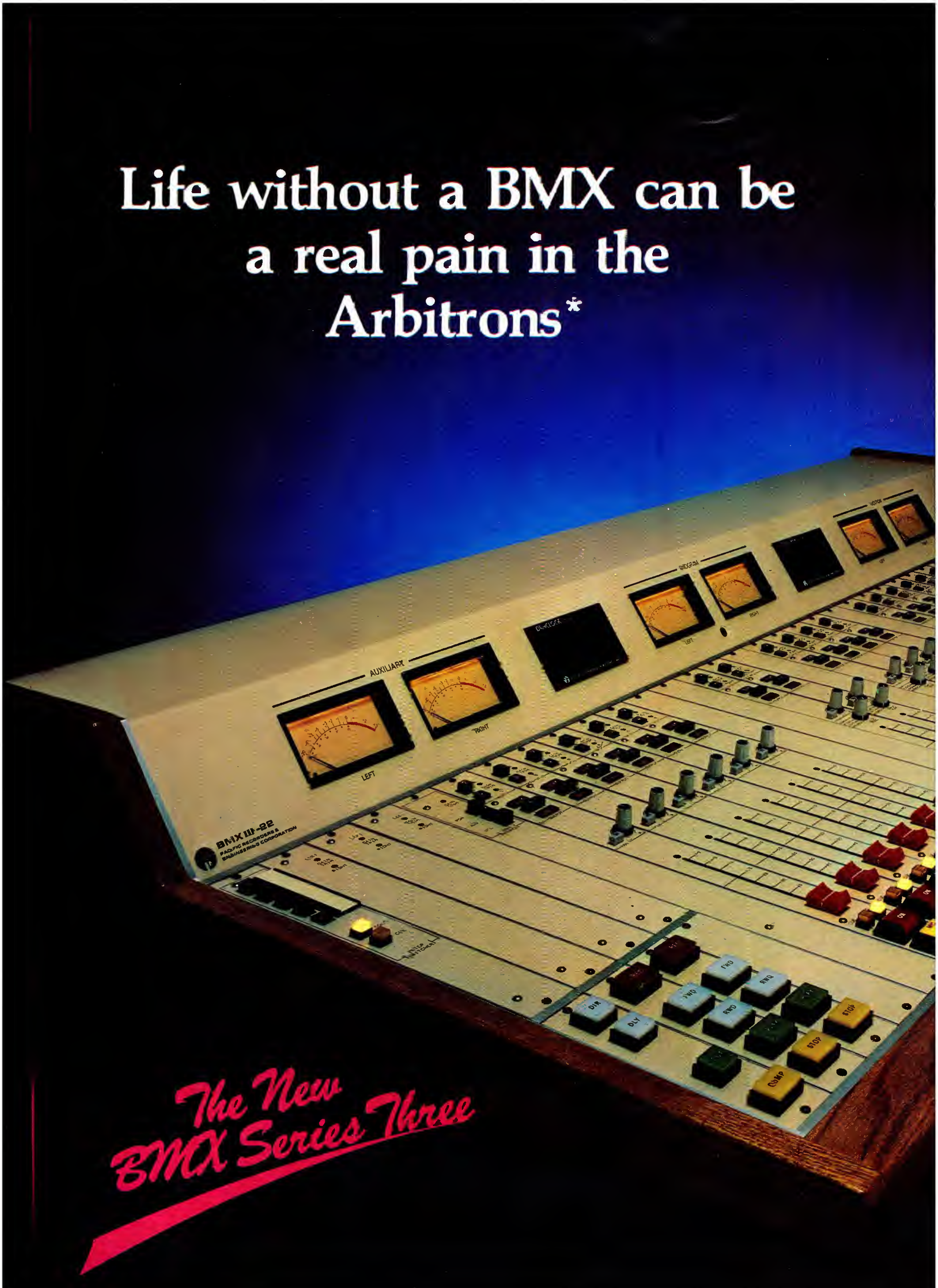
Now In 8, 10 and 12 Channels
The Medalist is equally well suited for AM/FM/TV on-air and production applications. Take your choice of three models—8, 10 or 12 channels.

Learn more about the Harris Medalist family of audio consoles. Write Harris Corporation, Studio Division, P.O. Box 4290, Quincy, Illinois 62305-4290. 217-222-8200.

HARRIS

Circle (35) on Reply Card




Life without a BMX can be
a real pain in the
Arbitrons*
AUXILIARY
LEFT
RIGHT
BMX III-22
PACIFIC RECORDERS & ENGINEERING CORPORATION
The New
BMX Series Three

Frank. This is really serious. Can you do ıe programming and sales team a favor ıd find out what kind of on-air ıuipment that new station recently put ? Their sound is exciting and tight. hey're doing things operationally that we ın't figure out either — their morning am handles all those in-studio and lephone guests so smoothly. Are you ıre you made the right decision to get us ıat budget console in "A"?

"Thanks, Frank. You're a good man. I ıew you'd help us out."

Ain't life a Birch? Just when you ıought you'd be a hero to management, ıved all that money on that bargain MX look-alike on-air board for studio A - the G.M. comes through the door and lls you the ratings are sinking fast.

Here's yet another sound reason why more #1 stations make the Pacific Recorders & Engineering BMX on-air console their #1 choice.

And the really good news for your station is that we've added new, useful features to our proven, ratings-building BMX, and kept the same performance and reliability that's made it, hands-down, the best on-air board you can buy, across-the-board.

Logically enough, we call it our BMX Series THREE.

Because we know you're anxious to hear what's new, here's the quick rundown on our latest console:

The BMX THREE has THREE main stereo mix buses, each with distribution line amplifiers. For increased flexibility for today's programming, we've built-in two telephone mix-minus feeds plus a telephone monitor mix. There's monitor facilities for two studios, not just one. Our system provides independent outputs for the console, host, co-host and guest telephone feeds. The stereo cue system has automatic headphone monitor switching. So that everyone can know what's happening, we've included a multi-way intercommunication system for producer and external feeds. For precise control, we've eng neered each input on the microphone and line modules to have full and independent remote control logic. All BMX THREE's have multi-function metering with automatic cue and solo level display, a voice slating system with a I.D. tone, and for easier performance check-outs, there's a bulit-in multi-frequency, low-distortion test oscillator.

The mainframes for the BMX Series THREE are available from 10 to 34 input positions, and we'll make 'em larger if you need. Naturally, they're fully prewired for all your present and future inputs, outputs, patch points and logic. Every BMX THREE comes with fully-regulated, independent power supplies for the audio, logic and microphone phantom power. Each module has its own on-board audio supply regulation too. Because many of you will be working with our new AMX and ABX production consoles, the audio and logic control systems are fully compatible — and the rear panel interconnections are clearly marked with silkscreened, functional designations.

There's not a lot of options to the BMX THREE, because we've built so much in. However, if you want, you can add two effects/foldback send mix buses, each with remote control logic. The only other option is stereo effects/reverb return, also with remote control logic.

Keeping to our tradition of keeping it simple, the BMX THREE is a clean, uncluttered design — making it easy to understand and operate.

There's a lot more to tell you about, including the impressive specs, but alas, we've run out of space.

Contact us now at 800-874-2172. In California, call 619-438-3911. We'll rush you a color brochure with all the details. While you're at it, feel free to ask about our other products, like the new Micromax, the Tomcat, and our other broadcast consoles that are geared to elegantly solve your toughest production problems.

And, by the way Frank, don't worry. You can probably unload that BMX look-alike, but you'd better hurry — it's not going to be easy after this ad is read.

ike Los Angeles ABC Radio Network affiliate KABC, more #1 stations have made the MX Series consoles their #1 on-air choice.

Pacific Recorders &
Engineering Corp.
2070 Las Palmas Drive
Carlsbad, California 92008
Telex: 181777

The *Choice* for More #1 Stations.

Checking signal quality

Stations need demodulators. A number of specialized instruments have been developed for measuring TV signals as well. The following list of products includes selected items of particular interest for checking on video signal quality.

BE's September Buyer's Guide Issue also lists other TV test products. Reader service numbers are included for your convenience.

ASACA (305)
- 201 envelope delay measuring set
- 925 color video noise set
- 948A differential phase/gain set

Barco (306)
- AVD, TVDM, VSD series demodulators

Broadcast Video Systems (307)
- PW-20 pulse width measurement set

Comark Communications (308)
- TE-2400 demodulator

Crow of Reading (309)
- Crow 69 interval timer

Digi-Tel (310)
- D4060 video noise unit

Elektroimpex (311)
- TR-0771 demodulator series

Grass Valley Group (312)
- 3258 SC/H phase meter (NTSC)
- 3259 SC/H phase meter (PAL)

HVS Image Analyzing (313)
- VP114 extensiometer

JVC Company (314)
- TU22 demodulator

Lenco (315)
- PVS-430 SC/H videoscope
- VNM-428 video noise meter

Link Electronics (316)
- 360 video noise meter

Marconi (317)
- 2920 TV interval timer

Philips (318)
- PM5548 video level meter
- PM5560 demodulator

Plisch Electronics (319)
- FME465 TV measuring receiver (PAL)

QSI (320)
- 400 demodulator

Rediffusion (321)
- RE109 UHF demodulator

Rohde & Schwarz (322)
- LFM2 group delay set
- UPSF2 video noise meter
- AFM2, EKF2 demodulators

Sony Corporation (323)
- TU1100UB UHF demodulator

System Video (324)
- 1204A insertion test analyzer
- 1407 vector analyzer (phase/gain)

Tektronix (325)
- 1430 random NTSC noise set
- 1450 demodulator

Telemet (326)
- 3710 demodulator

Thomson-CSF (327)
- TTV-8300 vecamscope (SECAM only)

Velec (328)
- VS563 demodulator

Videotek (329)
- Delphi I digital waveform meter
- DM-4RA demodulator

Continued from page 56

determination is used), transmitter operating powers
- the results of observations of VITS signals when remote control is being used.

Results of maintenance procedures and observations of the equipment are entered in the maintenance log as outlined in 73.1830 of the rules. Entries include times and dates of operational checks of auxiliary transmitter systems, equipment calibration checks, frequency measurements, quarterly tower lighting conditions, experimental operations and certain equipment in the broadcast chain.

Failures and/or replacements of modulation monitors, transmission system meters and EBS components are also recorded in the log.

A daily checklist

Both the maintenance and operation logs offer a fundamental checklist of system conditions. Adding more items to your log may give you better insight into equipment operation. Although the final power amplifiers are important, keeping track of other sections of the transmitters is also advantageous. Logging exciter, intermediate power amp stages, coolant flow and temperature, filament voltages and currents and feedline pressurization could point to pending disasters.

You could easily troubleshoot daily if you work at a station with co-located studio/transmitter facilities. If your station uses STLs to interconnect the two facilities, the daily process is even more important. An attended transmitter seems to run almost perfectly. The unattended system needs added attention to remain in top condition.

Mark your meter faces with maximum and minimum lines, showing a particular out-of-tolerance parameters. The maintenance report would note unusual meter readings or lighted status (fault) indicators, alerting the chief engineer or staff in charge of maintenance, who would check the data of the noted condition.

Keep an abundant supply of the forms at the transmitter site. Turn in the completed form daily.

Looking for problems

Once the dates are collected, you must interpret them. Just as some automatic systems scan for out-of-tolerance conditions, you should look for any large changes or even slow-moving trends that might point toward failure. Stable voltages and currents on all tubes' elements indicate all is well.

You must know your equipment and how it operates to make such an analysis of meter information and other related notes. A newcomer to the station is not a likely candidate for the job of analyzing the information.

Keeping these logs requires only a few minutes each day, or each week. Preventative maintenance for any questionable item may save you the headache of failure that spells indefinite downtime and perhaps the expense of large replacement parts.

Admittedly, it is not possible to prevent the Murphy's Law event—the one that can't possibly occur but somehow does. However, if a trend shows a device to be aging prematurely, and if it is replaced before an actual failure, you might avoid the domino effect of component destruction. Too often, crash-program maintenance costs more than a preventative approach.

Maintenance at your station can be simplified with careful measuring and logging of information, when done on a regular basis. Observing the results of the measurements can often give warning of pending failure. Work with your staff to better understand the reason for making the measurements. The overall result should be a more pleasant maintenance schedule and a more efficient operation.

Freedom to Choose your Digital Video Processor or Transmit by Satellite Without Affecting your Audio

That's what is designed into Lexicon's Model 1300 audio-to-video delay compensator.

20-kHz bandwidth

< 0.025% harmonic distortion

Transformer balanced inputs and outputs

Delay from 0 to 340, 680, 1365, or 2048 ms – 1300s (stereo) 0 to 680, 1365, 2731, or 4096 ms – 1300 (mono)

+24-dBm input/output level

lexicon

Your video devices should communicate with an audio delay unit that precisely* compensates for video delay, holding lip sync.

The Model 1300 does just that – with any video device you own or expect to own. The Model 1300's advanced engineering provides transparent audio processing and conforms to the 16-bit standard, offering the highest quality broadcast audio even when your signal is passing through a series of delay processors.

The Lexicon Model 1300 has been evaluated and approved by ABC, CBS, and NBC network laboratories and is in use at all three facilities. For more information call or write Lexicon.

*Hysterisis prevents video sampling alone from doing the job – for more technical information call or write for our Delay Synchronizer Applications Note.

Circle (36) on Reply Card

Lexicon-designed and manufactured converter subassembly with 16-bit linear PCM encoding and 48-kHz sample rate

Software-based input control module that measures video timing differences or recognizes pulse widths, RS422, or a variety of other sync protocols

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60 Turner Street
Waltham, MA 02154 USA
(617) 891-6790
Telex 923468
Export: Gotham Export Corporation
New York, NY 10014

Field report: Sound Technology 1510A tape recorder/ audio test system

An internal view of the Sound Technology 1510A tape recorder/audio test system, which features microprocessor-controlled measurement. (Courtesy of Sound Technology.)

By Gary Breed, broadcast technology consultant, Peoria, IL

For many broadcast technicians, the Sound Technology 1510A will be their first look at a microprocessor-controlled automatic test system. And it is a very good unit for that introduction, with many internally programmed functions, as well as an optional IEEE-488 interface bus.

Although originally conceived as a tape recorder test system, the 1510A has so many measurement functions that are universal that the name (1510A tape recorder/audio test system) has been accurately chosen to reflect its true capabilities. It is first an extremely useful tape recorder test set, with enough value in other audio measurement areas to warrant its second label as a general-purpose audio test instrument.

1510A features

As with any of the current generation of complex, automated test instruments, station engineers will not be able to use the 1510A with just a brief look at the front panel controls. For technicians who are used to less complicated test equipment, there may even be some reluctance to use the unit, and that would be a big mistake! After reading the operating manual and practicing a few simple test procedures, tape recorder repair

Rodney Kobayakawa uses SONEX a little differently...

and so do thousands of others.

Just Listen — 1. You might even say that Rodney Kobayakawa's use is off-the-wall. He lines the ceiling of KGMB-TV's remote video truck with SONEX. "Controls the high ambient noise...Close speaker mounting caused problems with sound orientation...and they look so nice! White audiofiles match the chrome look of our equipment." He's the Audio Engineer at KGMB, Honolulu.

2. "Musicians are always impressed by your SONEX products." Dennis Scott of Chelsea Entertainment Organization, who won a Grammy in 1981 for **Sesame Country,** an album featuring Crystal Gayle, Loretta Lynn, Glen Campbell and the Muppets.

3. "Takes the 'ping' out of hard walls." Don Bachmeier, KFYR-TV, Bismarck, N.D. uses SONEX on wheeled, portable panels to kill voices on adjoining news sets.

4. "Delighted with SONEX's effectiveness...pleasing aesthetics...audio professionals notice reduced standing waves...increased soundproofing." Sherrie Thomas, Producer, recording studio for the General Conference of Seventh-Day Adventists, Washington, D.C.

5. "Good!...in radio station's master control and production room." Craig Falkenstine, WJCF, Morgantown, W.V.

Pictures do speak louder than words.

When we asked our customers to show us how they used SONEX, we weren't surprised to hear that SONEX did the job. We knew that SONEX's special acoustical foam — with its sculptured anechoic design — absorbs sound successfully. What really amazed us was the number of different SONEX applications they showed us.* See (and hear) for yourself: **Wherever** sound is the problem, SONEX is the solution.

SONEX is manufactured by Illbruck/usa and distributed exclusively to the pro sound and A/V industries by Alpha Audio. Get all the facts by calling or writing:

AlphaAudio®
2049 West Broad Street
Richmond, Virginia 23220 (804) 358-3852
Acoustic Products for the Audio Industry

*SUBMITTED BY FIRST GROUP OF SONEX PHOTO CONTEST WINNERS

Circle (38) on Reply Card

The 1510A's display of audio parameters include harmonic distortion, frequency response, channel separation, operating level headroom, noise and wow and flutter. (Courtesy of Sound Technology.)

technicians can cut their setup time for any machine by at least 50%.

One manufacturer's recorder repair facility that uses this unit claims to do a complete alignment of a high-quality tape recorder in 5 to 7 minutes—a job that used to take at least a half-hour using a number of separate boxes. This manufacturing facility has also taken advantage of the computer interface capabilities of the instrument to program only the specific tests required for its unit and standards.

The production line or a busy repair facility is an ideal place for the 1510A. However, it is a shame to leave it there when it can do so much useful work at a broadcast facility.

In addition to the IEEE-488 bus, another option that is useful is the ⅓-octave audio spectrum analyzer. With the modern audio equipment found at broadcast stations, the spectral information provided by this feature can be very useful in troubleshooting work. Figure 1 shows some of the many optional test configurations of the 1510A. Figure 2 shows option specifications.

The CRT display is the key to the efficiency of the 1510A. The engineers at Sound Technology have developed a display format that provides information in a logical, relatively simple and highly readable manner. Both graphic and alphanumeric displays of the test functions and results are presented on the oscilloscope-sized CRT. For most tests, the horizontal axis serves as a logarithmic scale of frequency, and the vertical axis serves as a level scale in dB.

For some tests, the display gives a large bar-graph readout—somewhat like an analog meter—while other test displays plot parameters-vs.-time on the horizontal axis. The display also has a 1-dimensional cursor, which can be moved along the horizontal


And now a message on Yamaha's new RM1608 recording mixer.

RM1608

SPECIFICATIONS

TOTAL HARMONIC DISTORTION (T.H.D.)
Less than 0.1% at +4dB *output, 20Hz to 20kHz (all Faders and controls at nominal)

HUM & NOISE (20Hz to 20kHz) Rs = 150 ohms
(INPUT GAIN "−60")

−128dB	Equivalent Input Noise (E.I.N.)
−95dB	residual output noise: all Faders down.
−80dB	(84dB S/N) PGM Master volume control at maximum and all CH PGM assign switches off.
−64dB	(68dB S/N) PGM Master volume control at maximum and one CH Fader at nominal level.
−73dB	(77dB S/N) STEREO Master Fader at maximum and all CH STEREO level controls at minimum level.
−64dB	(68dB S/N) STEREO Master Fader at maximum and one CH STEREO level control at nominal level.
−80dB	(70dB S/N) ECHO SEND volume at maximum and all CH ECHO volumes at minimum level.
−75dB	(65dB S/N) ECHO SEND volume at maximum and one CH ECHO volume at nominal level.

CROSSTALK
−70db at 1kHz: adjacent Input.
−70db at 1kHz: Input to Output.

MAXIMUM VOLTAGE GAIN (INPUT GAIN "−60")

PGM	74dB: MIC IN to PGM OUT.	ECHO	70dB: MIC IN to ECHO SEND.
	24dB: TAPE IN to PGM OUT.	C/R	74dB: MIC IN to C/R OUT.
	34dB: ECHO RETURN to PGM OUT.		24dB: 2 TRK IN to C/R OUT.
	14dB: PGM SUB IN to PGM OUT.	STUDIO	74dB: MIC IN to STUDIO OUT.
STEREO	74dB: MIC IN to STEREO OUT.		24dB: 2 TRK IN to STUDIO OUT.
	24dB: TAPE IN to STEREO OUT.		
	34dB: ECHO RETURN to STEREO OUT.		

CHANNEL EQUALIZATION
± 15 dB maximum
HIGH: from 2k to 20kHz PEAKING. MID: from 0.35k to 5kHz PEAKING. LOW: from 50 to 700 Hz PEAKING.

HIGH PASS FILTER −12dB/octave cut off below 80Hz.

OSCILLATOR Switchable sine wave 100Hz, 1kHz, 10Hz

PHANTOM POWER 48V DC is applied to XLR type connector's 2 pin and 3 pin for powering condenser microphone.

DIMENSION (W x H x D) 37-1/2" x 11" x 30-1/4" (953 mm x 279.6 mm x 769 mm)

Hum and Noise are measured with a −6dB/octave filter at 12.47kHz; equivalent to a 20 kHz filter with infinite dB/octave attenuation.
*OdB is referenced to 0.775V RMS.
• Sensitivity is the lowest level that will produce an output of −10dB (245mV), or the nominal output level when the unit is set to maximum gain.
• All specifications subject to change without notice.

The specs speak for themselves. But they can't tell you how natural, logical and easy the RM1608 is to work. All the controls and switches are logically arranged to help you get the job done quickly and accurately.

And in the tradition of Yamaha's sound reinforcement mixers, the RM1608 sets new standards of reliability as well as ease of operation. For complete information, write: Yamaha International Corporation, P.O. Box 6600, Buena Park, CA 90622. In Canada, Yamaha Canada Music Ltd., 135 Milner Ave., Scarborough, Ont. M1S 3R1.

YAMAHA

Circle (39) on Reply Card

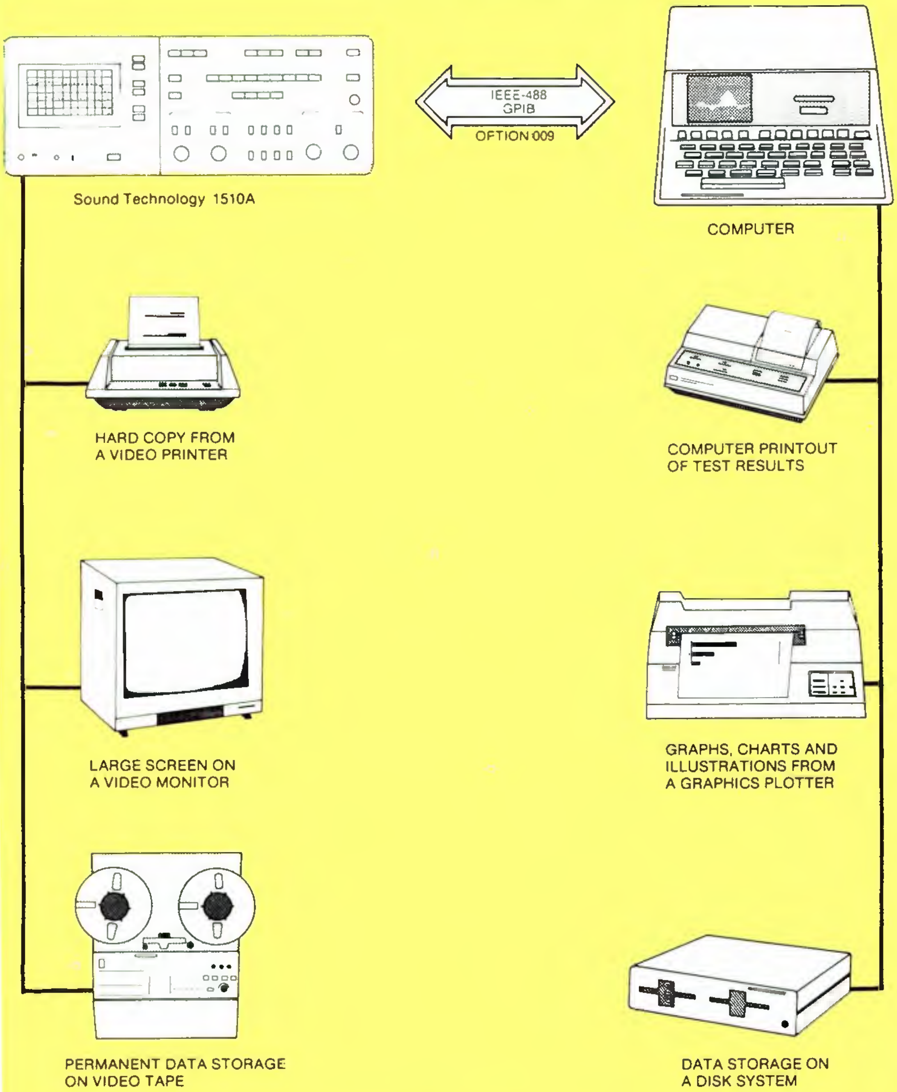


Figure 1. Some of the control and information storage options available with the 1510A. The computer interface option allows equipment measurement under software control from an external data processing system.

Figure 2. A CRT display of spot frequency measurements using the instrument. The system can generate a fast, segmented frequency response sweep from 40kHz to 20Hz. Placing the cursor bar at a point on the CRT trace will generate the alphanumeric data of frequency and level.

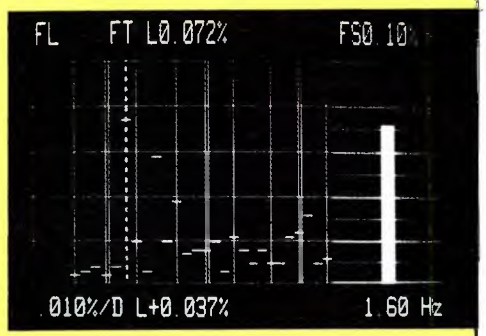


Figure 3. A typical display of tape recorder flutter performance. The upper digital readout gives a 2-sigma smoothed average, and the bar graph shows the instantaneous system flutter.

OPTION SPECIFICATIONS

⅓ OCTAVE SPECTRUM ANALYZER
Accuracy: 1.0dB.
Rejection Ratio: >60dB.
Maximum Peak to Peak Pass Band Ripple: <1dB.
Center Frequency Accuracy: <3%.
Typical Filter Slope: >50dB per octave.
Dynamic Range: >90dB.
Filter: ANSI S1.11-1966 (R1975) Third octave, class II, type 0.
Noise Frequency Range: 20Hz to 20kHz.
Flutter Frequency Range 0.5Hz to 200Hz.

IEEE-488 GENERAL PURPOSE INTERFACE BUS
Compatible with the IEEE-488, ANSI MC1.1 and IEC 625-1 bus configurations. All front panel buttons and functions are accessible from GPIB.

CCIR 468-2 FILTER
Replaces CCIR/ARM filter.

MOL/MAXIMUM OPERATING LEVEL
Measurement & Display: Output level vs. Input level at test frequency.
Measurement Frequencies: 31 user selectable frequencies between 40Hz to 40kHz.
Accuracy: 5%.
Output Level: −10 to +20dB.
Sweep Time: 33s.

DROPOUT
Output Frequencies: 3.0, 3.15 and 8.0kHz.
Measurement Time/Range: 1000s in 20s steps/0 to 253 dropouts per step.
Standard: IEC #94, Sept. 1981.

axis. This is perhaps the display's single most useful feature. At the point selected by the cursor, the value on the vertical axis is presented alphanumerically.

For example, the cursor can be used to obtain a precise reading of frequency response at any point in a sweep test without the ambiguity of an "eyeball" interpretation of the graphical display. Figures 2, 3 and 4 show typical displays from the 1510A.

Test functions

The manufacturer's data sheet lists all the test functions of the 1510A (Figure 5). It has everything, including amplitude, distortion, frequency response, noise and speed errors as well as combinations of functions. Particularly convenient for my applications were distortion-vs.-level test measurements to check headroom and limiting action, and the azimuth

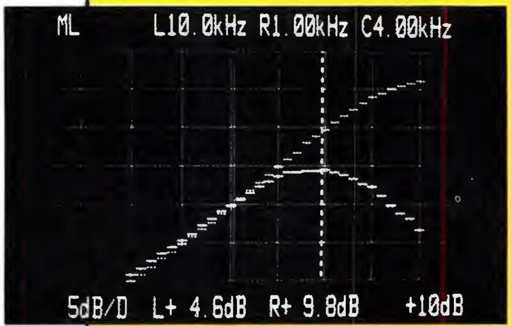


Figure 4. The CRT display for the maximum operation level (MOL) test feature of the 1510A. Sweeping input level-vs.-output level can be done at 31 different frequencies. The measurements can be used to check tape saturation, noise reduction system performance or compressor/ limiter trigger points.

test, which steps the unit under test through a number of frequencies (2.8, 5.7, 11.8 and 15.8kHz) at a 10 frequency-per-second rate.

In my review of the 1510A, I looked for problems and deficiencies, too. One problem, not unique to this unit, is a fixed output impedance of 50Ω, and a high impedance input. This arrangement makes it necessary to add external matching circuitry when testing any impedance-sensitive equipment. A selectable 150/600Ω input and

TEST MODES

AC VOLTS

Measure Left Channel Only, Right Channel Only, or Both Channels

Accuracy: True rms, ±2% of reading with a crest factor no greater than 6.
Autoranging: 300μV to 40Vrms full scale. 10dB steps.
Residual Noise: <100μV.
Display: Vertical bar graph.
Digital readout of acV: 3 digits; dBM: 0.1dB.

AZIMUTH/PHASE METER

Measurement Frequencies: 2.8±1, 5.7±1, 11.8 +1/−4, 15.8±1 kHz.
Cycle Time: 0.1s through noted frequencies.
Measurement Range: ±180° of electrical phase.
Accuracy: ±2° electrical phase (Eqv. to 1/26min of arc in cassette format).
Display: Dynamic; shows instantaneous phase error between L and R channels, plus digital readout of error at measured frequencies.

DISTORTION

Measure & Display: 2nd or 3rd Harmonic vs. Level.
Fundamental Frequencies: User selectable 315, 333, 400 or 1000Hz.
Accuracy: ±5% of reading.
Residual Distortion; Output <0.01%; Input <0.025%.
Input Level from Recorder: Display shows distortion vs. level in 1dB steps.
Output Level to Recorder: +20 to −10dB in ½dB steps referred to preset output.
Sweep time: <40s, +20 to −10dB. Can be terminated earlier with STOP button or at Low Sweep Limit or controlled manually.
Display: Trace shows plot of distortion vs. input level.
Digital readout of distortion in % and dB.

FREQUENCY RESPONSE

Frequency Range: Continuous sweep from 40kHz to 20Hz. Can be

WE'RE FLATTERED

The Most Imitated AM Stereo Processor On The Market

We're flattered that America's stereo broadcasters have made the SMP 900 AM Stereo Processor a best seller. There is no need to compromise the quality of their mono sound for the sake of stereo. With CRL you get BOTH . . . outstanding stereo AND improved mono. There is no loss of coverage.

The SMP 900 typically provides 50 db of separation with 30 db or better at 10kHz. CRL developed the stereo enhance control to increase the apparent separation another 6 db. It has been copied by our competitors . . . We're flattered.

CRL has a patent pending on our single channel negative limiter that prevents single channel information (one channel dead) from creating distortion in the receiver. One of our competitors has copied this idea, but their method produces an instantaneous switch to mono under single channel conditions. This produces a strange "swimming" effect that may upset your stereo listeners.

Another important CRL feature is the continuously variable pre-emphasis control that lets you "fine tune" your sound from the front panel. No plug in modules to fool with. With CRL you decide how you want to sound and adjust accordingly. The decision is yours; not ours.

Call now for more information. Find out why CRL is the processor that the others TRY to copy. Don't just optimize . . . MAXIMIZE with CRL.

Circle (41) on Rea y Card

CRL AUDIO

Circuit Research Labs, Inc.
2522 W. [illegible] Dr. ■ Tempe, Arizona 85282 U.S.A.
(602) 438-0888 ■ TELEX [illegible]0464

terminated earlier with STOP button or Low Sweep Limit or controlled manually.
Accuracy/Resolution: ±5% of reading/±3%.
Amplitude Accuracy/Flatness: ±0.1dB/0.1dB
Minimum Input S/N Ratio: 20dB.
Max Input Signal Slope: 60dB per octave in normal mode.
Sweep Time: 34s from 40kHz to 20Hz.
Output Level Offsets: User selectable +10, 0, −10 or −20±0.1dB.
Display: Trace shows level at 123 discrete frequencies. Digital frequency readout. Level readout referenced to input or display.

SPOT FREQUENCY RESPONSE

Frequency Spots: 20, 50, 100, 200, 500, 1K, 2K, 5K, from 10K to 20K and 40kHz.
Sweep Time: 12s, in fast mode; 17s in normal mode.
Other Specifications: Same as Frequency Response.

CHANNEL SEPARATION

Frequency Range: Continuous sweep from 20kHz to 20Hz with ⅓ octave resolution.
Residual Noise: $<100\mu V$.
Amplitude Accuracy: ±1dB.
Output Level Offsets: User selectable +10, 0, −10 or −20dB ±0.1dB.

△SPEED/DRIFT

Measurement Time/Range: 0 to 610s/±4%.
Output Frequency: 3.0kHz (NAB, JIS) or 3.15kHz (DIN, ANSI) ±.005%.
Display: Trace shows 10 second average speed error vs. time. Digital readouts of both instantaneous and 10 second average error.

FLUTTER

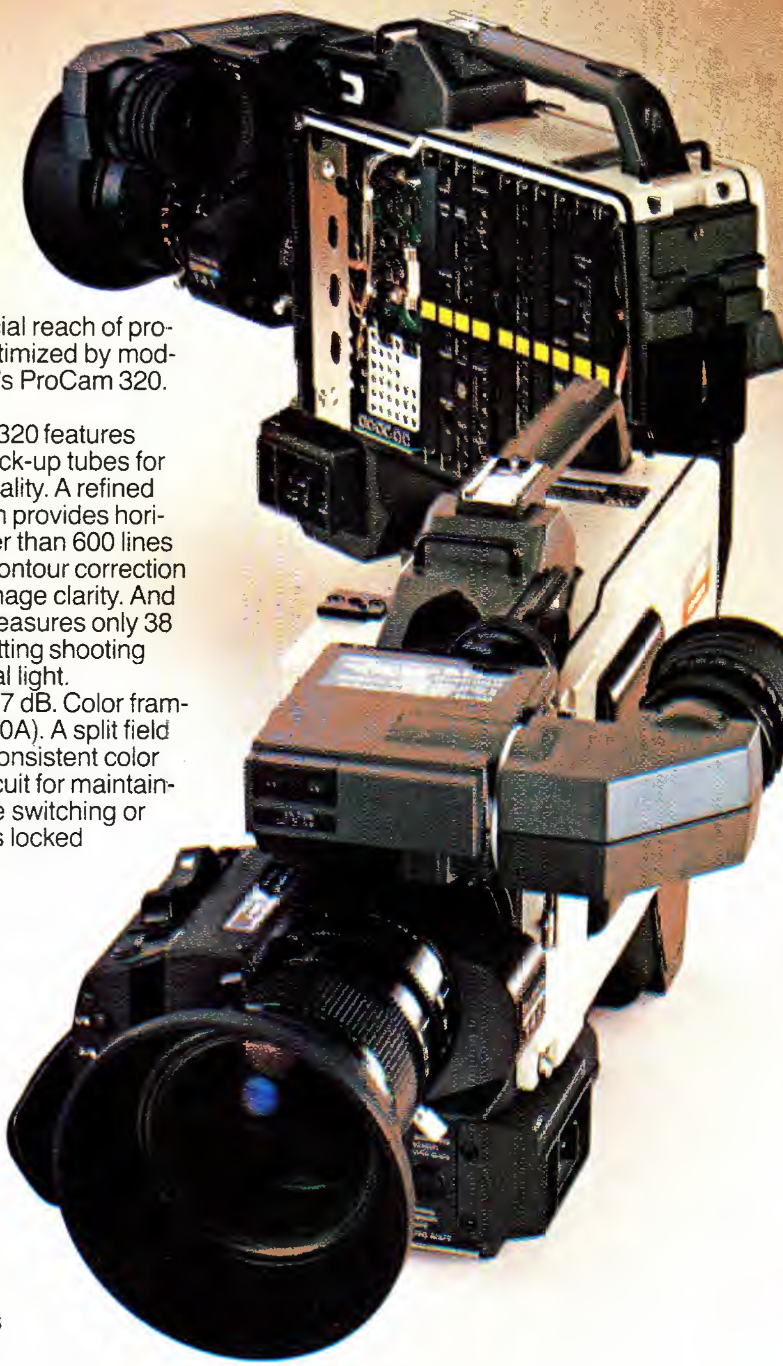
Output Frequency: Same as speed and drift.
Autoranging: 0.03 to 10% full scale.
Accuracy/Residual Flutter: ±5% of reading/<±0.005%.
Detection, Weighting and Display Dynamics: Per NAB, JIS, or DIN/ANSI standards.
Display: Vertical bar graph. Digital readout shows 2-Sigma signal (smoothed, 95% of peak).

NOISE

Residual Noise: (1V reference) Flat −92dB, Weighted −97dB.
Flat Response: −3dB points at 20Hz and 20kHz.
Detection, Weighting and Display Dynamics: Per NAB, ANSI, CCIR/ARM or CCIR standards.
Output: Floating 50Ω termination.
Accuracy: ±5%.
Display: Autoranged vertical bar graph with digital readout referred to input reference level.

320.

The ProCam™ Video Camera with Plumbicon* tubes at Saticon** price.



JVC's experience—and success—in designing the highest quality and reliability into compact video production cameras is unmatched. Now, continuing this tradition of high performance at an affordable price, JVC has brought a "high-end" teleproduction camera within the financial reach of production people often victimized by modest budgets. This time, it's ProCam 320.

What a package!

SENSITIVITY. ProCam 320 features three, 2/3" Plumbicon pick-up tubes for incomparable picture quality. A refined f/1.4 prism optics system provides horizontal resolution of better than 600 lines at center. A 2H vertical contour correction circuit further assures image clarity. And minimum illumination measures only 38 lux (3.6 fc) at f/1.7, permitting shooting even in limited or artificial light.

A video S/N ratio of 57 dB. Color framing output signal (RS-170A). A split field color bar generator for consistent color reference. A genlock circuit for maintaining a stable picture while switching or mixing with other signals locked on the same source.

EASY OPERATION. Several 8-bit data memory chips offer operator conveniences for quick set-up and consistent performance. These include: Auto centering, auto-black balance and auto-white balance, auto black level stabilization and auto beam control circuits. Matrix masking for true color reproduction and automatic protection for the pick-up tubes are a few of the many features standard on this new camera.

VERSATILITY. Easy portability. Outstanding performance in low-level lighting. High degree of automation. An extensive selection of options and accessories combine to make the ProCam 320 suitable for both studio production, EFP or ENG; or, indeed, to any application, anywhere, that calls for top quality video production while staying within a tight budget.

PROCAM TECHNICAL SUPPORT. Your ProCam sales representative will be happy to explain the availability and calibre of the ProCam technical support program.

For a demonstration of the ProCam 320 Video Camera, a 320 Spec Sheet, or JVC's complete catalog, call, toll-free:

1-800-JVC-5825

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PROCAM
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Professional Video Division

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GENERAL SPECIFICATIONS

OUTPUT

Balanced and Floating Dual Channel

Impedance: 50Ω ± 1%.
Response: 20Hz to 40kHz < ± 0.1dB.
Maximum Levels: + 30dBm for distortion and MOL test. + 20dBm for frequency response and channel separation test. + 10dBm for ac volts, △Speed, Flutter and Dropout tests.
Level Control: 0.1dB vernier with a 20dB range.
Level Attenuation: Selectable 20, 40 or 60dB.
Differential Residual Noise: < 50μV.

INPUT

Differential Dual Channel

Impedence: 100kΩ ± 1%.
Maximum Level: + 34dBm (42Vrms).
Minimum Level: – 70dBm (245μVrms).
Common Mode Rejection: > 60dB at 60Hz.
Response: 20Hz to 40kHz > ± 0.1dB.
3dB Bandwidth: > 100kHz

GENERAL

Rear Panel Outputs: Composite video signal, 1V p-p ± 6dB, 75Ω, negative sync. Demodulated flutter signal, autoranged, < 15V p-p, 1kΩ.
Power: 100, 120, 220, 240V, 48-66Hz, 120W.
Dimensions – HWD: 7.0 X 17.0 X 16.4" (18 X 43 X 42cm).
Weight – Net/Ship: 34 lbs. (15.5kg)/43 lbs. (19.5kg).
Environmental: 90% RH, + 50 to + 104°F (+ 10 to + 40°C).

output impedance would be a welcome addition.

Another area that might be a problem to some users is not of a technical nature but rather the purpose for which the unit was designed. The 1510A is an outstanding tape recorder test set, with general audio test capabilities as a secondary function. Users should, therefore, closely study the features of the unit to be sure that it will satisfy their needs, if tape recorder (reel-to-reel or cartridge) work is not a primary application.

The Sound Technology 1510A has been designed for ease of operation, moderate price and excellent performance. The built-in test programs make it relatively easy to get started with the system, and the optional computer interface makes it possible to access all of the power within the unit.

The manufacturer will often make the 1510A available for evaluation and review by a potential user, and such concern for the technician should be commended.

Editor's note:

The field report is an exclusive **BE** feature for broadcasters. Each article is prepared by the staff of a broadcast station, production facility or consulting firm. The intent is to have the equipment tested on-site. The author is at liberty to discuss his research with industry leaders and to visit other broadcasters and/or the manufacturer to track down pertinent facts.

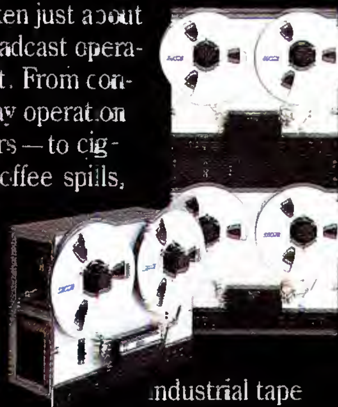
In each field report, the author will discuss the full applicability of the equipment to broadcasting, including personal opinions on good features and serious limitations – if any.

In essence, these field reports are prepared *by* the industry and *for* the industry. Manufacturer's support is limited to providing loan equipment and 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 a product endorsement or disapproval by **Broadcast Engineering.**

For more information on the Sound Technology 1510A Tape Recoder/Audio Test System, contact Sound Technology, 1400 Dell Ave., Campbell, CA 95008.

TAKE YOUR BEST SHOT



Otari's ARS-1000 Automated Radio Station Reproducer has taken just about everything that broadcast operation has thrown at it. From continuous day after day operation in hot, dusty corners — to cigarette smoke and coffee spills, an ARS performs automation tasks flawlessly and faithfully.

Born from Otari's line of heavy duty industrial tape duplicating and loading equipment that moves tape at up to 480 ips, the ARS-1000 is engineered for continuous use, simple operation, and ease of maintenance.

Bulletproof? Of course not. But it *is* the kind of equipment that frees you to get involved in the real challenges of today's new, dynamic radio. Because you're not constantly fixing something that shouldn't have broken in the first place. From Otari: The Technology You Can Trust.

Contact your nearest Otari dealer for a demonstration, or call Otari Corporation, 2 Davis Drive, Belmont, CA 94002 (415) 592-8311 Telex 910-376-4890

OTARI.

Circle 45 on Reply Card

SONY PRESENTS THE MOST ADVANCED FIELD/STUDIO CAMERA UNAVAILABLE TODAY.

INTRODUCING THE SONY BVP-360. ON MAY 1, 1985, THE REMARKABLE BECOMES AVAILABLE.

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

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

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

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

THE ⅔-INCH IMAGE FORMAT COMES OF AGE.

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

First, the BVP-360 employs the remarkable, Sony-developed ⅔″ Mixed Field* tubes. The first real challenge to big tube performance. Because they deliver twice the registration and geometric accuracy of conventional ⅔″ tubes. Plus greater depth of modulation. And thanks to the special Sony-developed FET that is built into the tube and yoke, an extraordinary signal-to-noise ratio. (MF Plumbicon™ or MF Saticon™ tubes are available.)

Secondly, the Sony BVP-360 is equipped with a breakthrough F1.2 prism design that single-handedly results in sensitivity and depth-of-field comparable with 25mm image formats. And vastly superior to any current ⅔″ Field/Studio camera at any price.

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

A SUPERHUMAN FEAT OF HUMAN ENGINEERING.

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

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

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

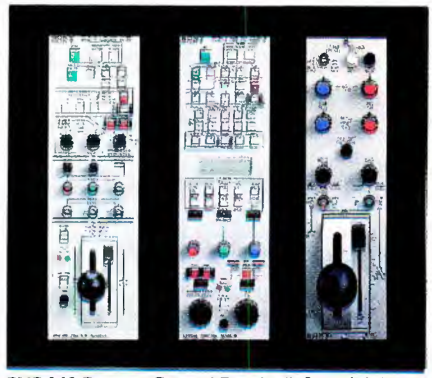
And still others referred to the BVP-360's extensive camera head memory, which can store up to sixty-four scene files, eight setup files, sixteen lens files and three reference files.

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

NOT JUST A CAMERA. A CAMERA SYSTEM.

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

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



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

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

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

ADOPT A WAIT-AND-SEE ATTITUDE.

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

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

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The effects of ac line disturbances

Part 3

Part 3 of our examination of the effects of ac line disturbances on broadcast equipment examines the mechanics of component failure because of transient overvoltages.

By Jerry Whitaker, radio editor

Transient protection is important in a modern broadcast facility because of the widespread use of high-speed logic systems, sensitive analog integrated circuits and low-voltage discrete semiconductors. These devices require a clean supply of power in order to perform correctly. The first line of defense in the protection of broadcast equipment from damaging transient overvoltages is the ac-to-dc power supply.

The power supply components most vulnerable to damage from an ac line spike are generally the rectifier diodes and filter capacitors. Diodes will occasionally fail from one large transient, but many more fail because of smaller, more frequent spikes that punch through the device junction. Such occurrences explain why otherwise reliable systems fail "without apparent reason."

Capacitors are vulnerable to damage from transients because the working voltage of the device may be exceeded during the occurrence, punching a hole in the dielectric and leaving the capacitor useless at its normal operating value. The most damaging conditions result from an operational change with the "right" amount of residual magnetism in the power supply transformer or dc reactor, or an operational change with the "right" amount of energy in the filter capacitor(s).

Although these situations may be rare in normal operation, the possibility of such *worst case* conditions cannot be disregarded.

Semiconductor failure

Transistors and other semiconductor devices can be destroyed or damaged by transient disturbances in one of several ways. A high reverse voltage applied to a non-conducting PN junction can cause avalanche currents to flow, heating the junction ir-

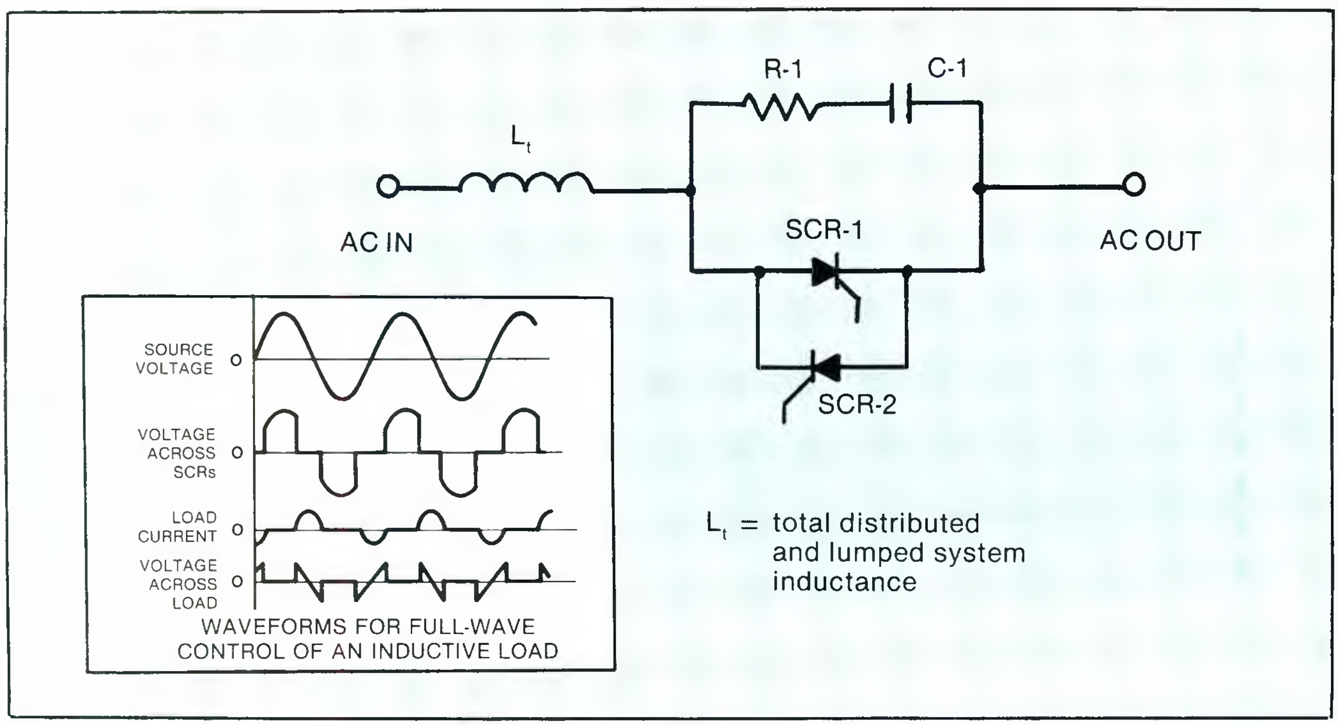

Figure 1. The basic R-C snubber network commonly used to protect thyristors from fast rise-time transients.

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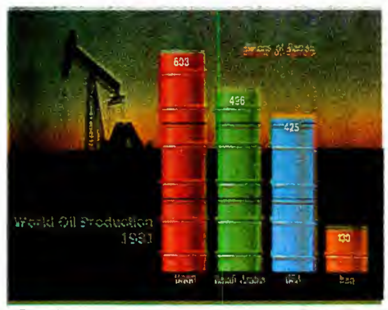
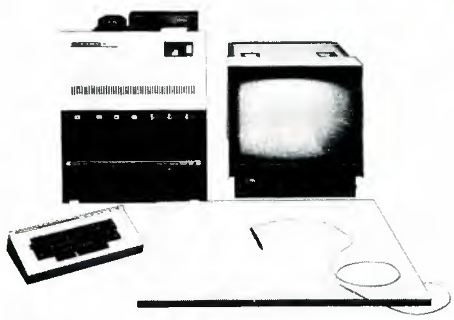


Graphics like this are easy on the Paint Box.



MCI/QUANTEL
The digital video people.

Circle (47) on Reply Card

regularly and consequently releasing more carriers, which conduct added current in the heated junction area.

If enough heat is generated in this process, the junction can be damaged or destroyed. A damaged junction will result in higher than normal leakage currents, increasing the steady-state heat generation of the device, which may ultimately destroy the semiconductor junction.

If such a process occurs between the base and emitter junctions of a transistor, the effect may be either minor or catastrophic. With a minor failure, the transistor's gain can be reduced by the creation of "trapping centers," which restrict the free flow of carriers. These "trapping centers" are created by avalanche-damaged emitter-base junctions. With a catastrophic failure, the transistor will cease to function altogether.

Another transient-caused failure that is possible in a semiconductor device is thermal runaway triggered by a sudden increase in gain resulting from the heating effect of a transient on a transistor. This increased gain caused by the transient disturbance can bring a transistor (operating in the active region) out of its Safe Operating Area (SOA).

The oscillating and decaying tail of many transient disturbances can also subject semiconductor devices to severe voltage polarity reversals, forcing the components into or out of a conducting state. This action can damage the semiconductor junction or result in catastrophic failure of the component. The position of the transient on the ac wave can have a significant effect on the damaging potential of a disturbance. This explains, in part, why identical spikes do not always cause identical damage.

Thyristors (SCRs), like diodes, are subject to damage from transient overvoltages because device's peak inverse voltage or instantaneous forward voltage (or current) ratings may be exceeded. Thyristors face an added problem because of transient occurrences due to the possibility of device misfiring.

A thyristor can break over into a conduction state regardless of gate drive if either a too-high a positive voltage is applied between the anode and cathode or a positive anode-to-cathode voltage is applied too quickly (dv/dt rating). If the leading edge is sufficiently steep, even a small voltage pulse can turn a thyristor on. This represents a threat not only to the device, but to the load that it controls.

Any application of a thyristor must take into account the device's dv/dt rating and the electrical environment in which the unit will operate. A thyristor controlling an appreciable amount of energy should have protection against fast rise-time transients that may cause the device to break-over into a conduction state.

The most basic method of softening the applied anode-to-cathode waveform is the resistor/capacitor snubber network shown in Figure 1. This standard technique of limiting the applied dv/dt relies on the integrating ability of the capacitor. In Figure 1, C-1 "absorbs" the excess transient energy, while R-1 defines the applied dv/dt with L_t, the external system inductance.

An applied transient waveform (assuming as infinitely sharp transient wavefront) will be impressed across the entire protection network of C-1, R-1 and L_t. The total distributed and lumped system inductance, L_t, plays a significant role in determining the ability of C-1 and R-1 to effectively

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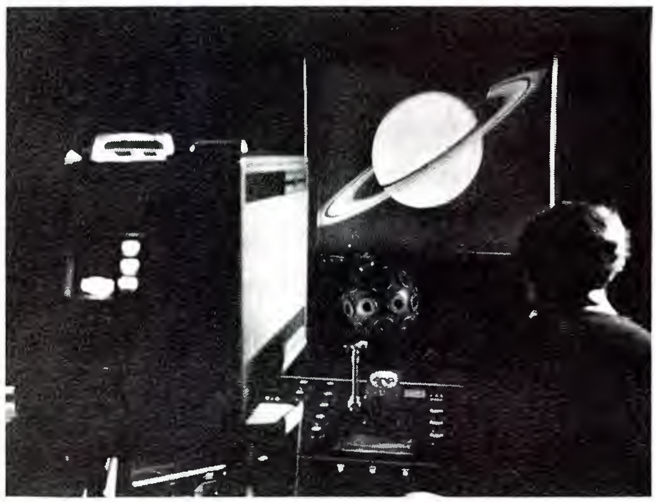
View from ringside transmitted live to guests in Caesar's Palace lounge.



View from spacecraft transmitted live from NASA to sell-out planetarium crowd.

View from finish-line projected in racetrack lounge is preferred over grand stand by many patrons.

View from armchair at home is duplicated between races to draw extra admission fee at racetrack lounge.

GENERAL ELECTRIC

Circle (49) on Reply Card

snub a transient waveform. Power sources that are "stiff" (having little series inductance or resistance) will present special problems to design engineers seeking to protect thyristors from steep transient waveforms.

Problems can be caused in broadcast facilities by transient overvoltages not only through device failure, but also because of logic state upsets. Studies have shown that an upset in the logic of typical digital circuitry can occur with transient energy levels as low as 1 x 10^{-9}J. Such logic state upsets can result in microcomputer latch-up, lost or incorrect data, program errors and control system shutdown.

In addition to the single-occurrence logic upset, exposure of semiconductors to a high transient environment can cause a degrading of the device, which can eventually result in total failure. Figure 2 shows the energy-vs.-survival scale for several types of semiconductors. This chart clearly shows the importance of effective transient suppression.

Other components

The high voltages that are often generated by breaking current to an inductor with a mechanical switch can, with time, cause pitting, corrosion or material transfer of the switch contacts. In extreme cases, the contacts can even be welded together.

The actual wear (or failure) of a mechanical switch is subject to many factors, including the contact construction and type of metal used, amount of contact bounce that typically occurs with the particular switching mechanism, the atmosphere, temperature, steady-state and in-rush currents and whether ac or dc voltages are being switched by the mechanism. Another significant factor in switch contact wear is the amount of energy that is dissipated in each operation of the device.

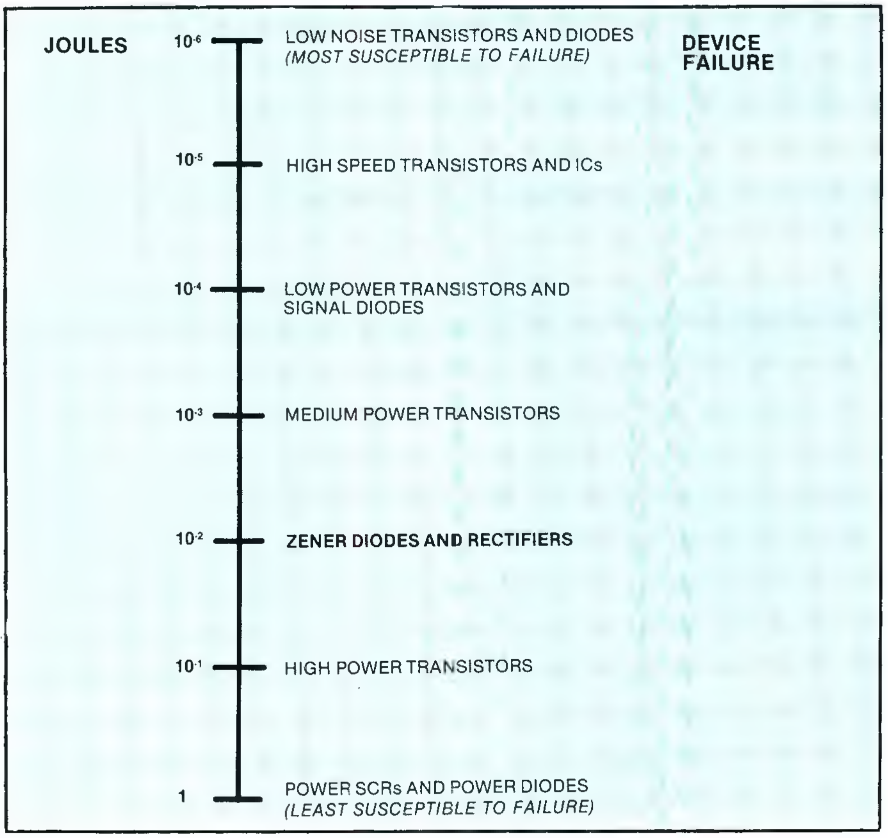
Effective transient suppression can significantly reduce the amount of energy dissipated during the operation of switch contacts. This reduction in dissipated energy will result in a corresponding increase in switch life. In applications where relay contacts are acting as power switching elements, the use of effective transient suppression techniques will reduce the amount of maintenance (contact cleaning) required for the device.

Transient suppression can also reduce the problems resulting from insulation breakdown. The breakdown of a solid insulating material usually results in localized carbonization, which may be catastrophic, or may simply result in decreased dielectric strength of the material at the arc-over point. The occurrence of additional transients will often cause a breakthrough at the weakened point in the insulating material, and eventually result in catastrophic failure of the insulation.

Similar problems can occur within the windings of a transformer or coil. Arcing between the windings of an inductor is often caused by self-induced voltages with steep wavefronts that are distributed unevenly across the turns of the coil. Repetitive arcing between windings can cause eventual failure of the device.

Printed circuit board arcing can result in system failure modes in ways previously outlined for insulating materials and coils. A breakdown induced by high voltage along the surface of a PCB can create a slightly conductive path of carbonized insulation and vaporized metal from the printed circuit wiring traces or component leads.

Circle (51) on Reply Card



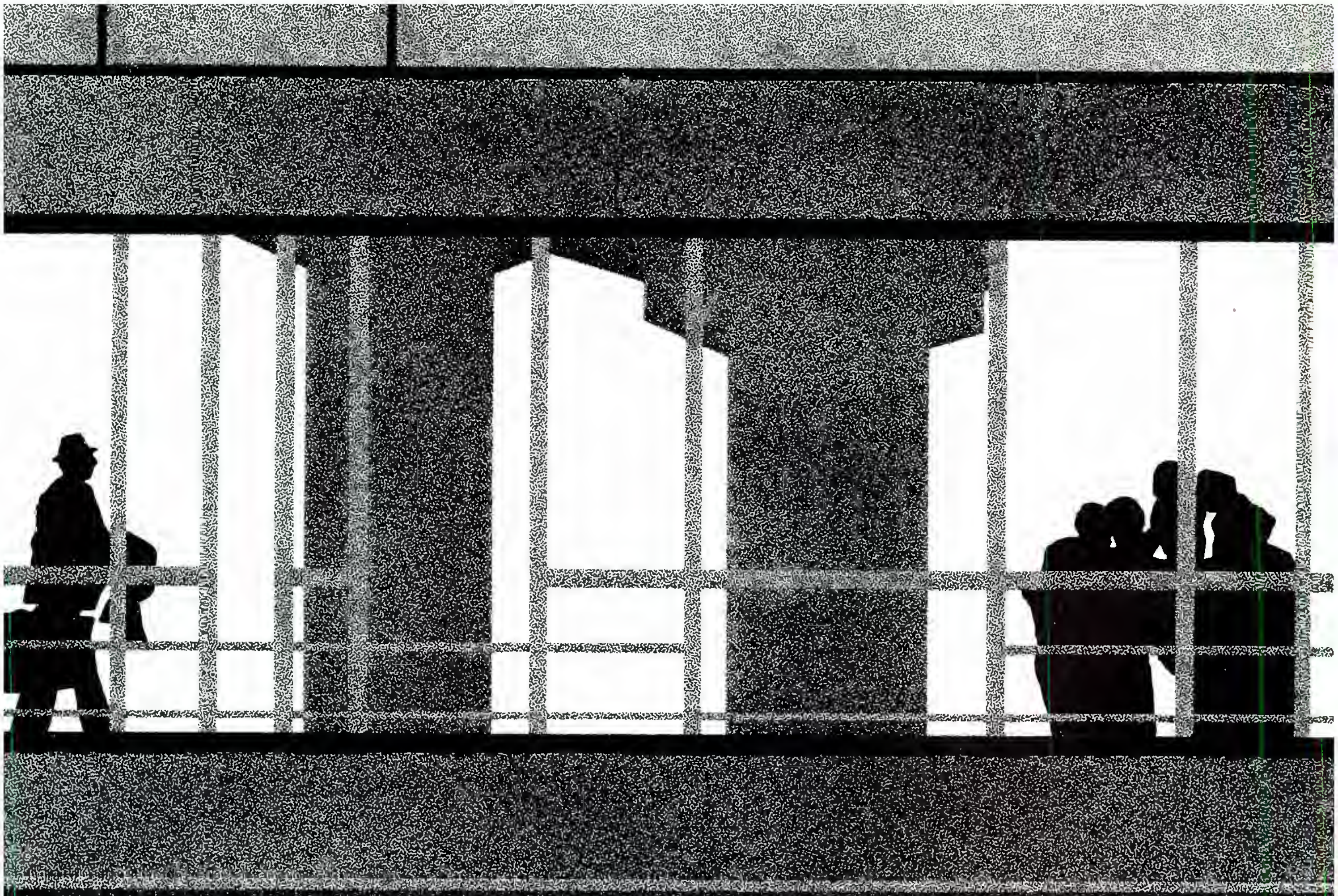
The greatest damage to equipment from insulation breakdown because of transient disturbances generally occurs after the spike has passed. The follow-on steady-state current that can flow through fault paths created by a transient often cause the actual component damage and system failure.

Transient-generated noise

As outlined previously, the computer-based electronic systems widely used in broadcast equipment today are particularly susceptible to logic state upsets caused by transient activity. Switch contact arcing and other repetitive transient-generating operations can also induce significant amounts of broadband noise into an electrical system, possibly disturbing the operation of nearby CMOS or TTL devices.

Noise generated in this fashion is best controlled at its source, almost always an inductive load. Switch contact arcing generates an effect known as "showering," a low-current, high-

Figure 2. An estimate of the susceptibility of semiconductor devices to failure because of transient energy. The estimate assumes a transient duration of several microseconds.



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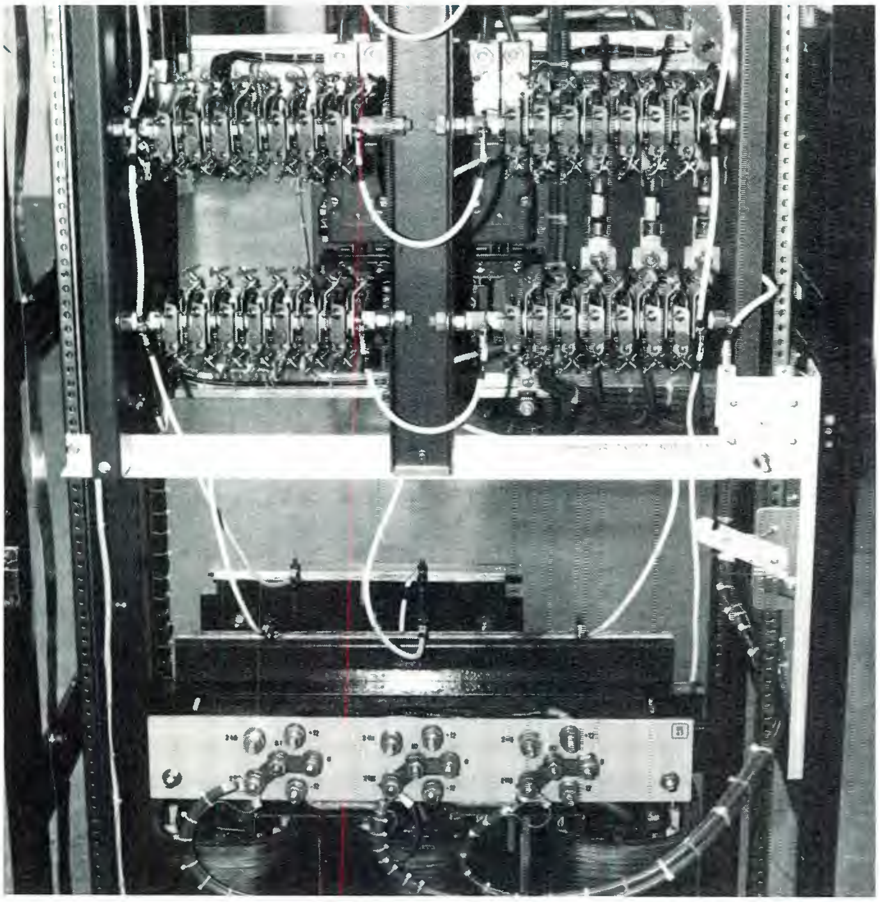

High voltage rectifiers—such as those found in radio and TV transmitters—are vulnerable to damage from transient disturbances, unless adequately protected. The failure of a high voltage (and high current) rectifier is usually caused by several transient spikes that—over a period of time—punch through one of the device junctions.

voltage series of brief discharges of a damped oscillatory nature (frequencies of 1MHz or more are common). This "shower" of noise can travel through power lines and create problems for microcomputer equipment either through direct injection into the system's power supply, or through coupling from adjacent cables or printed circuit board wiring traces.

SCR power controllers can also contribute to noise-induced microcomputer system problems. Each time a thyristor is triggered into its active state in a resistive circuit, the load current goes from zero to the load-limited current value in less than a few microseconds. This step action generates a broadband spectrum of energy, with an amplitude inversely proportional to frequency. Electronic equipment using full-wave thyristor control in a 60Hz ac circuit can experience this noise burst 120 times a second.

In a broadcast or industrial environment, where various control systems may be closely spaced, these noise bursts can cause latch-up problems or incorrect data in microcomputer equipment, or interaction between thyristor control units in machine control equipment. Power line cables within a facility can couple thyristor noise from one area of a plant to another, further complicating the problem.

The solution to the thyristor noise

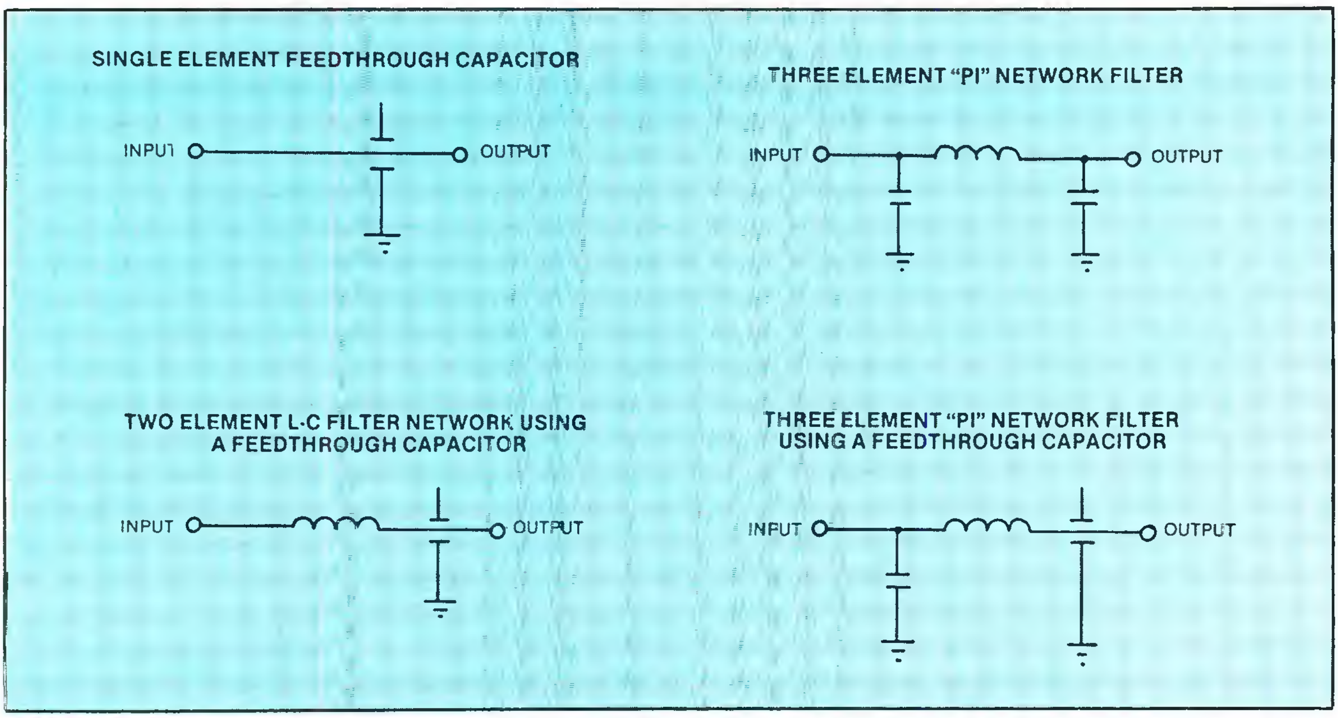

Figure 3. Common radio frequency interference (RFI) filtering networks. These filters, combined with tight mechanical assembly construction and printed circuit board ground plane shielding, will eliminate (or at least significantly reduce) the possibility of noise-caused equipment disturbances.

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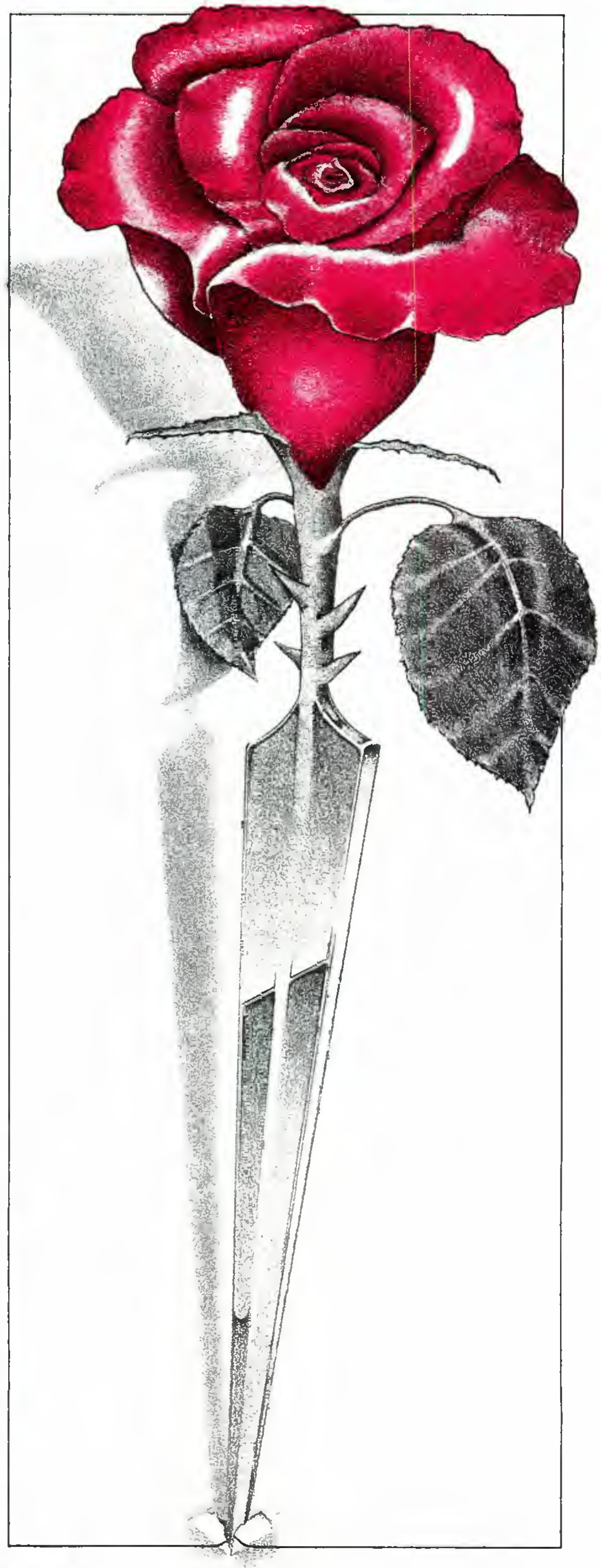

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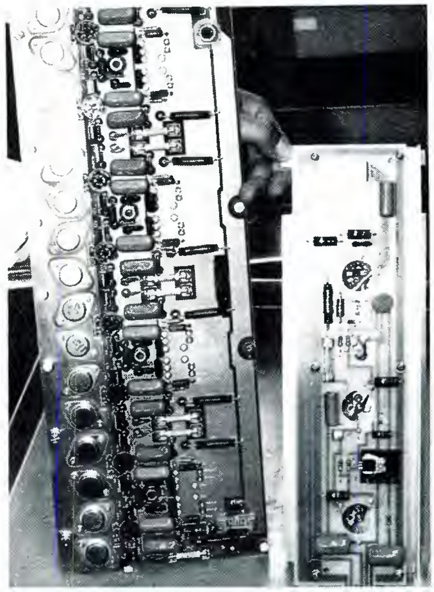
problem is found by looking at both the source of the interference and the susceptible equipment. The use of good transient suppression techniques in the application of SCR power control equipment will eliminate noise generation in all but the most critical of applications.

As a further measure of insurance sensitive electronic equipment should be adequately shielded against noise pickup, including metal cabinet shields, ac power line filters and input/output line feed-through RF filters. Fortunately, most broadcast equipment is designed with RF shielding as a primary concern. Figure 3 shows several common RFI filter networks.

Suppression devices

The decision on how to proceed with a transient protection program is not an easy one, but it is made somewhat less complicated by the economics involved. A commonly available discrete protection device can be purchased for $5 to $20 and installed by station personnel at critical points in the transmission plant.



High power semiconductor devices, while rugged, can be damaged by transient disturbances on the supply line, unless protection methods have been designed into the overall system. RF power transistors—such as those shown here—must also be protected from transient overvoltages that may be generated by or coupled onto the load (antenna system).

The alternate method is to purchase a transient suppressor unit designed for connection to the utility company primary input lines at the protected facility. The "system" approach is certainly the most effective way to prevent damaging transient overvoltages from entering a broadcast plant. It is also, however, the most expensive way. A commercially available quality transient system can cost at least $1500.

The amount of money a broadcaster is willing to spend on transient protection is generally a function of how much money is available in the engineering budget and how much the station has to lose. Spending $10,000 for transient protection for a major-market station, where spot rates can run into the hundreds or thousands of dollars, is easily justified. At small- or medium-market stations, however, justification is not so easy.

The options available to broadcasters in transient suppression equipment will be discussed in Part 4.

Bibliography

H. Niles Gloer. "Voltage Transients and the Semiconductor." **The Electronic Field Engineer,** 2 (1979).

General Electric Company MOV Varistor Data and Applications Manual. General Electric Company, Auburn, NY.

SCR Applications Handbook. International Rectifier Corporation, El Segundo, CA. 1977.

SCR Manual, fifth ed. General Electric Company, Auburn, NY.

Reference Data for Radio Engineers, sixth ed. Indianapolis, IN: Howard W. Sams Co.

Keeping cart machines rolling

By Dave Montgomery, technical services manager, International Tapetronics Corp./3M

The contemporary broadcast facility has been gifted with technological advances that could not be imagined 10 years ago. Audio consoles, transmitters, remote control systems and even turntables have gone high-tech. Alongside these is the cartridge machine, one of the most used—and probably least understood—pieces of equipment at the station. Proper cart maintenance procedures will ensure top-notch operation and minimize downtime.

Keep in mind that your cartridge machines, along with your cartridges, are a *system*. The machines are only half of a complete working partnership that produces your on-air sound. The relationship between the cart and the machine is similar in importance to the relationship between the studio and the transmitter. Therefore, there are several points to remember.

The author conducts performance tests on an ITC/3M Delta record/playback tape deck. Proper and regular maintenance of cartridge equipment is vital to reliable, high-quality performance.

First, the cart machine will sound only as good as the cart that is used in the unit. A bad cart in a good machine will still sound bad, as will a good cartridge used in a bad machine.

Carts wear out. Their life ends long before the tape finally breaks. The end of life for a typical cartridge should be established as the point at which the flutter performance of the unit creeps up beyond an in-house limit, or when the frequency response of the cart begins to fall off (or a combination of both).

When performance begins to suffer, the cartridge should be taken out of service and replaced or rewound before it becomes a problem on the air.

Second, all "NAB cartridges" aren't alike. Think about consoles or transmitters; they have specific performance requirements, but as you well know, they are not quite the same. Some work better than others. Anyone who tells you that you can intermix cartridge brands is wrong.

For the same reasons that one brand is *better* than the other, you cannot intermix cartridge brands and expect premium performance and consistency. Pick one brand—and one brand only—and do not intermix. Optimize all your machines for one cartridge, and your sound will improve overnight.

Third, choose one tape type for all cartridges at the station. Tapes are just as different as cartridges, and the best machine can do only so much *compensating* for bad or different tapes. Your listeners—including those who buy advertising time from you—like good, consistent sound. Varying quality, especially muddy-sounding spots or music, is one of the fastest ways I know of to turn off listeners and advertisers. Standardizing tape type can have a significant effect on a station's on-air consistency.

Now, down to business

When planning cart machine maintenance, think of how you would service any high-use item. Consider its importance to the overall operation, and the level of performance you expect from it. Also, consider the unit's prior service record. Then, develop a service schedule—one that you and the equipment users can live with. Implement it and live by it without fail. Your loyalty to that service schedule will pay dividends in improved reliability and reduced downtime.

Because the typical cart machine is in a high-profile environment—the control room—a failure in its mechanism will usually cause a noticeable condition on the air. Modern cart machine design takes this into account, and anticipates long periods of high use separated only by brief maintenance sessions. The equipment test procedures are usually simple, to the point, easy to repeat and produce the desired effect without much tweaking.

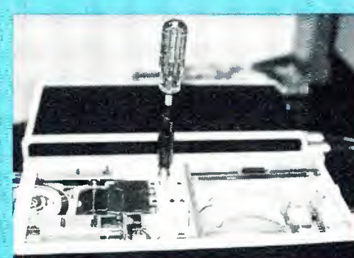
Manufacturers frequently make changes in their setup procedures to improve or simplify the process. Therefore, if you routinely service equipment that is several years old, check with the equipment manufacturer for the most recent test procedures and fixtures for that particular model. Use the proper tools, too. A brand "X" set-up gauge may not necessarily do the job on a brand "Y" machine.

Avoid using substitute parts unless it is absolutely necessary. Many companies make components that may look like they are usable, but do not assume that they will work. Pressure rollers immediately come to mind. A brand "X" pressure roller on your brand "Y" cartridge machine may cause a number of problems. Be careful about part substitution.

Align the machine

The first step in cart machine

Tooling up



One of the handiest little items that I have in my tool kit is one that we made at the factory from some common hand tools. The device allows us to loosen the head screw lock nut with a nutdriver, and adjust the tape head azimuth screw simultaneously.

We made the tool out of a pocket-sized ¼-inch nutdriver by drilling a hole through the handle top into the hollow shaft. This allows us to loosen the head screw lock nut, adjust the azimuth and relock the headblock nut in one operation.

Any engineer can make this tool for himself—to use on either cartridge machines or reel-to-reel machines—by using wrenches of the appropriate size. It is one of the handiest tools you can have when aligning. After using the device a few times, you'll wonder how you ever did without it.

Which company provided FM transmitters to over 1,000 broadcasters in the last five years alone?

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Ask Warren Shulz, Chief Engineer, WFYR-FM, Chicago, Illinois

"Our FM-25Ks have logged over 12,000 hours in alternate/main service at our Sears Tower site since December of 1982. When I am conducting an audio proof, it's encouraging to know that the FM-25K and the MX-15 are always performing better than spec. And any time help was needed, Harris service people were accommodating and pleasant."

Ask Tom Jones, Chief Engineer, WBAM-FM, Montgomery, Alabama

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Ask Steve Lampen, Chief Engineer, KJAZ-FM, Alameda, California

"After talking with other engineers, there was little question I wanted the Harris FM-2.5K right from the start. The transmitter worked perfectly after a difficult installation in a very tight location. It's very easy to tune. The exciter sounds clean and gorgeous on the air. Even non-technical listeners have noticed the difference."

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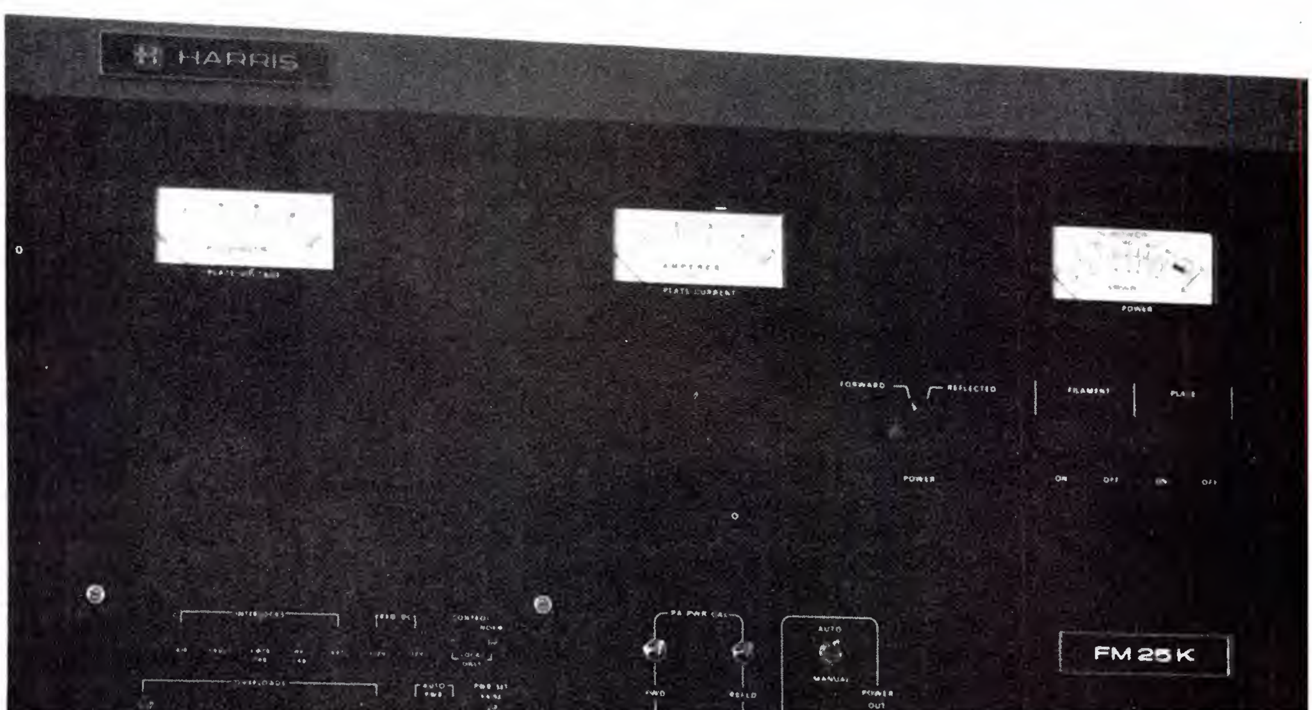

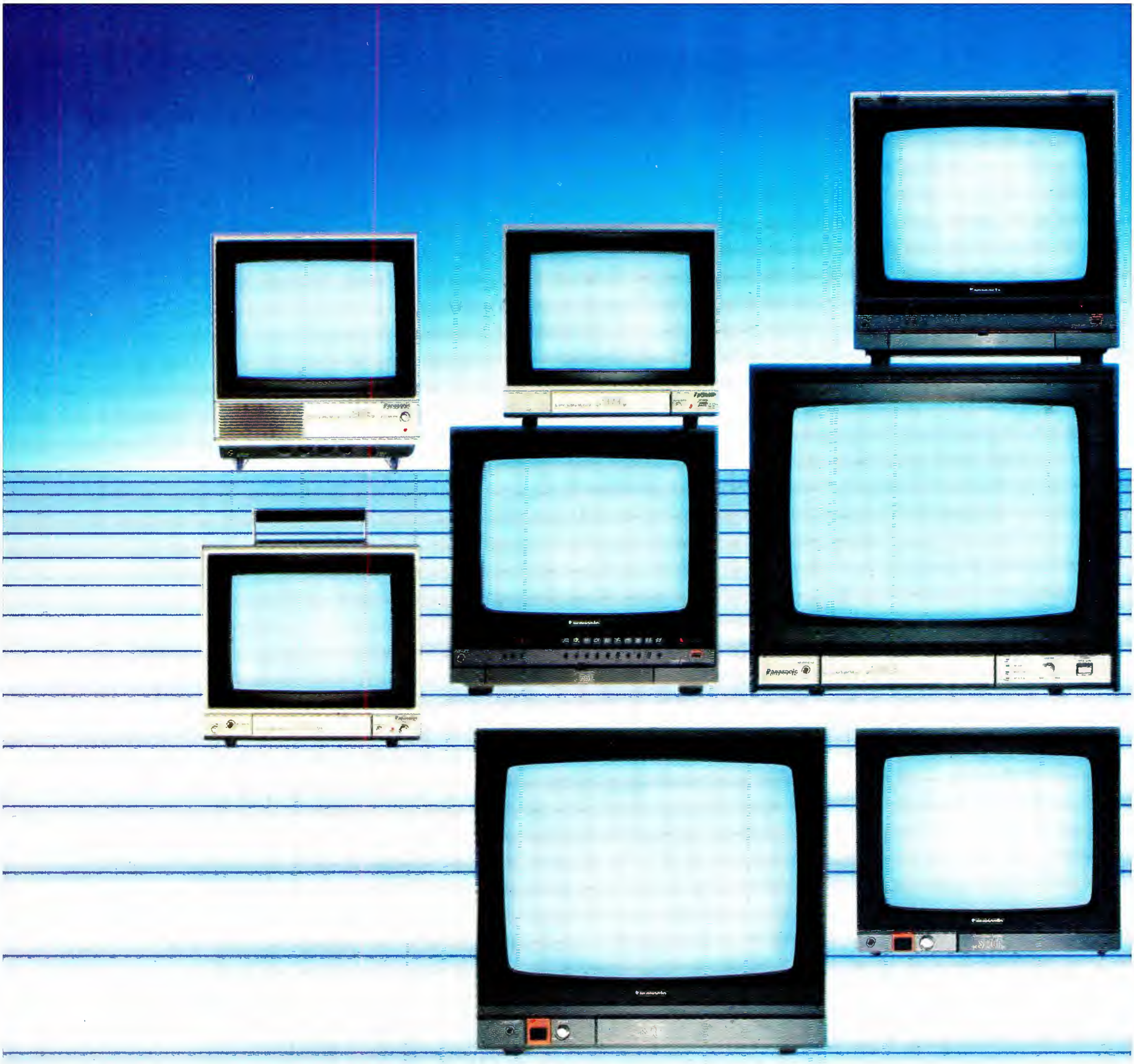

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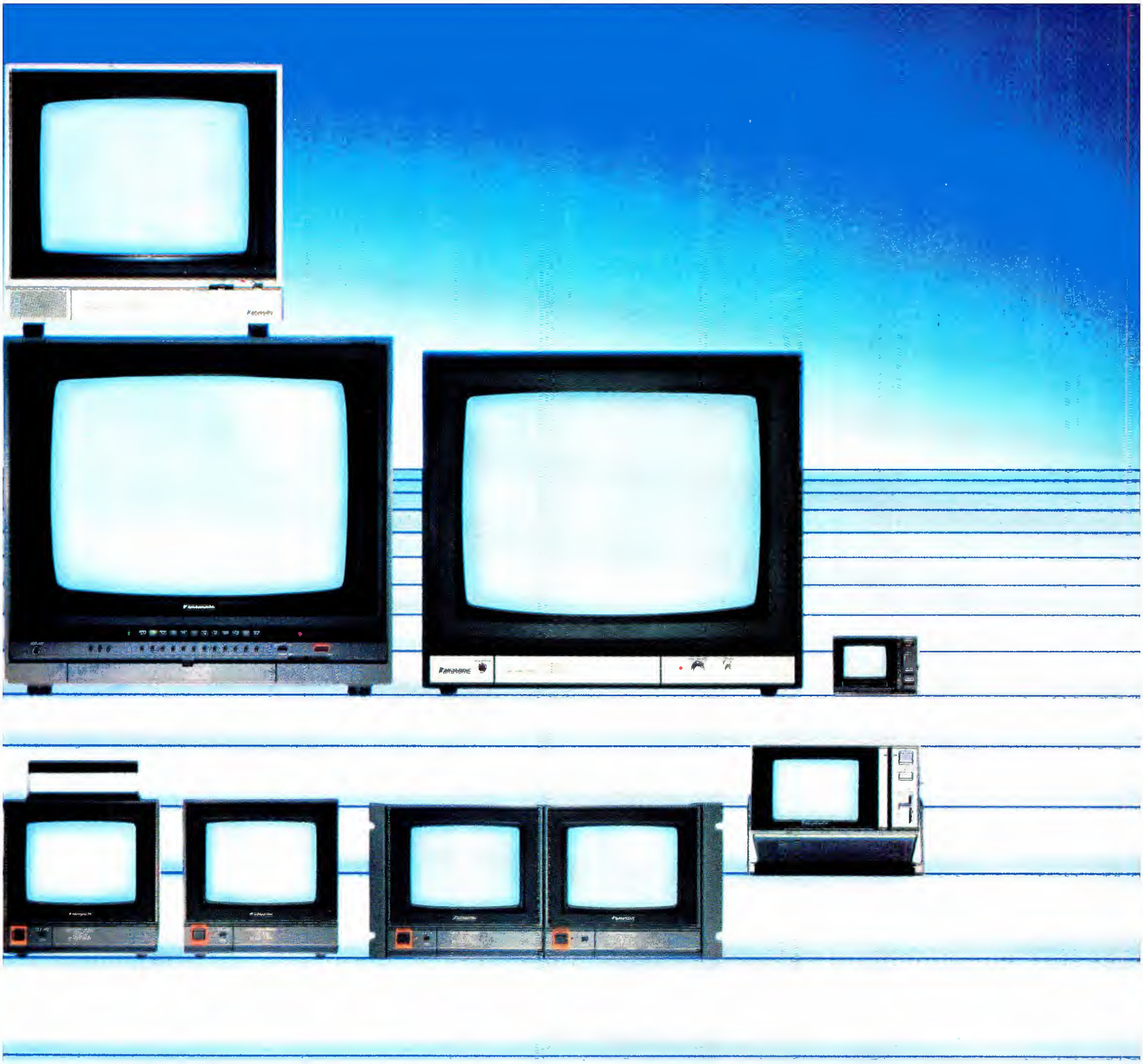

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maintenance is mechanical alignment of the unit. Use the manufacturer's recommendations, and follow the procedures *to the letter*. Shortcuts on alignment procedures frequently result in less than optimum or out-of-spec performance, and frazzled nerves to boot. Each machine has a personality of its own. Learn its quirks and idiosyncrasies. It will make you a better servicer, and the machine will be much less likely to revolt in the middle of the night.

Electrical setups cannot, and must not, be pursued until a thorough mechanical alignment has been successfully completed. It is a good idea to set up several carts. I have more than once thought I had a machine problem and was ready to throw in the towel, only to discover that a bad cartridge was the root of my problem. Do each setup carefully, and then check it by using more than one cart. The setup should hold its own over several cartridges.

The amplifiers and tape heads need the most attention during routine service. For this reason, it is best to follow test procedures *by the book*. Use an alignment tape loaded in exactly the same cartridge shell as the ones you use on the air.

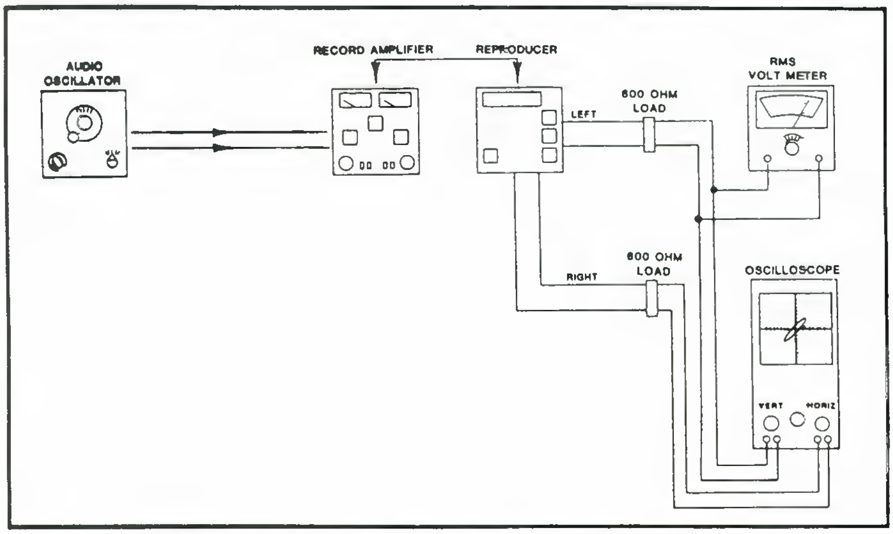

Figure 1. A typical test setup for checking the performance of a record/play tape cartridge system. Closely follow the manufacturer's recommendations on mechanical and electrical alignment for best results. (Courtesy ITC/3M.)

Also, use only one alignment cart to set up every machine at the station, including any recorders. This will ensure that all machines are duplicating exactly the same performance characteristics. Remember, the goals are consistency and high-fidelity.

The importance of cleaning

For tape machines to be able to do their best, they must be kept clean. Tape heads, guides, pressure rollers and tape path components should be cleaned at least once a day. One operation I was involved with cleaned the heads at the end of every air shift. It was cheap, easy to do and only took a minute of the operator's time. And, we never had a bad sounding cart on the air.

A word of caution: There are several compounds sold that are labeled as generic head cleaner. However, these compounds are nothing more than organic solvents similar to fingernail polish remover and are highly

Cleaning ceramic capstans

Your new tape decks with ceramic capstan shafts may present a new set of problems for you. Just exactly how are you supposed to clean them? To best clean a ceramic capstan, you need to know a little about them.

Ceramic is porous, and looks a lot like Swiss cheese when viewed under a microscope. These microscopic "holes" may soak up moisture—such as cleaning compounds—and trap dirt along the surface. Because of this, they seem to get dirty faster than the steel shafts most engineers are used to. Small particles of oxide and lubricants may collect just below the running surface of the shaft and discolor the pearl white finish of the ceramic. Unless abnormally heavy, this discoloration is normal and usually does not affect the capstan's ability to pull tape.

The author demonstrates the correct procedure for cleaning a ceramic capstan shaft.

When cleaning ceramic shafts, use only enough cleaning fluid necessary to loosen contaminants on the shaft. Otherwise cleaning fluid may be absorbed into the ceramic shaft, and subsequently redeposited onto the surface of a tape cartridge. This can lead to premature tape failure and library contamination.

To prevent this, use the following procedure:

- Clean ceramic shafts with a clean, soft rag. Cotton swabs do not get the job done well enough, and they allow too much liquid to reach the shaft.
- Lightly moisten the rag with isopropyl alcohol. Place the rag between your thumb and forefinger, and then grip the turning shaft with the rag. The rag will slightly moisten the shaft, pick up any dirt and dry the shaft at the same time.
- Repeat the cleaning step, using a fresh spot on your rag.

You will be surprised how well this procedure works, and how clean the shaft looks afterward.

Ceramic capstan shafts may retain a slight discoloration, even after a routine cleaning. This in no way affects the ability of the shaft to pull tape. Also note that the procedure uses common isopropyl alcohol, and not an expensive or hard-to-find industrial cleaner. A ceramic capstan shaft cleaned in this manner will provide satisfactory service without the worry of chemical contamination of your tape library.

destructive to any plastic material. When you consider the number of plastic parts in the tape path—including the head filler, tape, cartridge shell and pressure roller—using organic solvents as cleaners can (and usually does) cause irreversible damage. Do not use solvents to clean tape heads. Isopropyl alcohol is a good, inexpensive cleaner that is relatively safe and can be used around plastics.

Here's another tip. Use 6-inch wooden-handled cotton swabs to clean the tape heads. Buy them at your local hospital supply house, along with isopropyl alcohol. You will save a good deal of money, and be hard pressed to find a better applicator. Buy the alcohol in plastic pint bottles. They are small, unbreakable, and the right size to sit on the shelf or counter in the studios.

Regular maintenance is the key

There is no trick to maintenance, and no secret. It involves just plain hard work and care. If you set up a schedule and stick to it, you will be rewarded with long periods of unfailing performance. Studios using many cart machines usually spend a good deal of time maintaining that equipment. But, considering the payback—the high amount of airtime these units put in and the money they generate—it is easily justifiable.

If you have questions regarding your cartridge machine maintenance procedures, or need assistance solving some particular problem, contact the machine manufacturer. Customer-oriented companies maintain a staff of well-trained technical people who specialize in problem solving. Call them and talk about your needs.

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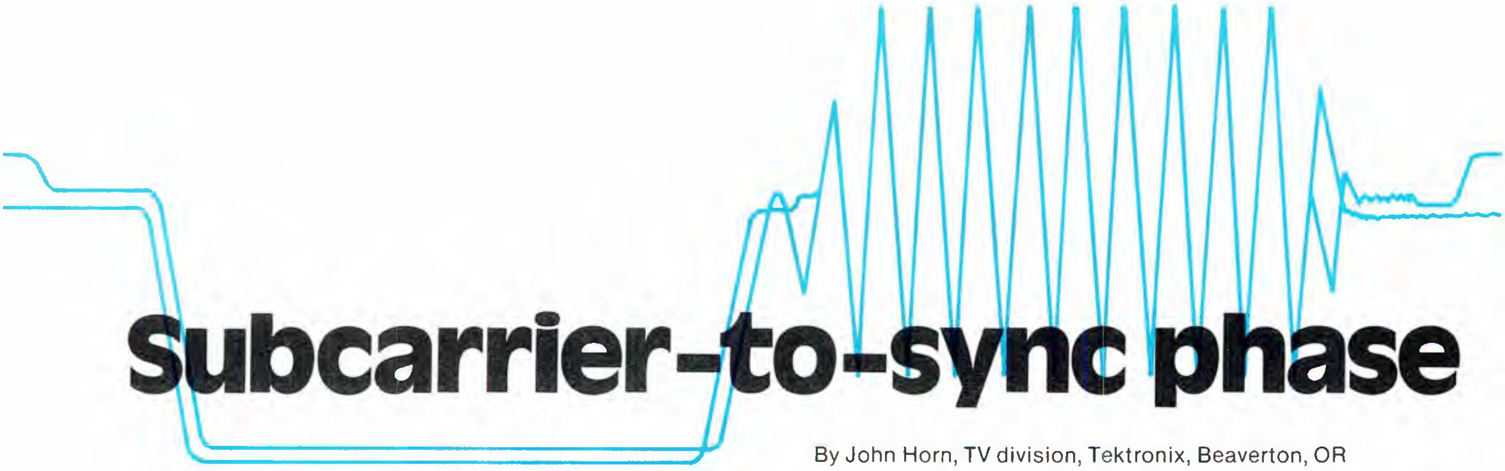

Subcarrier-to-sync phase

By John Horn, TV division, Tektronix, Beaverton, OR

The importance of maintaining SCH phase and color frame alignment has only recently been recognized. SCH phase and its significance in modern television systems is reviewed with some characteristics of the NTSC signal.

In NTSC, a reference subcarrier signal is required to properly demodulate the chrominance components. This subcarrier reference is encoded into the composite video as a burst of nine cycles following each horizontal sync pulse.

Sync pulses and the reference subcarrier are both timing information needed for reconstruction of the video image. SCH (subcarrier to horizontal) phase refers to the timing relationship between the horizontal sync pulses and the zero crossing of the reference subcarrier (burst).

Why is SCH phase important?

For any video signal, it is not necessary to have a particular relationship between these two timing references. The original standard for NTSC (RS 170) did not specify a phase relationship. If two or more signals are to be combined, however, problems arise if both sync timing and burst phase are not in step. For the chrominance information in the signals to be properly combined, the subcarrier phase of the various signals *must* be precisely matched.

"Phasing" of the signals is often done by delaying each feed so they arrive "in step" at some point (i.e.. at the inputs of a switcher or VTR). If the timing of the sync pulse in each of the signals does not have a known relationship to subcarrier phase, the adjustments in delay for proper

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chrominance phasing may cause differences in the timing of sync among the various feeds.

Although these timing differences will be small (140ns or less), they can cause noticeable picture "jumps" and other undesirable transient effects.

What is "color frame"?

NTSC television uses an *interlaced* raster format (CCIR System M). Interlace requires that a complete scanning frame be composed of two fields with an odd number (525) of horizontal scanning lines per frame.

SCH phase and color frame measurement

The 1750 Waveform/Vector monitor has modes designed for SCH phase and color frame measurement.

"Absolute" SCH phase display

This mode of operation determines SCH phase relationship in a single feed. Either input A or B may be used, the internal reference selected and "SCH" mode selected. The "sync dot" in the display (Figure 5) shows the sync timing of the selected signal relative to the burst phase of the same signal. The burst phase vector is the same as in a normal vector display, while vectors (if any) other than burst are blanked.

If the phase control is adjusted to place the burst vector in the normal -x axis position, the SCH phase error of the signal is read on the outer circle of the vector graticule. Gaps in the circle each denate 10°.

Because the 1750 displays the phase difference between the sync edge and the nearest zero crossing of subcarrier, it will always display less than 90° of error. (If SCH phase is increased through about 90° in either direction, the display shifts and indicates a decreasing error of the opposite polarity.)

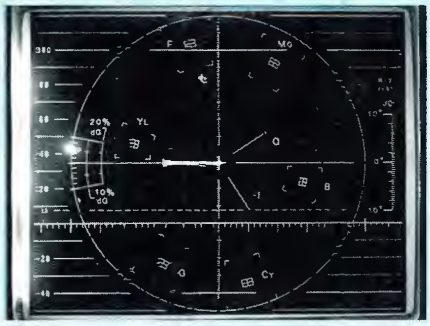

Figure 5. The 1760 SCH display snowing a small SCH phase error of about 5°. With internal reference, this display shows the SCH phase of the selected signal. With external reference, the relative color frame of the selected reference signals is also indicated.

Relative SCH phase display

If "EXT REF" is pushed, and "SCH" mode activated, then the display for the A or B selected signal is referenced to burst phase of the reference signal. The reference signal connects to the external reference input (Figure 6) and may be any composite signal. The selected signal's sync dot and burst vector are displayed relative to the reference signal's burst.

The "PHASE" control positions the burst vector with internal reference. The display will then show relative phase (of burst *and* sync) when the "EXT REF" button is pushed.

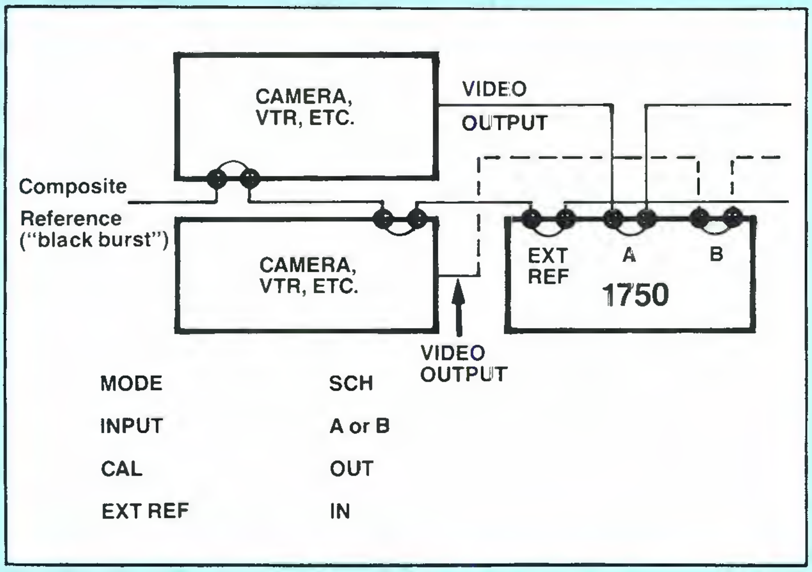

Figure 6. Connection and setup diagram for relative SCH (color frame) display.

Color frame matching display

When set for relative SCH phase, the 1750 indicates relative color frame between the selected signal and the reference signal. If the signals are properly framed, the display will be identical to an absolute SCH phase display (Figure 5). If the two signals are not color framed, the dot will be displayed to the right of the center (Figure 7). In this mode, the phase between sync and burst of the selected signal can be displayed at any angle (up to 180°).

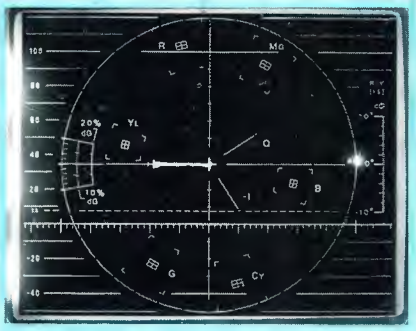

Figure 7. Display of the sync dot to the right, as in this photo, indicates a color frame error between the selected signal and the reference. (External reference is required for color frame comparisons.)

The SCH phase of the reference signal itself must not approach 90°, as color frame cannot be defined in this region and the display could be misleading. The display will show a sudden change in color frame indication as the SCH phase of the reference signal passes through about 90°.

Interpretation of the sync jitter

Because the SCH modes display sync timing relative to reference subcarrier, it is possible to observe certain kinds of sync instabilities on the 1750 display. If the sync dot traces an arc (Figure 8), or is unstable in its position, the extremes of position may be interpreted as the peak-to-peak jitter of sync.

Figure 8. A timing jitter of about 6ns peak-to-peak on the selected signal's sync on the SCH display.

The circle of the graticule, used to calibrate sync dot position, is marked each 10° of subcarrier. Because a half cycle of subcarrier (180°) occurs in very nearly 140ns, each degree represents about 0.78ns and the 10° gaps in the graticule circle represent about 7.8ns.

If the SCH and R-Y buttons are pressed together, the display will be composed of the verticle (R-Y) components of the burst and sync dot displayed vertically is displayed with a selected sweeps for horizontal component (Figure 9).

This display shows "time vs. time," i.e. the vertical axis represents sync time with a resolution of about 8ns per major division. The horizontal axis represents time corresponding to waveform monitor sweep rates of V and 2V.

In the R-Y/sweep mode, the "linear" conversion of angle to

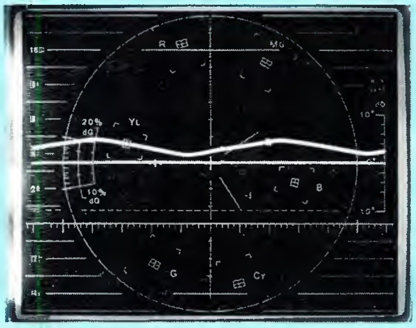

Figure 9. The 1750's SCH/sweep mode allows correlation of sync jitter with other factors, including power line hum and video APL.

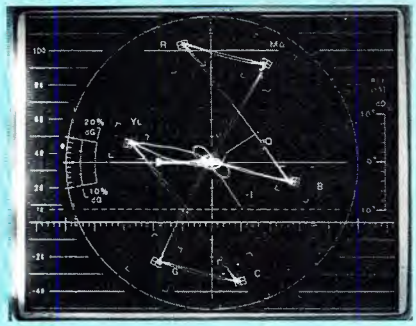

Figure 10. "VECT" and "SCH" provides both displays simultaneously, allowing normal vector monitoring while keeping a watch on SCH.

time is acceptably accurate only for small angles. The actual function vertically is the sine of the phase angle of the sync timing error, with a peak amplitude corresponding to the height of the graticule circle.

Other display modes

Single button selection of waveform ("WFM"), "R-Y," vector ("VECT") and "SCH" modes may use either internal reference or external reference signals (by depressing the "EXT REF" button). Any of these display modes (except "SCH") may be used with the line selector.

Additional display modes selected by pushing two function buttons provide monitoring of the horizontal interval, with the leading edge of sync displayed at the highest sweep speed (200ns/div). They include:

- "SCH" and "VECT" to display the normal vector representation and the sync dot at the same time (Figure 10).
- "WFM" and "R-Y" advance the waveform display such that the horizontal blanking interval is viewable at the beginning of the display (Figure 11).
- "WFM" and "SCH" display the horizontal interval in the center of the screen (Figure 12).

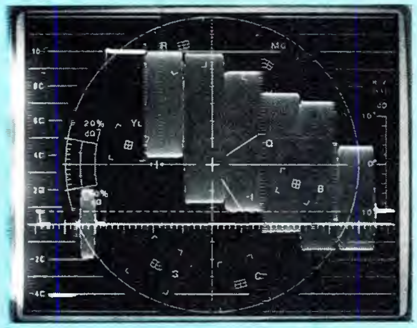

Figure 11. Selecting "WFM" and "R-Y" together provides this display and AFC sweep synchronization.

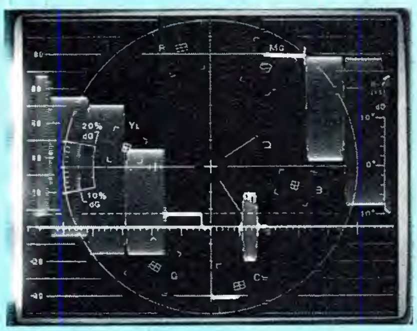

Figure 12. Simultaneous "WFM" and "SCH" selection will display the H interval at the center of the one line sweep.

To reduce interference with the luminance portion of the image, the chrominance is *interleaved* by having an odd number of half cycles of subcarrier during a scan line. This alternates the phase of the subcarrier from line to line by 180°. (Figures 1 and 2 show the two formats for a horizontal blanking interval. Note the phase of the burst.)

Because a frame must be composed of an odd number of lines and two fields, four fields with an even number of scan lines (1050) must occur before the chrominance phase returns to its original value on a given line of the field. Thus, there are four distinct fields in a full sequence of an NTSC color signal rather than the two field sequences of a monochrome video signal. Two video signals will match for both sync timing and burst

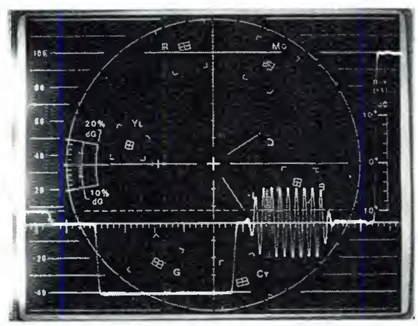

Figure 1. The horizontal blanking interval, shown in waveform mode in 1 s/div. sweep speed.

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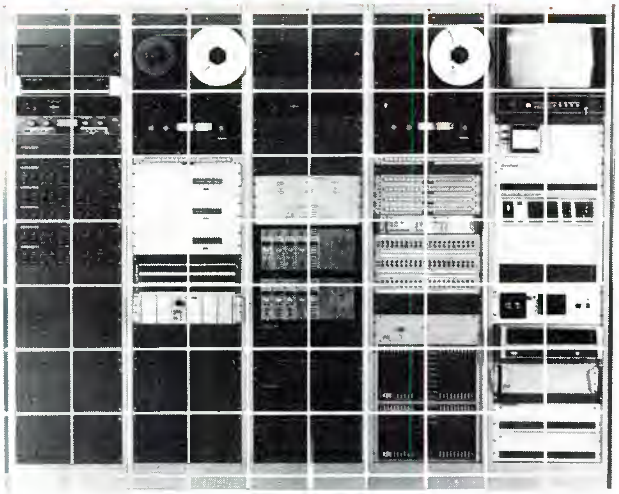

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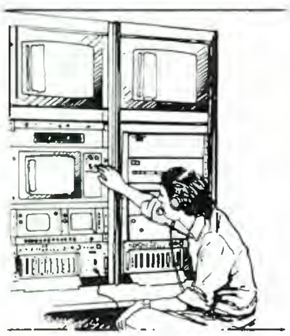

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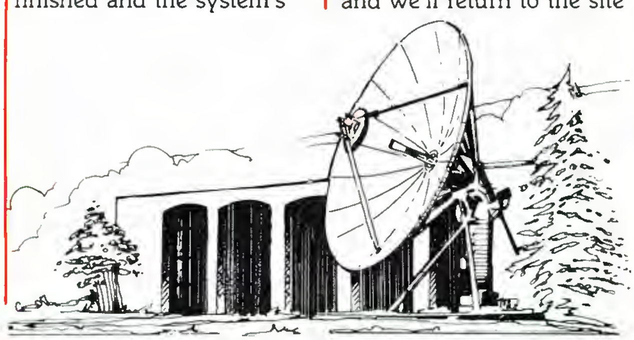

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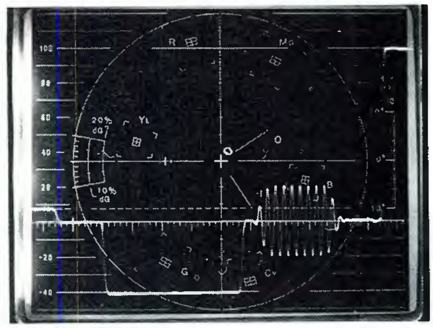


Figure 2. Horizontal blanking interval, but showing the alternate burst phase.

phase only if they are at the same place in the color field sequence at a given time. Such signals are properly "color framed" or "color frame matched."

RS 170A

This EIA standard adds a definition of color fields and tolerances for SCH phase to the NTSC format. Color fields 1 and 3 have a whole line between the first equalizing pulse and the preceding horizontal sync pulse, fields 2 and 4 have a half line preceding the first equalizing pulse.

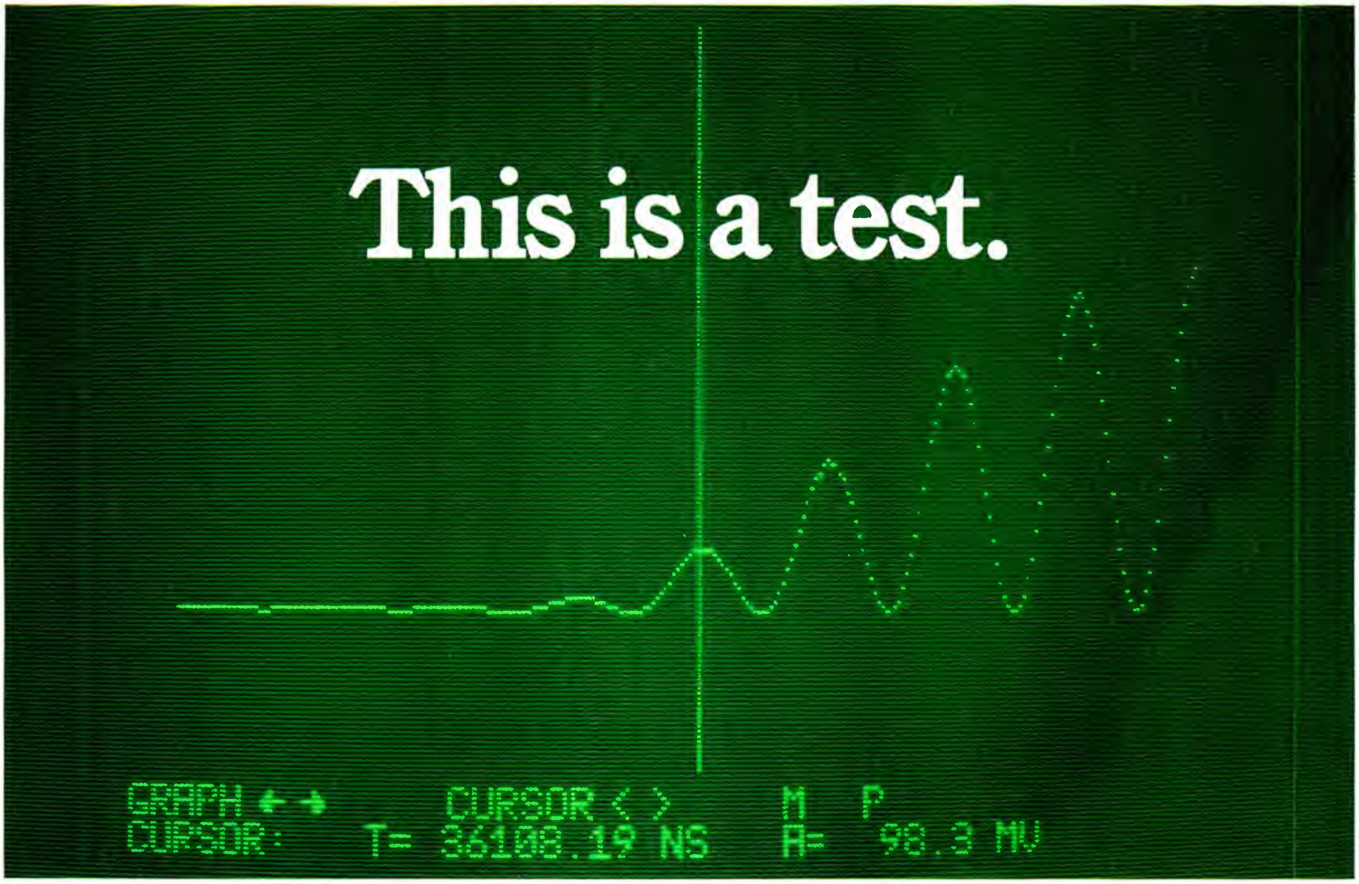
Fields 1 and 2 of the four-field sequence are defined as color frame A and fields 3 and 4 are defined as color frame B. The zero crossings of the reference subcarrier should be coincident with the half-amplitude point of the leading edges of horizontal sync pulses. On line 10 of each color field, positive zero crossings should be coincident in fields 1 and 4. Negative zero crossings are coincident in fields 2 and 3.

RS 170A states that "where the relationship between sync and subcarrier is critical for program integration," the tolerance on SCH phase should be 40°. Good practice and the current equipment suggest a much tighter tolerance.

The start of burst is defined as the zero crossing, which precedes the first half cycle to exceed 50% of burst amplitude. This burst start event should occur 19 cycles after the horizontal sync event. Note that the 19 cycles interval refers to the location of burst, while the reference subcarrier zero crossings are used to specify SCH phase.

Color frame error

In interlace, the sync pulse format in the vertical sync interval differs in fields 1 and 3 and fields 2 and 4. It is unlikely that field 1 will be mistakenly aligned with field 2 or field 4. If field 1 is synchronized with field 3, however, and the subcarrier phase is matched, everything appears proper *except* that sync timing is in error by



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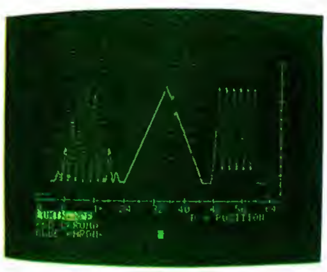

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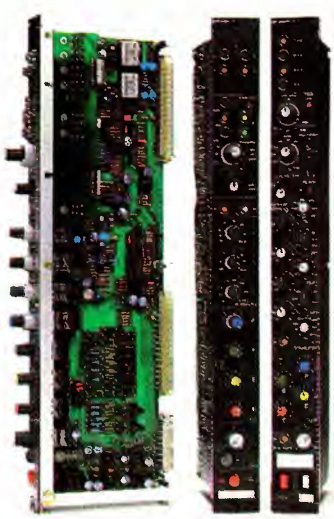

Basic input modules feature 3 or 4 band EQ, microphone/line inputs, 5 pre/post-fade auxiliary sends, and channel overload indicators. Options include transformerless mic preamps on a subcard, separate transformerless TAPE input for remix, stereo input modules, stereo EQ, internal stereo X-Y/MS active matrix, stereo blend control, dual line inputs, variable HP and LP filters, user defined panel switches, and the list goes on.

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STUDER REVOX

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140ns, equivalent to a half cycle of subcarrier (Figure 3).

Bringing the sync pulses of these misframed signals into coincidence would result in chrominance being phase inverted (180° error) in one signal relative to the other (Figure 4). Because of the severe effects of phase errors between signals compared to the usually more subtle effects of small timing errors, it is far more likely that the timing offset condition will exist when there is a color framing problem.

Equipment considerations

Commonly, a composite reference signal ("black burst" or "color black") is supplied to each piece of equipment, with the various units locking ("genlocking") to the reference signal. Timing can usually be adjusted at each genlocked unit without the need for accurate cutting of cables.

There are potential problems as each unit in the system must go through a series of steps to lock to the reference. The output of the genlocking equipment will be rapidly slewed to bring the vertical sync group into alignment with the reference.

Then the signal will be further shifted to bring the horizontal sync edges into alignment. Finally, the burst phase between the genlocked output and the reference is brought into coincidence.

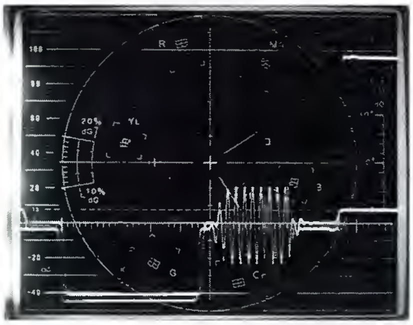

Figure 3. This double exposure photo shows two signals that are not color framed. Burst phase has been matched, but the sync details are mistimed by 140ns. The second trace has been vertically offset for viewability.

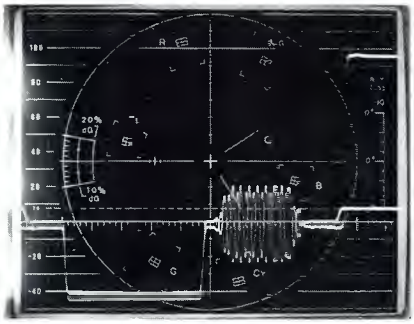

Figure 4. The same signals as Figure 3. The sync timing error has been corrected by changing signal delay, but the burst timing error of 180° results.

In the first two steps of this sequence, the alignment of the sync pulses between the output and the reference cannot be exact when the internal control circuits advance to the next step. This requires that some tolerances be built into the control circuits. Within these tolerances, the equipment should remain stably locked. If the internal tolerances are exceeded, the control circuits reenters the lockup sequence, causing noticeable transient effects.

If the SCH phase of a signal varies, timing of the sync edges will change, even though genlock is maintained on the subcarrier (burst) signal. It is also important to remember that if SCH phase is allowed to be near 90°, color framing cannot be determined. Different pieces of equipment may lock to different color frames in what seems to be an arbitrary manner.

The SCH phase of the reference signal and of each regenerated signal must be maintained to ensure that equipment will not be required to "relock" unexpectedly and to ensure that color framing is maintained.

Editor's Note:
This information is taken with permission from Tektronix application note No. 36, 20W-5613.

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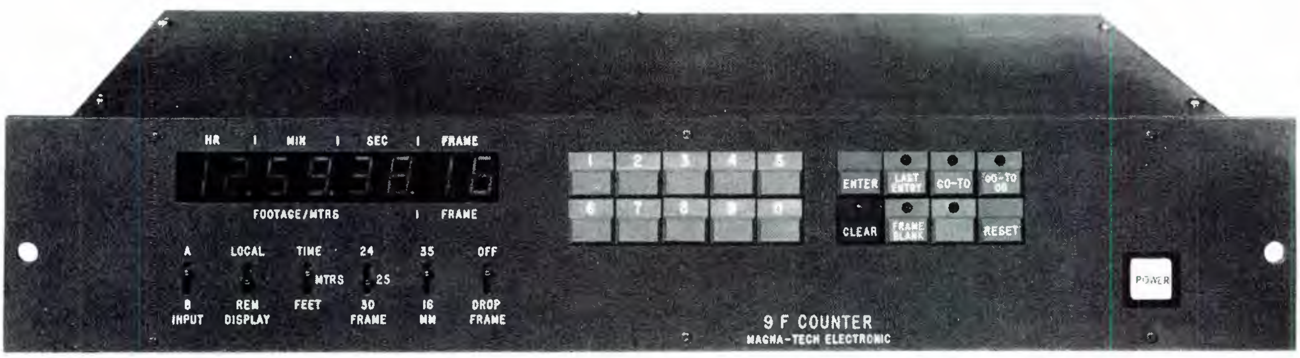

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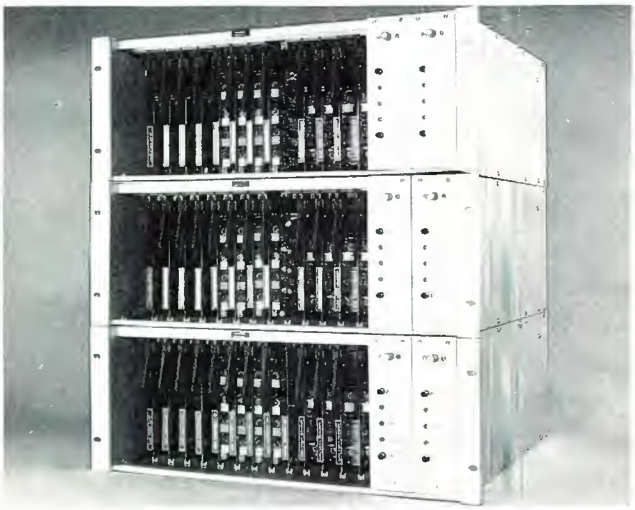
RCPC replay

By Jerry Whitaker, radio editor

The Radio Convention and Programming Conference lived up to its theme, "Up With Radio." An estimated 5080 broadcasters packed the first RCPC gathering, sponsored jointly by the NAB and NRBA. This was a convention dedicated solely to radio, and the radio engineers, managers and programmers in attendance loved it. The TV side of broadcasting was nowhere to be found. All of the engineering sessions (and management/programming sessions) were directed toward the needs and concerns of radio broadcasters. At this convention, radio didn't feel like a poor cousin!

The RCPC—held in Los Angeles Sept. 16-19—brought together the annual NAB Programming Conference

More than 135 exhibitors displayed their products and services at the first Radio Convention and Programming Conference.



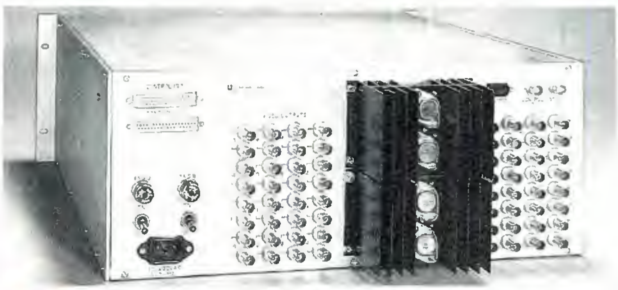


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Exhibit area totaled more than 45,000 square feet, and estimated attendance for the 3-day convention was 5080.

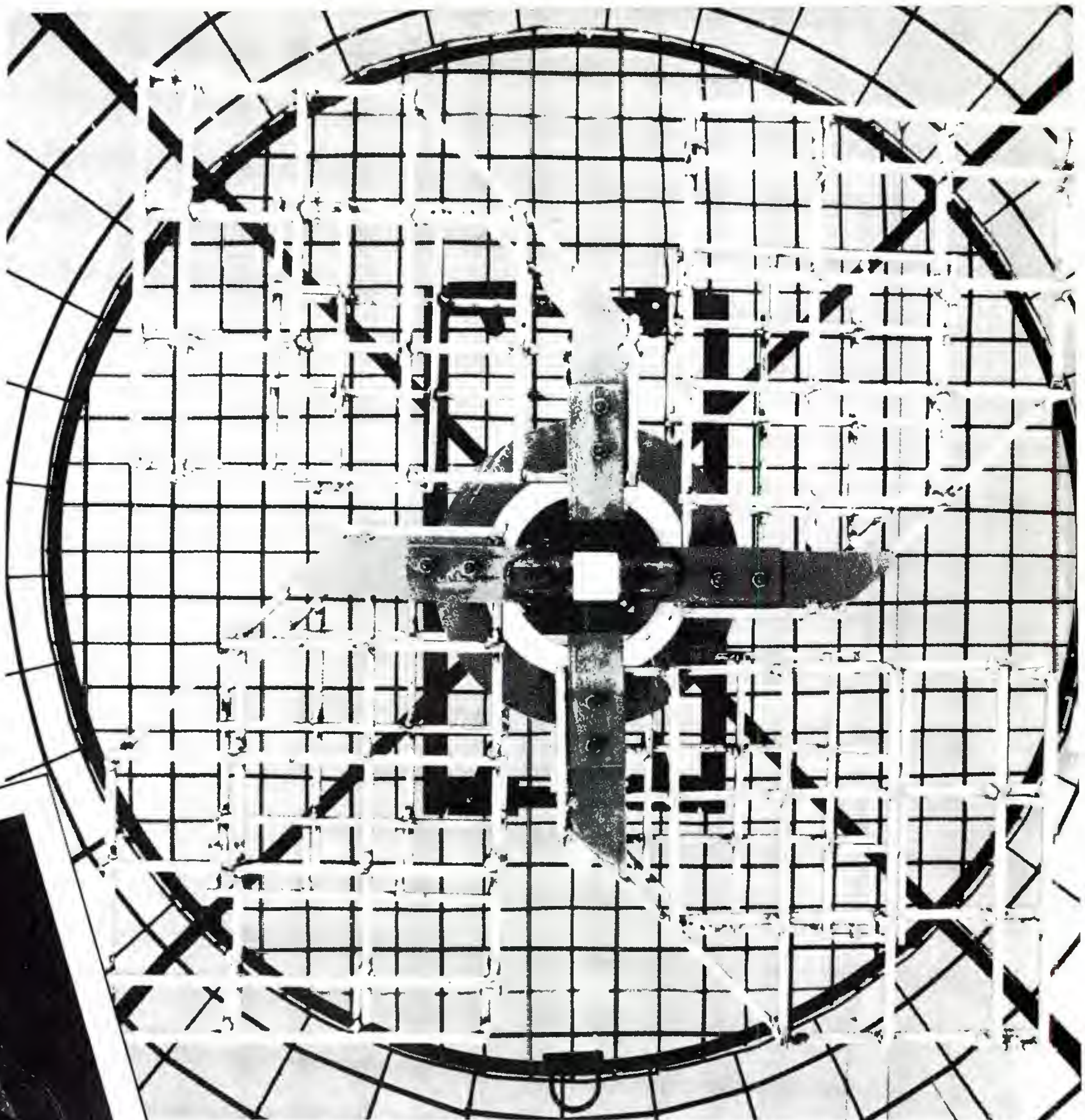
and the annual NRBA Convention. The exhibition area covered more than 45,000 square feet, and there were more than 100 exhibitor hospitality suites.

For engineers attending the conference, there was no shortage of technical sessions. Fifteen engineering panel discussions were held during the 3-day convention, covering a wide range of topics from dealing with the "new" phone company to the upgrade/downgrade decisions now being faced by many FM broadcasters as a result of the FCC's Docket 80-90 decision. The sessions that generated perhaps the greatest interest dealt with the use of FM subcarriers and the actions of the FCC.

"Hello, I'm from the FCC"

In a wide-ranging, well-attended session titled, "Hello, I'm from the FCC," engineers were given the opportunity to question representatives of the commission, including James McKinney, mass media bureau chief. Also on the panel, moderated by Wally Johnson of Moffett, Larson and Johnson, consulting engineers, were H. John Morgan, chief of the AM branch; Ray LaForge, chief of the FM branch; and James Zoulek of the Long Beach, CA, field office.

Much of the discussion was about



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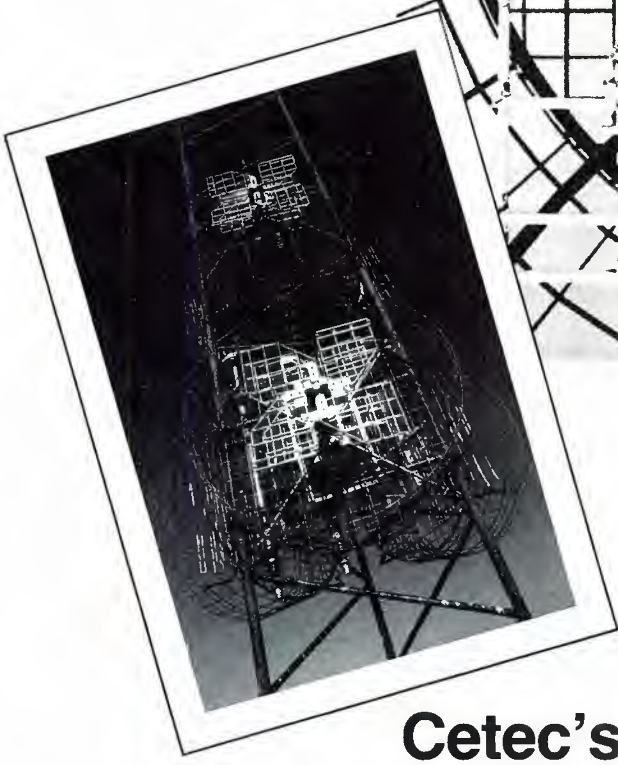

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The session "Hello, I'm From the FCC" gave engineers an opportunity to question a panel of FCC officials about various aspects of the commission's rules and policies. The session was moderated by Wally Johnson (center).

Docket 80-90, and how licensing procedures would be handled. Spectrum allocation concerns regarding 950MHz STL users were also discussed, with the panel predicting at least some relief to hard-pressed broadcasters in the near future.

In response to questions from the audience, the panel addressed itself to the effects of technical deregulation. McKinney said there had been no noticeable increase in violations issued by the FCC field offices to stations since the move toward technical deregulation began several years ago. The broadcast industry has not suffered under the recent policies of the FCC, he said, and the industry has done a good job of policing itself in the absence of certain FCC rules.

McKinney said, "Deregulation, as a policy, has been a success because it is in the best interests of both the public and the station. The commission has put the requirement for proper operation on the broadcaster, and allowed the broadcaster the freedom needed to meet those requirements the best—and most economical—way he sees fit."

McKinney added that because of deregulation the industry has been able to respond to new developments and introduce new technologies that would have otherwise been slowed by the FCC's old regulatory process.

McKinney warned the audience, however, that the commission is concerned about the proper operation of broadcast stations and will deal strongly with violators.

"The commission is concerned, and will remain concerned, with the aspects of a radio station's operation that can affect other broadcasters, such as frequency, power, modulation and spurious emissions," he said.

"SCAs Now"

The engineering session devoted to FM subcarrier use, "SCAs Now," included a large panel of respected SCA equipment manufacturers and subcarrier users.

Bill Dunnavant of WJMW/WZYP radio, Athens, GA, outlined his station's experience as an operator of an SCA paging service. He said that the station was generally pleased with the paging system performance, despite some initial equipment problems with the pagers themselves. Dunnavant reported that WZYP-FM was receiv-

The engineering session "SCAs Now" was probably the best attended of all the panel discussions. The session was moderated by Tom McCoy of the NRBA (standing).

ing about $1000 a month from the subcarrier paging business, and that the station had not experienced any decrease in the performance of the main channel programming, including loss in apparent volume.

Panel member Thomas Lamoreaux of the Telocator Association of America—a radio common carrier (RCC) industry group—told the audience that SCA paging can work, although some significant problems must be solved in order for an FM station to compete effectively with long-established local RCC operators. Lamoreaux identified reliability and intelligibility as the primary requirements of any paging service, and that a paging service would have to approximate the level of service available from the local RCC in order to succeed.

In an interesting twist, Lamoreaux reported that some RCC operators have expressed an interest in leasing SCA channels from FM broadcasters as a possible means of distributing their paging signals. This is in sharp contrast to the suspicion and fear that was most often voiced by the RCC industry when subcarrier paging was first discussed several years ago.

Another panelist, Joe Meier of Bonneville Telecommunications, said data transmission was an important part of future SCA use. He told the audience that there is a significant market for data transmissions via FM subcarriers. He characterized such systems as both efficient and reliable.

John Kean of National Public Radio—another member of the panel—said that it was difficult for a station to plan an SCA system unless the user is known and his exact needs have been identified. He said that with the wide variety of possible subcarrier transmission systems available, broadcasters should carefully consider the needs of the user before any equipment choices are made.

Frequency coordination

The need for frequency coordination was discussed at several sessions during the conference. At an "Engineer's Rap Session," which featured a number of respected members of the engineering community, Richard Rudman of KFWB radio presented a review of the frequency coordination procedures used during the two political conventions and the Olympics. Rudman, who is vice

The RCPC featured several field trips to various stations and facilities in the Los Angeles area, including a field trip to the studios of KFWB radio. The tour was conducted by KFWVB engineering manager Richard Rudman.

presdent of the SBE and chairman of the society's National Frequency Coordinating Committee, reported that the coordination efforts paid off, with virtually no interference experienced by local radio or TV broadcasters during the three events.

Rudman credited Mike LoCollo of ABC for his work with the Olympics coordination effort and Rich Harvey of CBS for coordination work for the San Francisco and Dallas political conventions. He said that the three events, taken together, prove the value of frequency coordination. Rudman added that without the close cooperation of the networks and local broadcasters, smooth coverage of major events such as these would have been impossible.

Rudman noted that the 2GHz TV ENG band was the most critical part of Olympic coordination. He also said that a newly designed and installed amplitude compandored sideband (ACSB) community repeater system allowed added flexibility in coverage of the event. About 900 different frequencies were used in covering the Olympic games, and about 450 frequencies were used during the coverage of each convention.

Planning has already begun for the 1985 RCPC convention, which is scheduled for Oct. 6-9 in Dallas.

VSWR—Causes and effects

Editor's note:
This is the first article of a monthly column devoted to troubleshooting radio and TV studio and transmission equipment. Each month, **BE** will examine an area of interest to maintenance technicians, looking at the theory behind the problem and practical solutions. For this article, troubleshooting tips were provided by the field service department of the Harris Corporation.

The voltage standing wave ratio (VSWR) of an antenna with its transmission line is a vital parameter that has a considerable effect on the performance and efficiency of a transmission system. VSWR is a measure of the amount of power reflected back to the transmitter due to an antenna and/or transmission line mismatch. (See Figure 1 for calculation data.) A mismatched or defective transmission system will result in a high degree of reflected power, or a higher VSWR.

Common practice calls for us to set a VSWR of 1.1:1 as the maximum level within the transmission channel that can be tolerated without degrading the quality of the on-air signal. When power is reflected back to the transmitter, it causes the RF output stage to *look* into a mismatched load with unpredictable phase and impedance characteristics.

Because of the reflective nature of VSWR on a transmission system, the longer the transmission line (assuming the reflection is originating at the antenna), the more severe the problem may be for a given VSWR. A longer line means that reflected power seen at the RF output stage has greater time (phase) delays, increasing the reactive nature of the load.

The effects of transmission line length vary depending on the service. For example, the crosstalk performance of an FM transmission system can be degraded because of a long line. It has been suggested that the maximum VSWR for a system with up to 100 meters (328 feet) of transmission line should be below 1.1:1 for top performance. Systems with lines from 100 to 200 meters should have a VSWR of at least 1.08:1 for equally good performance in FM broadcasting (NAB Engineering Handbook).

VSWR is affected not only by the rating of the antenna and transmission line as individual units, but also by the combination of the two as a system. The worst-case system VSWR equals the antenna VSWR multiplied by the transmission line VSWR. For example, if an antenna with a VSWR of 1.05:1 is connected to a line with a VSWR of 1.05:1, the resultant worst-case system VSWR would be 1.1025:1.

Given the right set of conditions, an interesting phenomenon can occur in which the VSWR of the antenna can cancel the transmission line VSWR, resulting in a perfect 1:1 match. The determining factors for this condition are the point of origin of the antenna VSWR, the length of transmission line and the observation point.

The effects of modulation

The VSWR of a transmission system is a function of frequency and changes with carrier modulation. This change may be large or small, but it will occur to some extent. The cause can be traced to the frequency dependance of the VSWR rating of the

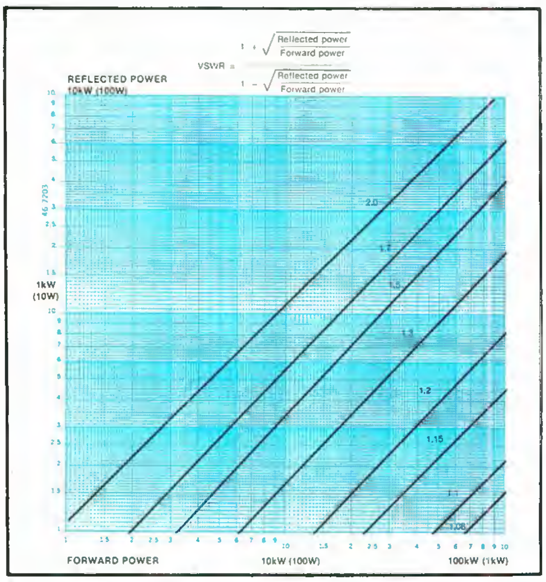

Figure 1. A graph that can be used for determining the VSWR performance of a transmission system. For low-power operation, use the values in parenthesis.

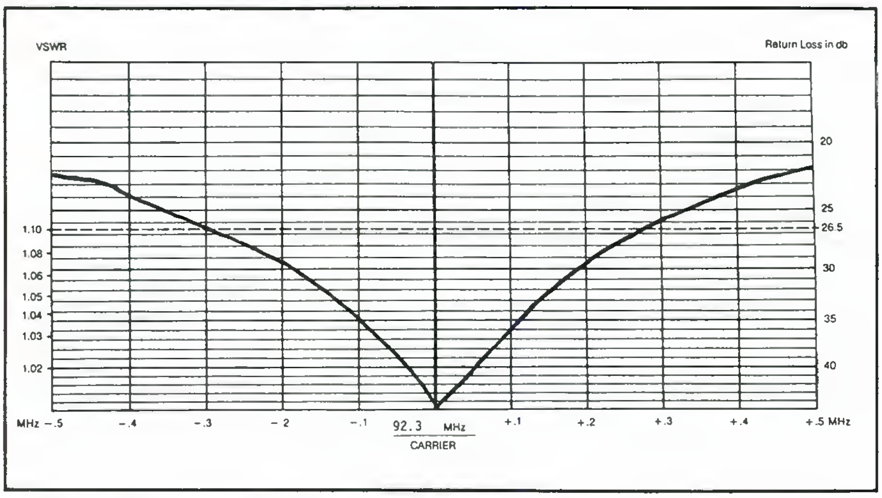

Figure 2. The measured performance of a single-channel FM antenna (tuned to 92.3MHz). This antenna—a 10-bay circularly polarized unit—gives a VSWR performance of below 1.1:1 over a frequency range of nearly ±300kHz. *(Courtesy of Cetec Antennas.)*

antenna (and to a much lesser extent the transmission line), as demonstrated in Figure 2.

Although this plot—showing the VSWR-vs.-frequency performance of a common FM antenna—is good, notice that with no modulation the system VSWR is one figure. VSWR measurements are different with positive modulation (carrier plus modulation) and negative modulation (carrier minus modulation).

VSWR is further complicated because power reflected back to the transmitter from the antenna may not come from a single point, but instead, from a number of different points. One reflection might be caused by the antenna-matching unit, another by various flanges in the line and a third by a part of the antenna system that has been damaged. Because these reflection points are different lengths from the transmitter PA plate, a variety of standing waves can be generated along the line, varying with modulating frequency.

Energy reflected back to the transmitter from the antenna is not all lost. A small percentage of the energy is turned into heat, but the majority of it is radiated by the antenna, delayed in time by the length of the transmission line.

Maintaining the system

In order to maintain low VSWR readings, service the transmission line and antenna system regularly. Inspect the antenna elements, interconnecting cables, impedance transformers and support braces at least one each year. Falling ice can often damage FM and TV antenna elements if proper precautions are not taken.

Icing on the elements of an FM or TV antenna will degrade the antenna VSWR performance because the ice lowers the frequency of the electrical resonance of the antenna. Two methods are commonly used to prevent a buildup of ice on an antenna—electrical de-icers and radomes.

Check AM antennas regularly for structural integrity. Because the tower itself is the radiator, each section of the structure should be bonded together for a good electrical contact. Clean base insulators and guy insulators (if used) as often as required. Obviously, it is only practical to clean the guy insulators near the tower and near the ground. Keep lightning ball gaps clean and properly adjusted.

Inspect the transmission line for any signs of damage. Check supporting hardware, and investigate any indication of abnormal heating of the line immediately. Keep a detailed record of VSWR performance in the station's maintenance log, and investigate any increase over the norm.

Recording line and tank pressure for pressurized transmission lines is also helpful in identifying line or antenna problems. Once the regulator is set at the desired line pressure, the tank and line readings should be recorded each week and charted. If possible, the observation should be made at about the same time of day each week, because the ambient temperature can have a significant effect on the line pressure. Any temperature extremes should, therefore, be noted in the transmission line log. The line pressure will often change slightly depending on whether the carrier is on or off. The pressure will typically increase when the carrier is on and the internal conductor of the coax is hot.

After a few months of charting the gradual loss of tank pressure, you should see an obvious pattern. For example, say the system loses 10psi of tank pressure each week. Any substantial increase from that level will signal a problem somewhere in the transmission line or antenna.

VSWR overload

VSWR overloads in transmitting equipment can be caused by a number of different problems. Some common problems and solutions:

1. VSWR overloads are usually caused by an improper impedance match external to the transmitter. The first step in the troubleshooting procedure is to substitute a dummy load for the entire antenna and transmission line system. Connect the dummy load at the transmitter output port, thereby eliminating all coax, external filters and other RF hardware that might be present in the system.

2. If the VSWR trip problem is eliminated in step 1, the problem is somewhere in the transmission line or antenna. The dummy load can next be moved to the point at which the transmission line leaves the building and heads for the tower (if different than the point checked in step 1). This test will allow you to check any RF plumbing or filter assemblies. If the VSWR overload condition is still absent, the problem is in the transmission line or the antenna.

3. If a standby antenna is not available, you can run the system at reduced power on a temporary basis. For example, if arcing occurs in the antenna or line at full power, emergency operation may be possible at half power. Inspect the antenna and line for any signs of trouble. Repair work beyond this point normally requires specialized equipment and a tower crew. This discussion assumes that the problem is not caused by ice buildup on the antenna, which can be alleviated by reducing the transmitter power output until VSWR trips do not occur.

4. If you find the VSWR overload of step 1 to be internal to the transmitter, you should first determine whether the problem is being caused by an actual VSWR overload or by a failure in the VSWR control circuitry. You can check this by disabling the transmitter exciter and bringing up the high voltage. Under these conditions, RF energy will not be generated. (We assume the transmitter has proper bias on all stages and is properly neutralized.) If a VSWR overload is indicated, the problem is in the VSWR control circuitry and not the RF chain. Possible explanations for control circuitry failure include loose connections; dirty switch contacts; dirty calibration potentiometers; poor PC board edge connector contacts; defective IC amplifiers or logic gates; and intermittent electrolytic capacitors.

5. If step 4 shows the VSWR overload is real, and not the result of faulty control circuitry, check all connections in the output and coupling sections of the final stage. You should look for signs of arcing or loose connections, particularly on any movable tuning components. Inspect high-voltage capacitors for signs of overheating, which might indicate failure, and check coils for signs of dust build-up, which might cause a flash-over. In some transmitters, VSWR overloads can be caused by improper final stage tuning or loading. Consult your equipment instruction book for this possibility. Also, certain transmitters include glass-enclosed spark-gap lightning protection devices, which can be disconnected for testing.

Check the following items if your AM radio station experiences VSWR overload conditions which are caused by a fault external to the transmitter:

1. If a normal (near zero) reflected power reading is indicated at the transmitter under carrier-only conditions, but VSWR overloads occur during modulation, there are two possible causes. A voltage breakdown could be occurring within one of the capacitors at the antenna tuning unit (ATU) or phasor. If the overloads occur with any modulating frequency, the probable cause of the problem is capacitor failure. If, on the other hand, the overload seems particularly sensitive to high-frequency modulation, then a narrow antenna bandwidth is indicated. Note the action of the transmitter's forward-reflected power meter. An upward deflection of reflected power with modulation is a symptom of limited antenna bandwidth. The greater the upward deflection, the more limited the bandwidth. If you note these indications, conduct an antenna impedance sweep of the system, and consider an antenna broadbanding scheme.

2. Tower static buildup can also cause VSWR tripping. This problem is characterized by a gradual increase in reflected power—as shown on the transmitter front panel. The static buildup—which usually occurs during poor weather conditions—continues until the tower base ball gaps arc over and neutralize the charge. The reflected power reading then falls to zero. A static drain choke at the tower base to ground will generally prevent this problem.

3. Static buildup on guy wires is another phenomenon that can cause VSWR tripping of an AM transmitter. The effect is similar to a nearby lightning strike in that no charge is registered during the buildup of potential on the reflected power meter. Instead, the static charge builds on the guys until it is of sufficient potential to arc across the insulators to the tower. The charge is then removed by the static drain choke and/or ball gaps at the base of the tower. You can prevent static buildup on guy wires by placing RF chokes across the insulators, or by using non-metallic guys. Arcing across the insulators may be reduced or eliminated by regular cleaning.

Although these procedures do not give all of the possible causes of VSWR overload conditions, they provide a starting point for the solution of most problems. Next month's article focuses on the design and maintenance of ¼- and ½-wave tube-type cavities for FM and TV service.

CORPORATE DATA

The Communications Systems Division of **Midwest Corporation,** Edgewood, KY, a professional video dealer and a manufacturer of mobile teleproduction units, announces a significant change in ownership. A purchase agreement was signed on Sept. 14, between Midwest Corporation and the newly formed **Midwest Communications Corporation,** that transfers most of the assets and certain liabilities of Midwest Corporation's Communications Systems Division to the new company. Midwest Communications Corporation is owned by a group that includes key management personnel and an outside investor, Charles J. Kubicki. The new company's president and chief executive officer is David K. Barnes, who had been with Midwest Corporation since 1976. Barnes had served as vice president and general manager of the Communications Systems Division for the past 4½ years. Kubicki, chairman of the board, is a Cincinnati commercial real estate developer and owner of a number of related businesses who has recently begun to diversify into aviation, high-technology manufacturing and communications areas.

Sound Summit, a studio featuring digital recording, opened recently in Lake Geneva, WI. Sound Summit offers 48-track analog recording with digital mixdown capability, using the Mitsubishi X-80A recorder. The studio is equipped with two Studer A800 analog tape machines and Studer A80 ½-inch and ¼-inch recorders. Its mixing console is a Neve 8068 with Necam automation.

Radiation Systems, Washington, DC, has announced that the company has purchased the assets of the Anixter-Mark Division of **Anixter Bros. Mark Antenna Products,** a new RSi subsidiary, was established. Richard E. Thomas, chairman and president of Radiation Systems, said the purchase price was $2,741,000. Payment terms included cash and a 5-year note to Anixter Bros. The new company will remain at its Des Plaines, IL, location.

The Broadcast Division of **Data Communications Corporation,** Memphis, TN, announces the acquisition of **Briner-Chase Group,** Salt Lake City. DCC is marketing the Briner-Chase single product, Phoneix System, under the name Bias PC Radio.

Philips TV Systems, a North American Philips Company, has named **Modulation Sciences,** New York, as its primary supplier of stereo TV broadcast equipment, effective immediately. As part of the arrangement, Modulation Sciences and Philips TV Systems have signed an original equipment manufacturing (OEM) agreement, providing for Modulation Sciences to supply Philips with stereo TV hardware, including stereo TV generators, SAP (Second Audio Program) generators, and the professional channel generator. The stereo TV generator puts full-range stereo on a station's baseband. The SAP generator allows a television station to put a second audio program channel, intended for reception by the general public, on its aural baseband. The professional channel generator is intended for a station's internal use, such as cueing.

Stereo sound and multilingual channel capacity premiered on the **Wold Communications Satellite TV Network,** Los Angeles, on Oct. 1. This follows the FCC's decision last December to establish a single standard for Multichannel Television Sound (MTS). The October premier also coincides with the fall debut of new stereo TV sets by major manufacturers and the introduction of stereo broadcasting services by stations across the country. Wold Communications has selected the Wegener Communications Series 1600 subcarrier transmission system and the Wegener Panda II noise reduction system for its MTS transmissions.

ICM Video, Oklahoma City, has announced the appointment of a new factory representative, **Components International,** New Milford, NJ. Components International will represent ICM Video in New York state and northern New Jersey. The ICM line consists of video processing and commercial satellite receiving products.

Comsat, Washington, DC, announced that preliminary agreements have been reached under which it, the **Prudential Insurance Company of America** and **Douglas F. Ruhe,** Brentwood, TN, would become the principal general partners in providing direct broadcast satellite (DBS) TV services using small receive antennas. The transaction would be subject to the negotiation of a definitive agreement and its final approval by these parties. Under agreed terms, Comsat would initially own approximately half of the partnership, which would be capitalized through both equity and debt. The agreements provide that **United Satellite Communications** (USCI), in which Prudential has a substantial investment, would be integrated with **Satellite Television Corporation** (STC), a Comsat subsidiary, and both businesses would be conducted by the partnership. Shareholders of USCI, other than Prudential, would also hold minority limited partner interests in the partnership.

Atlantic Research Corporation, Alexandria, VA, and **Yukong Ltd.** (formerly Korea Oil Corporation), Seoul, Korea, have signed a letter of intent to execute a license agreement, one that would permit Yukong to manufacture and sell Arc-Coal, a coal-water fuel (CWF) designed to replace residual fuel oil. The companies will be working together to demonstrate the use of this new fuel in Korea.

The first of three satellites deployed from the space shuttle Discovery was placed into final geostationary orbit through the assistance of two earth-bound 8.1 meter **Harris** antennas. The communications satellite SBS-4, owned by **Satellite Business Systems,** was tracked as it traveled by booster rocket from its shuttle orbit of 184 miles to geostationary orbit 22,300 miles above Earth. The Harris antennas are located at SBS tracking, telemetry and control stations at Castle Rock, CO, and Clarksburg, MD.

EQUIPMENT SALES

Artel Communications Corporation, Worcester, MA, has been awarded a contract to supply fiber-optic video systems for Bell Atlantic. The contract calls for Artel's SL3000L single-mode, fiber-based systems. The systems will initially be used by Bell Atlantic's Chesapeake and Potomac (C&P) Telephone Company to transmit video in the Washington, DC, area for broadcast of the presidential inauguration.

A complete prewired/racked FM system using FM transmission from **Catel Telecommunications,** Santa Clara, CA, is being installed and will transport 60 channels for cable TV in La Hacienda Heights, a Los Angeles suburb.

Hughes Communications Galaxy, Los Angeles, has announced plans to offer part-time use of satellite capacity. The new service, Galaxy Video Timesharing Service, is available on

Galaxy II, positioned at 74° west longitude. Hourly service rates are determined by two time-of-day classifications, prime-time and off-time. The service rates are especially economical for users who requires at least 10 hours of satellite video transmission per month.

The Robert Bosch Corporation, Video Equipment Division, Salt Lake City, recently shipped its new PAL format BCN VTR to **Intercontinental Televideo,** New York. The B format has been officially adopted by the European Broadcasting Union (EBU) and should eventually become the primary professional broadcast standard in Europe. ITI's BCN-51 VTR is the only unit in New York in the PAL configuration, and one of only a few units in operation in the United States.

Studio East, Nova Scotia, Canada, and **The Videotroupe,** Salem, NH, have recently added the Paltex Edit-Star to their facilities. The Edit-Star, Paltex's 4-VTR, microcomputer-based editing system, was introduced at the NAB Show in April.

Interactive Systems, Boulder, CO, reports that 10 ISC System 31 videotape editors were used by ABC at the Los Angeles Summer Olympics. The same systems were previously used in Sarajevo for the Winter Games. The ISC editing systems include slow-motion software that provides accuracy and flexibility in editing slow-motion sequences. Key features of the software include 1 percent variations of speed with VPR-3 tape recorders, storage of the speed data in the edit list, capability to change the speed within an edit, capability to make match edits with multiple VTRs at different speeds, and control of picture centering in slow motion.

Centro Corporation, San Diego, announces the delivery of a teleproduction trailer at NAB in Las Vegas. The remote production system, Mobile One, was designed and built for **One Pass Film and Video,** San Francisco. The production area of the 45-foot trailer accommodates 12 people. Equipment includes a Grass Valley 1680, 24-input production switcher, Quantel DPE-5000 digital effects system, five RTS 802 master stations (with IFB), and video, audio and technical monitoring.

Paramount Pictures Corporation, Hollywood, and **Centro Corporation,** San Diego, announce the completion of video production and post-production facilities at Paramount's studios. The facility consists of a master control tape machine area, camera control room, two identical production/post-production suites and two audio production suites.

The government of India has selected **Continental Electronics Manufacturing,** Dallas, to design, manufacture and install Very Low Frequency (VLF) transmitter and related equipment in India. The contract, valued at more than $12 million, includes on-site testing of the equipment and training of Indian personnel.

Comsat General Corporation, Washington, DC. has signed a consulting contract with the **China Broadcasting Satellite Corporation** (CBSC) for the People's Republic of China (PRC). Under this contract, Comsat General will assist CBSC in its plan to obtain satellite and ground control network equipment for a direct broadcast satellite (DBS) system to distribute TV and audio services in the PRC. Comsat General will advise CBSC in the preparation of a request for proposals document, assist to CBSC during their contract negotiations with the selected suppliers of equipment.


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1/2-inch— no passing fad

by Carl Bentz, television editor

An agreement was signed in late September between the CBS TV network and Sony Broadcast for a major purchase of Betacam products. Included in the $11 million package were BVP-30 cameras with BVV-1 detachable recorders, BVW-20 field players, BVW-40 recorder/editors and BVC-10 Betacart systems. The equipment is planned to be used at the network news center in New York and at WCAU-TV, Philadelphia. CBS selected the Sony products after lengthy laboratory and operational tests. Some of the considerations that they no doubt reviewed are summarized here.

Getting started

When developmental ½-inch camera recorder systems first appeared to the public at NAB '81, they were considered revolutionary. Evolutionary is perhaps a more apt description of today's complete systems in either of the two ½-inch formats. Both meet the requirements mandated for ENG camera/recorders and supporting products.

Suggestions given to Sony and the M-format backers in 1981 requested ENG systems that were light in weight and easily used by non-technical operators. The 1-piece units should include many automatic features and produce a signal capable of withstanding vigorous multigeneration production. Output signals from the systems should be easily convertible to any of

The ½-inch format has been readily adaptable to electronic news gathering operations.

today's color transmission standards as well as to foreseeable technologies. In the last three years, Sony's Betacam and Panasonic's M-format have made their growing spurts, with field and studio players, editing units and finally automated multiple cassette players (i.e., Panasonic's MVP-100 in 1983, Sony's Betacart unit at NAB '84.)

Some stations have been unable to consider re-equipping their facilities because of investments before ½-inch. Now, however, the manufacturers also offer a series of interfaces. Virtually any camera may be used with a component recorder. Alternatively, any component camera can be interfaced to any composite recorder or production system.

Building down to ½-inch

The introduction of electronic news gathering (ENG) is but one of the major steps in the advancement of TV technology. The ENG camera operator was freed from the cables tying him to a control center. The cost of the freedom, however, was in the form of relatively heavy portable 1- or ¾-inch recorders.

Of the two, users seemed to prefer the cassette format over reel-to-reel tape because of its non-technical operational simplicity. That fact provided impetus to the U-matic (SMPTE E) format, launched in the early 1970s by Sony. Despite continuing design work, weight remained a drawback. Another problem was the fact that ¾-inch recordings did not fare well through multiple generations when using composite signals.

The step toward ½-inch tape material provides multiple benefits, including the greater availability of ½-inch blank cassettes. Another benefit was the reduced size of mechanical components. With smaller inertias to overcome, the units required less power. Either smaller batteries or longer battery life were possible. The result is an average operational weight of 19 pounds.

Video components

For better multiple generation quality, a video component plan was devised for ½-inch. Components answered the question of ready conversion to other signal formats. Previous experiences in circuit and mechanical systems evolved from the ¾-inch system into ½-inch.

The U-matic system was introduced as an inexpensive means to record and play composite signals. The recording plan, however, used separated luminance and color signals, Y/C.

Y FM-modulated a carrier signal with the video sync tip setting a frequency of 3.8MHz. Color, separated through a comb filter, was mixed from 3.8MHz to center around 688kHz, leading to the term *color under*. Y and C were mixed into one signal and written onto the tape.

For dubbing or editing, Y and C were available as off-tape RF signals. The wider bandwidth of the RF allowed better detail when dubbing from one tape to another. An encoded output is also available for editing.

In converting 688kHz color data back to the 3.58MHz spectrum, corrections for mechanical instabilities were made, resulting in a reasonably stable color output. Signal peaking and band filters took their toll in signal detail, leading to extensive use of compensation circuits in the BVU-200 machines to counteract phase shifts and non-linearities from filtering and other circuits.

Although Y and C were frequency separated in E format, the single channel for both signals courts possible interaction. Thus, in the ½-inch design, Sony engineers used a 2-channel system, driving separate luminance and chrominance heads. Each luminance head pass lays down one TV field of b&w information, while each chrominance head pass records R-Y and B-Y components separately. To do this, the 63.5μs/line color components are compressed in time by a factor of 2-to-1 and then written alternately to the tape. No color subcarrier is involved.

Upon playback, color components are expanded to their original 63.5μs lengths and modulated onto the 3.58MHz subcarrier for encoded composite video. For editing or post-production switching and effects, the components remain available as separate 1.5MHz bandwidth signals without subcarrier. Only when conversion to another format or a conventional display is needed, is the appropriate subcarrier introduced.

R-Y/B-Y color components are applicable to other areas of TV technology. Multiplexed analog component (MAC) concepts are being applied in satellite transmission of TV signals for DBS and HDTV. The components are easily handled with digital techniques. At the same time, no reference subcarrier is involved, until the signal is transformed for terrestrial transmission to conventional TV receivers. It has been pointed out that the Betacam components could be fed almost directly to uplink transmitters, thus avoiding the 3.58MHz subcarrier, which alone adds measurable improvement to the picture.

What about I and Q?

NTSC designates red, green and blue signal information transformation into composite video. First, luminance (Y) and two chrominance components (I and Q) are developed. I and Q modulate in-phase and quadrature-phase (90-degree phase shifted) color subcarrier, followed by suppression of the 3.58MHz carrier energy and filtering to remove excess bandwidths. With exactly 90° of shift, the two show minimum interaction, as they are interleaved into the composite signal.

Bandwidth reduction of I and Q is required to fit the signals into the NTSC video envelope. Fortunately, the human eye sees detail in color differently, depending upon the wavelength or hue of the light viewed. To retain detail along the more critical I (orange to cyan) axis, the I is trimmed to a 1MHz bandwidth, and the upper sideband is partially removed to keep the signal within the specified video envelope. Magenta to green, the Q axis, is less critical, however, and is reduced to a double sideband 500kHz bandwidth.

M-format designers chose I/Q components. As in Betacam, M-format uses a 2-channel approach. A field of FM-modulated luminance with a bandwidth of 10MHz is written onto the tape during each head pass. In the color channel, I information centers on 6MHz, with a bandwidth of approximately 7MHz. Q information is held to 2.25MHz excursions from a zero center frequency. These two are simultaneously writing onto the color track. No 3.58MHz subcarrier is introduced at this point.

For dubbing and editing, separate Y, I and Q components are provided. They may be converted to a Y/C U-matic signal through an adapter. A composite signal may be created by a 3.58MHz subcarrier. Through the use of the I and Q components, M-format appears directly applicable to NTSC, while R-Y/B-Y components will require matrixing, although minor, into the I/Q form.

Signal sources

Although the heart of the Betacam format is the recording format, an evolutionary process has also occurred in the matching cameras. The improved recording format receives its inputs directly from improved image sensing component video cameras.

After many years of vidicon tubes, greater sensitivity and resolution with decreased image retention came with the lead oxide target of Plumbicon tubes introduced by Philips in the 1960s. Another step in imaging came from NHK (Tokyo Broadcast Company) with Saticon target material (selenium, arsenic and tellurium), stemming from research by RCA's David Sarnoff Laboratories. With minimal reductions in sensitivity and resolution, an improved noise performance was realized.

Sony research combined the SAT target with the concept of electrostatic deflection and electromagnetic focus that General Electric demonstrated some years ago. The resulting pickup tube is more stable, capable of high resolution, reasonably sensitive and quieter. Electrostatic deflection requiring fewer coils to control the electron beam reduces the size, weight and power consumption of the camera. Again, longer useful battery life or reduced battery weight results. These factors are found in the BVW camera series. RGB matrixing forms Y, R-Y and B-Y components to feed the detachable Betacam recorders.

Another technology Sony has stressed is the single-tube camera. A striped filter on the faceplate of the tube and a 3-electrode Trinicon construction allows red, green and blue color signals to be developed through special clocking circuits. Sample and hold circuits in each channel smooth out the clocking ripples that switch the three channels on and off, as the electron beam scans the target. The resulting signals are processed into luminance and chroma components in the BVW-1 camea.

In the marketplace

The industry currently has a choice between two ½-inch formats. Proponents of Betacam and M-format claim large shares of U.S. ½-inch users. Neither Sony nor Panasonic have been idle, however. Refinements to circuitry continue. Complete systems support both formats and various interface devices allow intermixing. New models and additional features may be expected at almost every trade show.

One formal standard for ½-inch remains pending. Will 1985 perhaps unfold a new chapter or a new generation in the evolutionary processes of the ½-inch format story? [BE]

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Industry News

Continued from page 4

- Ampex and Kudelski, Sa/Nagra, for developing a portable 1-inch type-C VTR, which provides producers with a mobile recording facility;
- Lexicon, for developing the Lexicon model 1200 audio time compressor and expander;
- Sony, for developing single-frame recording techniques on stationary videotape and using incorporating the technology in the 1-inch type-C equipment;
- RCA, for pioneering work in the development of circular polarization technology in TV broadcasting; and
- Tektronix, for continued technical excellence and leadership in TV tests, measurement and monitoring technology.

Networks try new approaches

The 1984 Democratic National Convention in San Francisco in July turned out to be somewhat of a testing ground for TV production. Not only was extensive use made of fiber-optic materials, provided by Pacific Bell, but other items were introduced.

ABC found that the Videoplex Multiplexer offered a convenient method of displaying multiple signals on a single monitor screen. Originally developed in Germany and introduced to the CATV industry several years ago, the 4x4 display allows 16 non-synchronous video feeds to be shown simultaneously, each with its own customized source ID. The unit ABC used was modified to allow instantaneous and repetitive ID changes externally through a data entry keyboard. ABC also used the display system at the Olympics in Los Angeles and at the Republican Convention in Dallas.

CBS approached video coverage of the convention with a remote-control camera suspended overhead. An Ikegami HL-79 camera with a 30:1 lens was control with the Nettmann Cam-Remote system from Matthews Studio Equipment. The 360° rotation, pan, tilt, focus, iris and zoom capability were controlled by a single operator on the convention floor up to 400 feet away. Four systems were used at the Republican convention.

NBC's coverage included developments by Audio-Technica. Wireless communications headsets used a UniPoint unidirectional condenser mic on a boom to free the reporter's hands for other tasks. The highly directional characteristic shuts out the audio pandemonium of the surrounding area. The same microphone unit in a wand configuration, connected with the headset system through a small control box that allowed the headset unit to have priority. The output of the control box tied to a wireless mic transmitter.

The company said it expected the new equipment to be on the market soon.

AM Stereo Update

Continued from page 10

justments for AM stereo operation with about 90% envelope modulation at 1kHz. Make critical tuning adjustments (plate tuning and neutralization in the case of plate modulated transmitters) while watching the L – R meter on the modulation monitor and fine-tuning for a minimum reading.

The mid-frequency stereo separation will be equal to or slightly better than the ratio of main-to-subchannel crosstalk, which is what is being observed in this condition. Almost any transmitter can be optimized to produce IPM (or subchannel crosstalk) levels of 30dB to 35dB below 90% envelope modulation. *Optimized* means that there has been no sacrifice in mono performance, efficiency or positive peak capability in exchange for good stereo performance.

December's column will examine STL requirements for AM stations planning to convert to stereo.

FCC Update

Continued from page 6

initial 18-month CP period, and it was not demonstrated that construction was prevented by forces beyond the permittee's control.

Comments wanted on aural subcarriers

The FCC has issued a rulemaking notice seeking comments on whether cable TV systems should be required to carry program-related aural subcarriers of TV stations.

Last March, the commission expanded the permissible uses of the TV aural baseband to include stereo or second-language services. However, it deferred action on whether to require cable systems to carry broadcast-type aural subcarrier programming because of concern over possible technical problems.

Noting it does not have sufficient information to support the adoption of specific rules, the commission has asked for information regarding the impact a must-carry requirement for TV aural subcarriers would have in terms of promoting local program services in the public interest. Specifically, the commission wants to know:

- How long it would take for receiver equipment with TV stereo and second-language capability to achieve substantial penetration into TV markets;
- What proportion of new receivers would have stereo and second-language capability, only stereo, only second language, or none at all;
- How important stereo is to TV viewers;
- What the current status is of cable carriage of stereo sound in relation to pay services and other special programming;
- What kinds and amounts of programming would be produced with stereo sound and when it would be available;
- How much and what kinds of local programming would be produced with stereo sound;
- What the net effect on local TV service would be if local stations provided stereo service and cable systems carried none, carried all programming in stereo except that of local stations, or carried some programming in stereo but not that of local stations; and
- What proportion of viewers would use a second-language service.

Other questions of concern to the commission deal with the kinds of alternate communications services cable systems would offer independently on subcarrier facilities and whether the market would be better served by encouraging such independent services rather than through adoption of a must-carry standard.

Satellite Update

Continued from page 12

Terminal Type	Antenna	Uplinks	Receivers	Affiliate Interface
Master terminal (2-sites)	8m (Qty 2)	2	4	.....
Transmit/receive terminals (8 sites)	6.1m and 3.5m Backup**	2	4	4 video (8 audio) to affiliates 3 video (6 audio) from affiliates
Transportable terminals (6 units)	5m	2	4	Same as transmit/receive
Affiliates receive-only terminals (170 sites)	11m (2 sites)	***	4	4 video (8 audio) to affiliates
	8m (46 sites)	***	4	1 video from affiliate (for sync. reference signal) (at all affiliate sites)
	6m (122 sites)	***	4	

Notes – *Number of terminals as of May 1984 plan.
**3.5m backup antenna used during sun transit periods and other operational situations requiring a second antenna
***Uplinks can be installed at any receive-only terminal to turn it into a transmit/receive terminal

Table 4. Ground sement.

people

Joseph L. Scheuer, president of Chyron Corporation, Melville, NY, has announced the election of **William Buynak** as corporate vice president. Buynak joined Chyron Corporation in 1981 and has served as vice president of Chyron's Video Products Division. In his new capacity, he will direct the engineering research and development activities of the company.

Gary J. Stanfill has been appointed president of Cetec Vega, a division of Cetec Corporation, El Monte, CA. Stanfill has served as general manager of Cetec Vega since January 1983. Before that, he was director of engineering for the division, responsible for product design and development for both wireless microphones and signaling products.

Sam Goodman has been elected president and chief executive officer of Orrox Corporation, Santa Clara, CA. He replaces **Philip B. Arenson,** who will remain with the company in a senior executive position. Most recently, Goodman had been assisting Eagle Computer in developing a strategy to accomplish a turnaround for the manufacturer of IBM compatible computers.

J. Eugene Harrison has been appointed president and chief executive officer of Continental Electronics Manufacturing, Dallas. Harrison joins Continental from the Southcom Division of Loral Corporation, where he served as president for nine years.

Jerry Ford, chairman of the board and chief executive officer of Lenco, Jackson, MO, has announced the appointment of **Donald K. Ford** as marketing director. Ford had been the marketing manager for the Individual Trust Division of Mercantile Trust Company, St. Louis. Also, **Mark R. Peterson** has been appointed western district manager.

Virgil Lowe has been elected to a 2-year term as a section manager for the Atlanta chapter of the Society of Motion Picture and Television Engineers (SMPTE). Lowe is executive vice president and director of advanced development for Fortel, Norcross, GA.

Steve Reyes has been named product marketing engineer for Wiltron Company's Microwave Division, Mountain View, CA. Reyes will focus his attention on the support of new product development, preparation of training materials and promotional literature, and technical and applications support to regional managers and representatives.

BASF Systems Corporation, Bedford, MA, has named **Gay F. S. Spiegel** its product manager for audio magnetic products. Spiegel joins BASF from Webster Industries in Peabody, MA, where she was a product manager.

Joel Berger, most recently special projects director for *Fortune* magazine, has joined The Cable TV Guide Network in Boston as vice president for advertising sales.

Tom McCoy, NRBA executive vice president, has announced that **James F. Mackin,** long-time radio executive, has joined NRBA as director of membership.

Gary Rilling, Altec Lansing commercial sales vice president, has announced the promotion of **Gayle Campbell** to national sales manager, Commercial Products. Campbell will also be responsible for Altec's government sales.

new products

Dynamic microphones

Audix is offering the first of the UD-series dynamic microphones which incorporate their new air suspension design. The UD-200 is a high-output, low-impedance microphone with a smooth response from 50Hz to 18,000 Hz, tight cardioid pick-up pattern and an integral acoustical pop filter.

Circle (450) on Reply Card

Super beam mic

The MU-6200E super beam microphone from *JVC Company of America* provides sensitivity measuring 50mV/Pa at 1kHz with a frequency response from 50Hz to 15,000Hz. The microphone features continuous variable directivity and remote control of tone and directivity. Sound signal can sent at line level by the built-in amplifier with 15dB gain. The microphone weighs 4.1 pounds and measures 45 inches long.

Circle (451) on Reply Card

High gain mic

Electro-Voice has introduced a new cardioid condenser microphone which offers high gain before feedback for both vocal and instrumental live-performance applications. This microphone, model PL78, achieves heightened gain before feedback through a peak-free frequency response and a fine-tuned cardioid pick-up pattern. By positioning the transducer element close to the front of the microphone, unwanted background and reflected sound are reduced with a minimum of feedback.

Circle (452) on Reply Card

Test set

A noise-and-interference test set from *Hewlett-Packard* provides an accurate method of simulating flat-fade and/or interference conditions on microwave radio links. Designed for operation in the IF section of a digital or FM microwave radio, the HP 3708A will add calibrated levels of white noise and/or interference an operator-selected carrier-to-noise (C/N) or carrier to interference (C/I) ratio.

Circle (453) on Reply Card

Instrument cart

The *Leader* instrument cart is an all-steel, roll-about cart built to hold up to 450 pounds of equipment, with 14 square feet of storage space. It has an eye-level document rack for holding schematics and wiring diagrams as large as 19"x22", four 20⅝-inch-wide adjustable shelves, plus pull-out writing surface or additional shelf and pull-out storage bin. A holder for test probes or soldering iron is also included.

Circle (454) on Reply Card

Digital editing for the PCMF1

KEMA Marketing, a division of *AMEK Consoles*, is offering CLUE (Computer Logging Unit and Editor), which provides a cost-effective solution to problems caused by using the Sony PCMF1 and PCM 701ES digital audio processors. CLUE's features include sophisticated logging and auto-location facilities; but copy-editing can be per-formed in either analog or digital modes to frame accuracy (1/30 second NTSC). CLUE also facilitates insertion of auxiliary devices into the signal path during edits and makes provisions for fader and level adjustments.

Circle (455) on Reply Card

Time code generator

An easy, inexpensive SMPTE time code audio capability is available with the Aaton WLD6-A coder, manufactured by *Zellan Enterprises.* The WLD-6 fits onto the Sony Professional Walkman (WM-D6), supplying a SMPTE time signal and pilot tone on the right audio track and mono recording on the left track. Once recorded, the on-location cassette may be transferred to either 16mm or 35mm magnetic fullcoat with a SMPTE cue track or to multitrack audio tape.

The WLD-6 may be initialized with a master clock such as the "Origin C." It may also be initialized with a SMPTE generator or by flicking the *start* switch when the counter is set at zero. The coder offers a custom professional microphone input (Switchcraft socket) which may be used in place of the Sony WM-D6 mini-jack.

Circle (456) on Reply Card

Soldering iron

A soldering iron designed for soldering, desoldering and replacing surface-mounted devices has been introduced by *Hexacon Electric Company.* The Soldermaster SMD has a short reach, permitting precise positioning on fine line circuitry.

A wide selection of miniature tips is available for soldering both dual in-line leads and leadless packages. Specially designed slotted spade tips are available for soldering and desoldering leadless packages and chip resistors or capacitors.

Circle (457) on Reply Card

Stripping/coring tools

Ben Hughes Communication Products is introducing a new series of stripping and coring tools for the Quantum Reach Cable from M/A-Com Comm/Scope. The Cable-Prep SCT-QR series is available for 50Ω and 75Ω cable. Made for both 500 and 860 cables sizes, this tool also removes the outside jacket to manufacturer's specifications.

Circle (458) on Reply Card

Ampex tape machines

JRF Magnetic Sciences recently introduced a new conversion retrofit assembly for Ampex ATR series tape machines. This ATR assembly was designed specifically to master ½-inch, 2-track analog tape. The ATR assembly offers easily accessible adjustments for azimuth and head wrap. It also includes premium quality, long-wearing Saki magnetic heads for added performance.

Circle (459) on Reply Card

Bus console

The Amek Consoles Matchless series of 24 bus audio consoles features full 24-bus routing, 4-band equalization with swept mids and selectable Q, eight sends, eight returns, eight mono sub-groups, two programmable mute groups and line return facility through the monitor section during remix. The Matchless comes standard in a 26/24 mainframe configuration with larger frames and retrofit extenders also available. An optional version containing a full patchbay and producers desk is also available.

Circle (460) on Reply Card

Transient voltage suppressor

The Kalglo Electronics In-Line power cord transient voltage suppressor and EMI/RFI noise filter is designed to replace detachable computer power cords and provide voltage surge protection and EMI/RFI noise filtering. The unit features a 3-staged surge suppression network and a 3-staged noise filtering network which works synergistically with each other to provide six stages of total protection. It includes a 7-foot cord for wall outlets.

Circle (462) on Reply Card

In-line monitor consoles

Trident has introduced its first unit in the t.i.l. series of in-line monitor consoles. The t.i.l. console avoids status changes normally associated with in-line mixers because it routes all or any combination of the eight auxiliary sends to either the input or monitor section of the console. The t.i.l. is also able to route the entire equalizer section into the corresponding monitor section, but the routing can also be split so either the high and low or two swept midsections can be selected to monitor. During mixdown 60 line inputs with equalization are available.

Circle (463) on Reply Card

Remote control panels

MC series is a *Broadcast Systems* design that offers low cost functional remote controls for film islands and VTRs. The systems will interface with most popular machines. Lighted push-button switches with both normally open and normally closed contacts are used. Connections are made to the individual panels via barrier strip or (on request) *D* subminiature connectors. It features modular rack-mount or drop-in tabletop and a quality switcher with tally and film legend.

Circle (464) on Reply Card

Interface panels

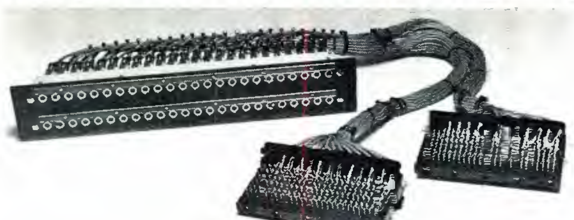
MC series interface panels from *Broadcast Systems* handles audio, video and control circuit interface. Panels are fabricated of brushed stainless steel. The panels feature audio I/O panel with XL-type connectors for nine circuits, audio I/O panel with three connectorized barrier strips and video I/O panel with isolated BNC connectors for up to 16 circuits.

Circle (465) on Reply Card

Audio mixer/recorder

Tascam has introduced the new Ministudio Porta One; a portable, battery-operated 4-channel audio mixer/ recorder designed for tough field work and convenient operation. Its features include standard 1⅞ips speed allowing playback of standard stereo cassettes, the capability of assigning one or all four channels to any track and switchable dbx noise reduction for wide dynamic range.

Circle (466) on Reply Card



Intercom/talkback system

The *Audix Limited* intercom/talkback system, designed for use in studios but which will also find broader application in large-scale communication systems is all digital, operates via a single loop of coaxial cable, with the option of utilizing fiber-optic links, and can carry up to 60 simultaneous channels of audio communication. The system can have up to 120 outstation terminals with interconnection and configuration remaining totally flexible and speedily updated through its central processor unit. Floppy disc storage of desired groupings is available and the entire system configuration can be immediately updated.

Visitors to the Audix Stand at the IBC in Brighton, England, Sept. 21-25, also saw a full production version of the 'Assignable' audio mixing console. Using digital control of analog signal processing circuits, the Assignable offers true total memory recall with floppy disc storage of all control settings. All signal processing circuitry is located in a remote rack, resulting in an operating console only a fraction of the size of conventional mixing desks.

Circle (467) on Reply Card

Fiber-optic link

By using a low-loss plastic fiber and a highly sensitive receiver-detector, *Thomas & Betts Corporation* has developed Data Channel, a fiber-optic transmission link with a transmission range of 425 feet without the need of an intermediate repeater. The link is field installable without additional tools and is based on a simple RS232C plug-in used between two stations for 2-way transmission of data in digitized format.

In operation, the data, originally in electrical form, is transformed into a light signal and transmitted through the plastic light path, then reconverted into an electrical signal. The transmission through the plastic-fiber conduit prevents noise and outside electrical surges from affecting the signal.

Circle (468) on Reply Card

Dual cassette recorders

Sarasota Automation has designed a new range of recorders to record conferences on compact audio cassettes. The Neal 6000 series recorders have two identical 3-motor type, logic controlled mechanisms fed by common inputs.

When the first cassette nears the last minute of recording, the second mechanism automatically begins recording in conjunction with the first cassette, ensuring no gaps during automatic changeover. An alarm alerts the operator to change the first cassette so it is ready for automatic changeover when the second cassette approaches the last minute of its recording length. Automatic changeover also occurs if a cassette malfunctions for any reason during recording.

Circle (469) on Reply Card

Microphone accessories

Atlas Sound's new E series stand and boom microphone attachment models are coated with an electrostatically applied, baked powder epoxy that will maintain the original finish. Models available include two conventional microphone floor stand models (with 10- or 12-inch diameter cast-iron bases) and one tripod-base Porta-Stand (32 inches high folded, 65 inches high extended).

Circle (470) on Reply Card

Continued on page 148

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Digital time base corrector

A modified version of the *For-A* Digital Time Base Corrector (FA-410) permits full use of the dynamic tracking capability of the Sony broadcast U-Matic BVU-820. Modification allows it to accept the vertical signal from the BVU-820 and the TBC can follow the speed of the VTR. The FA-410 digital TBC operates in a heterodyne mode and handles the full range of the VTR from 1X reverse speed through 3X forward speed, including frame-by-frame and still frame.

Circle (472) on Reply Card

50kW tetrode

Thomson CSF's TH 563 50kW tetrode was introduced in September at the IBC-84 Brighton show. This tetrode features a considerably reduced energy consumption which offers reduced operating costs for UHF broadcasting. Pyrobloc pyrolytic graphic grids and the super-efficient Hypervapotron cooling system are incorporated in the tube.

Circle (473) on Reply Card

Automatic voltage regulator

Hipotronics' new line of voltage regulators has input voltage range of +20% for ±1% output accuracy. All standard service line voltages are available, at currents ranging from 40 to 1000A for single and 3-phase systems. Optional features include individual phase control, bypass switch, and transient suppression.

Circle (474) on Reply Card

Graphics system controls laser displayer

New Media Graphics Corporation announces a new interface option for its GraphOver 9500 graphics system for controlling the playback of multiple Hitachi VIP-9500 laserdisc players. High resolution, animation-type color graphics can now be displayed in overlay mode on top of any accessible 108,000 video frames. Audio switching between multiple stereo channels is also possible under program control.

Circle (477) on Reply Card

Dimmer banks/modules

Electronics Diversified introduces Mark VII dimmer banks and SPI plug-in dimmer modules. The banks feature digital control with analog back-up, and individually cooled dimmer modules. For controlling house and stage dimmers, a single rack accepts up to 60 SPI plug-in modules containing single, dual or quad dimmers. Additional racks bolt together for expanded systems. Dimmers banks come prewired for connection to power and loads. The SPI plug-in dimmer module is available in 2.4kW. 3.6kW, 6kW, and 7.2kW capacities.

Circle (478) on Reply Card

Software

$EL-A-VISION, a software package from *Softpedal*, speeds TV time sales by generating instant "avails," ratings by cost efficiency and audience delivery and rating book trends. The system operates on IBM compatible PCs.

Circle (488) on Reply Card