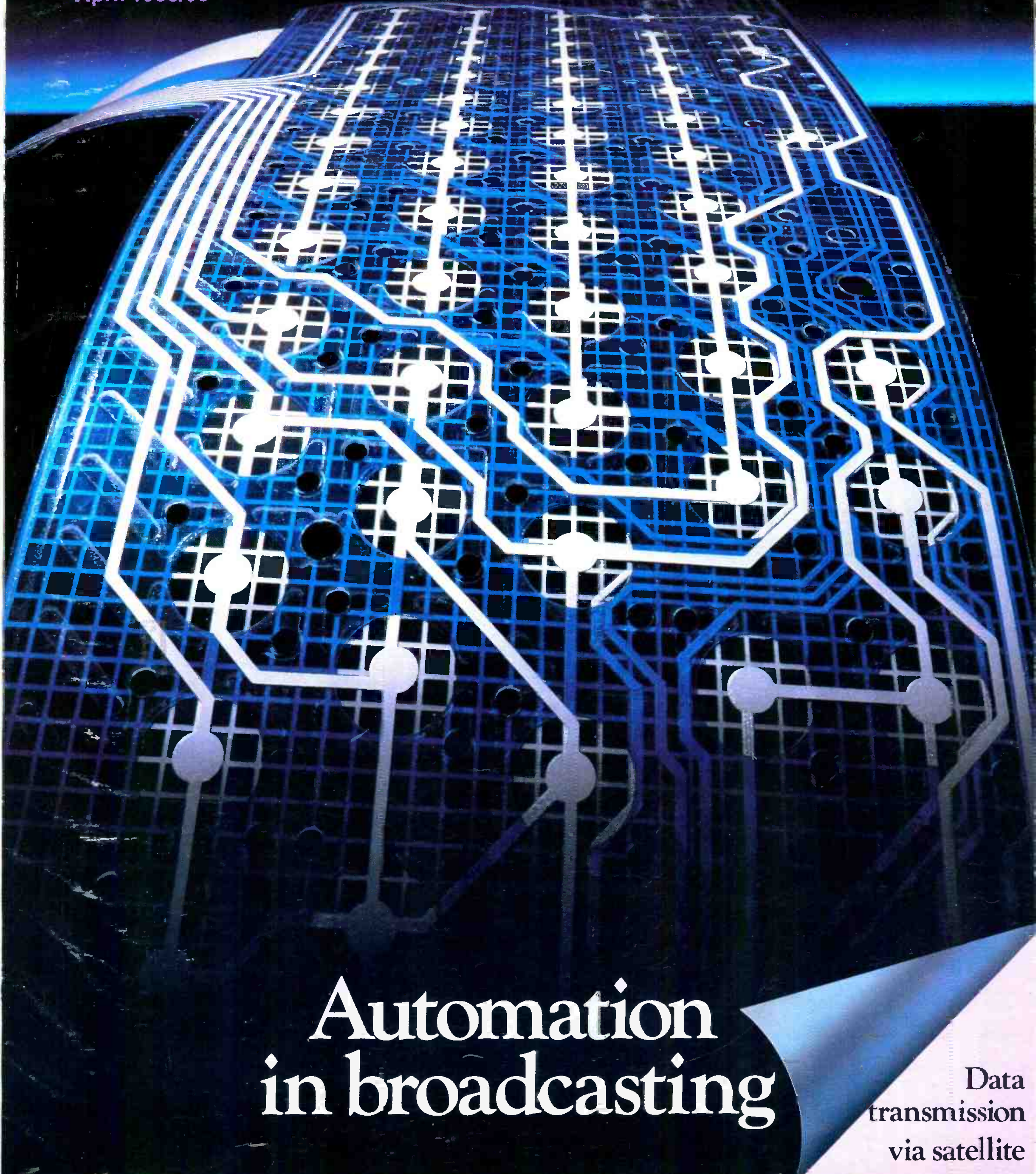
BROADCAST engineering®

April 1986/$3



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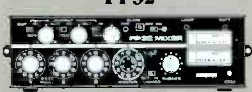

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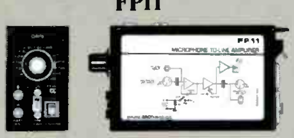

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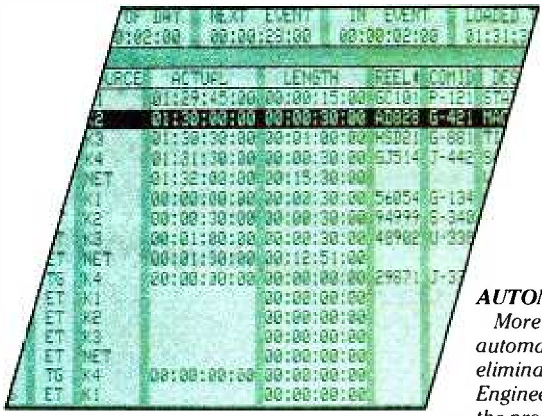

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Broadcast Engineering

AUTOMATION SPECIAL REPORT:

More and more, broadcast managers are looking to automated technology as a way to reduce operating costs, to eliminate operator errors and to improve program quality. Engineers must be aware of the benefits that are possible and the problems that can develop through the use of automation in the broadcast station. We examine some of the factors stations need to consider as automation becomes another important element in today's station.

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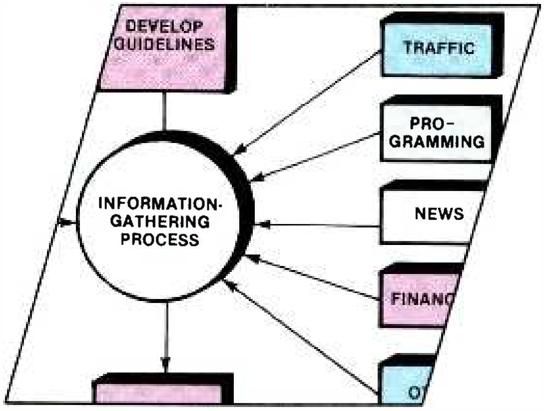

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ON THE COVER
Advancements in technology for the computer, aerospace and consumer industries have a significant effect on radio and TV broadcasting. Spin-off technologies have permitted the introduction of sophisticated, affordable automation equipment to the broadcast industry. Shown on the cover is a membrane switch made with types D and EL Mylar, used in a variety of broadcast and industrial products. (Photo courtesy of DuPont Company.)

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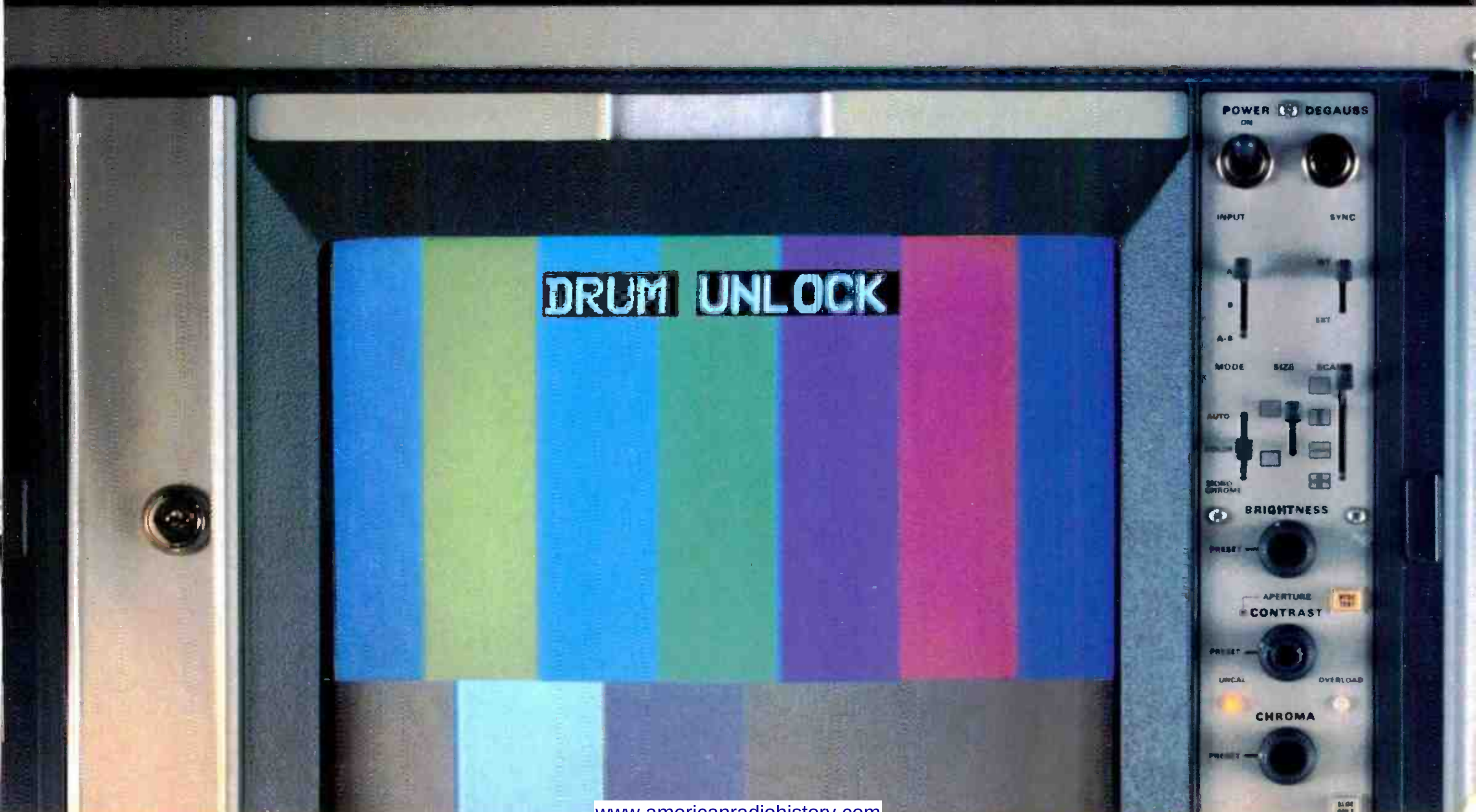

SMPTE imaging seminar

A 1-day tutorial seminar on *Imaging Manipulation: Matching the New Technology to Video and Film Production,* will be held on Saturday, May 10, in Los Angeles. The seminar is co-sponsored by the Hollywood section of SMPTE and the continuing education division of the School of Cinema-TV at the University of Southern California. Hours for the seminar, to be held on campus, will be from 9 a.m. to 8 p.m.

The event will focus on a broad range of film and video manipulation techniques, including image compositing with multiple levels of matting for traveling mattes and motion control photography; optical and digital video effects; electronic palettes; and titling/character generators. Pretaped and live video demonstrations will illustrate current image manipulation practices in the post-production environment. The sessions will conclude with a panel discussion open to audience questions.

Seminar attendance is open to industry professionals, students and other interested individuals. The registration fee is $35 for students, $45 for SMPTE members and $55 for non-members. Lunch is included.

Early registration can be arranged by contacting the continuing education division, USC School of Cinema-TV; telephone 213-743-7469, extension 9.

AES focus on TV audio

The fourth international convention of the Audio Engineering Society will convene in the Westin Hotel at Chicago's O'Hare Airport, on May 15. The central theme of the 4-day conference will be *Stereo audio technology for TV and video.* The prime goal of this event is to acquaint audio and video professionals with emerging technologies. Through a better understanding of technical and economic factors, industry growth will result.

A broad base of information will be presented to attendees in 23 technical papers. Presenters include network and station engineers, consultants and representatives from film, video and audio equipment manufacturers.

In addition to the papers program, special demonstrations have been arranged. These include satellite up/downlink stereo audio, TV transmitter/receiver links, live stereo remotes and post-production audio editing using analog and digital techniques. Consumer stereo audio/video playback equipment and a home media room will provide the present and a futuristic home environment for the systems shown. There is no formal equipment exhibit.

Advance registration fees are $345 for members ($395 for non-members) if payment is received by April 30. An additional $75 is required for on-site registration. For registration information, contact AES, 60 E. 42nd St., New York, NY 10165; telephone 212-661-8528; telex 6202298 UW.

128th SMPTE conference scheduled

The Society of Motion Picture and Television Engineers (SMPTE) has confirmed that the 128th technical conference and equipment exhibit will be held in the new Jacob Javits Convention Center in New York. The dates for the conference are Oct. 24 to 29. This will be the first SMPTE conference to be held over a weekend.

SMPTE officials hope that the new conference format will allow larger attendance and more exhibitors than the

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BROADCAST ENGINEERING

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From here to infinity

Dedicated broadcast engineers have always tried to deliver the best possible audio product to their audience with the available technology. And broadcasting has steadily improved. The transistorized equipment of the 1960s was (generally) better than the tube hardware of the 1950s. The amplifiers and processors of the 1970s, based on integrated circuit technology, performed better than their 1960s counterparts. Today, digital audio recording and transmission has taken us beyond the equipment standards of the 1970s. Will audio fidelity of the 1990s be even better? Could there be a limit to improving quality? Is this a curve that goes to infinity?

The curve *doesn't* go to infinity. We have already gone beyond human perception to pursue quality for its own sake, irrespective of the need. This pursuit comes from the incorrect application of engineering philosophy, the notion of a linear world: If a little is good, more is better and a lot is fantastic. We tend to think of physical and perceptual variables as a straight line—if you go far enough you get to infinity. In reality, curves invariably go flat; at some point, there is no perceptible difference.

In 1971, the first digital audio equipment was produced using 10-bit analog-to-digital converters and filters with 1dB or 2dB response irregularities. You could hear the limitations, but it took a little while for the honeymoon to end. The first equipment we used was, in fact, considered fantastic. However, professional audio perfectionists responded to the defects by crucifying the equipment and within two years it was out of production.

Digital designs had to be better than their analog equivalents, so users demanded that more bits be added to the converters. Instead of 10 bits with 60dB of S/N, we saw 12, 14 and 16 bits. The industry has now paused at 16 bits, but 18 is on the way. This means 72, 84, 96 or 108dB of S/N.

Why stop at 18? If 18 bits is better than 16, then 20 is probably better than 18. Twenty may be close to the technical limits today, but we should clearly aim for 22. After all, the more the better. Right?

We are now talking about numbers that boggle the mind. For harmonic distortion, we count the number of zeros after the decimal point, not the digit. It used to be that reducing harmonic distortion from 1% to 0.5% was a significant improvement. Now, equipment distortion levels drop from 0.1% to 0.001%. This improvement is interesting. However, psychoacoustic research shows that you can't hear distortion with normal music below about 0.5%.

Bandwidth (frequency response) also has widened considerably. In 1930, 3kHz was enough to understand speech and even appreciate music. 10kHz was considered professional quality by the 1940s; 15kHz was used in the 1960s. In the 1970s, the standard became 20Hz to 20kHz, more than most people can hear. But some people, particularly under the age of five, can actually hear above 20kHz and certain instruments do produce sounds above 20kHz, so 25kHz bandwidth ought to be safe. If 25kHz is safe today, by extrapolation, we should really be aiming at 30kHz and 40kHz in the 1990s. Besides, the dog is a full member of the family, so maybe we really ought to reach for 50kHz bandwidth.

In the world of professional audio, a Golden Ear is someone who is able to hear something that most people cannot. There are two categories of Golden Ears, indistinguishable by the lay public or by most broadcasters. The first type is the hallucinator. You often find this type writing for audio enthusiast magazines. Then there are people who, through training or birth, can hear things nobody else can.

In any given aspect of sound, there might be 50 people in the world who have Golden Ears. One of them is more golden than the others—Golden Squared Ears. Should Golden Squared Ears (or this person's child—Golden Cubed Ears) represent the human species in deciding what our equipment specifications should be? Shall we all set our standards according to this one person for as long as that person is alive?

Broadcasters, of course, need to be concerned about providing the best possible quality to their audiences. We should strive for the best possible performance from the best available equipment. However, we need to keep a reasonable amount of horse sense about us.

There is always an uncontrolled element through which our signals must pass on their way to our audience—the atmosphere. Broadcasters cannot, and never will be able to, control that element. As long as the limitation of the total end-to-end quality is dependent on uncontrollable elements, it does little good to pour a station's resources into technology that cannot be received or appreciated by the audience.

The quality of a station's on-air signal is of paramount importance. But reason must accompany efforts to maintain your station at the state of the art. Improvements in the performance of audio equipment, like everything else, eventually reaches a point of diminishing returns. It does not go from here to infinity.

Editor's note: This was developed from an article in *High Technology*, March 1983. The original article was based on a speech made by Barry Blesser, a former president of the Audio Engineering Society.

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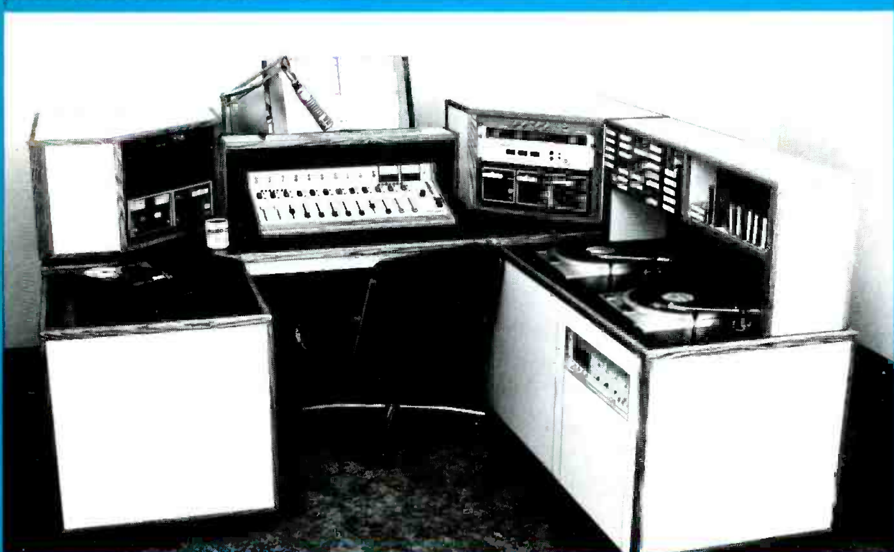

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Operator must be on duty at all times

By Harry C. Martin

According to section 73.1860, the FCC requires every broadcast station to have an operator on duty at all times. The duty operator may be stationed at the transmitter, a remote control point or at an off-premises ATS monitor/alarm point.

In an off-premises ATS operation, the rules require that the ATS control system incorporate circuits that will automatically terminate station operations if any of the following conditions are not corrected within three minutes:

- antenna input power exceeding authorized power;
- excessive modulation levels;
- failure of the circuit to the ATS monitoring and alarm point;
- failure of any of the required alarm system functions; and
- any loss of required ATS sampling functions.

Although off-premises operation with a conforming ATS system is permissible, the following types of situations violate the rules and could result in a stiff fine:

- Location of the remote control/ATS point at the duty operator's home during hours when he would be sleeping.
- The use of a telephone-controlled system that lacks a fail-safe mechanism that can detect the failure of the telephone line to the transmitter necessary to terminate operations.
- The failure of the licensee to equip the remote control point with an EBS receiver and instructions for the duty operator in case of an EBS alert signal.

Daytimer preference affirmed

The FCC has reaffirmed that licensees of AM daytimer stations, who meet certain prerequisites, can be awarded enhanced broadcast experience credit in FM comparative proceedings. This enhanced credit will be equal to the credit awarded for either local residence or minority ownership. However, the commission has announced several revisions and clarifications of the daytimer preference eligibility criteria:

- A daytimer preference still will be available to a former daytimer licensee who has been granted authority to commence nighttime operations on a foreign clear channel. However, in order to retain the preference, the former daytimer must accept less than 250W of nighttime power.
- The daytimer preference will be available only to a licensee applying for an AM channel in the same community of license as its AM facility.
- A daytimer licensee who seeks the enhanced credit must pledge to divest its AM facility within three years after putting the FM station on the air.
- To be awarded a daytimer preference, an applicant must have operated the daytime-only station continuously for three years prior to filing the FM application. (Previously, the requirement was that the FM applicant operate the daytimer for three years before designation of the application for hearing.)
- In order to be awarded the preference, the daytimer licensee must apply for the FM channel. (In other words, if XYZ Corporation is the licensee of the daytimer, XYZ Corporation must be the applicant for the FM station in order for the daytimer preference to be awarded.)
- With respect to the prerequisite that the licensee's owners must have participated substantially in the management of the daytime-only facility, full-time participation will not be required. An FM applicant will be viewed as having participated substantially in management of the daytime-only station if persons holding cognizable ownership interests spent more than 20 hours per week (individually or in the aggregate) in the management of the station.

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

ITFS rules reconsidered

The FCC has granted partial reconsideration of its May 31, 1985, decision modifying eligibility and operating rules for the instructional television fixed service (ITFS).

In May the commission adopted comparative criteria for selecting among ITFS applicants, cutoff procedures, standards for non-ITFS use of ITFS facilities and revised technical standards for the service. The commission also made non-local entities ineligible to file ITFS applications for one year (until July 27, 1986). The new rules were designed to accommodate the increase in demand for ITFS facilities experienced after the commission agreed to permit ITFS stations to lease their excess capacity.

In its reconsideration order, the FCC affirmed its May decision to limit eligibility to local applicants for one year. It decided that local entities, that probably had not applied for facilities previously because of a lack of funds, should be given the first opportunity to take advantage of the rules permitting sharing of facilities with commercial services. Non-local entities with applications already on file have 90 days to amend their proposals to incorporate a controlling local entity in their structures.

The commission altered its comparative criteria for selection among applicants to include an extra preference for applicants proposing new, as opposed to modified, facilities. In May the FCC adopted a point accumulation system for awarding licenses, with a random selection tie-breaker mechanism. The criteria for determining an applicant's comparative point total included whether it was local, whether it was an accredited school or governing agency, whether it would remain within the ITFS 4-channel limitation, the amount and kind of ITFS service proposed (with maximization of for-credit course material being preferred), and whether the applicant was a grandfathered E or F channel licensee seeking to relocate. The preference for applicants proposing new facilities was added to promote diversity in cases involving unresolvable conflicts among new applicants and existing licensees' proposals for modified facilities.

The FCC again refused to classify ITFS as a broadcast service. Nor did the commission substantially revise its definition of the essential use of ITFS channels, which require at least some part of the station's programming to include for-credit course material. However, the definition was expanded to include nationally accredited programming, as well as programming offered by hospitals for students to earn medical and allied health degrees and certificates.

By the book

By Carl Bentz, TV technical editor

With the change in broadcast operator licensing and tight economic conditions, it is common for the duty operator at a TV station to have other assignments. Depending upon the configuration of the station, those duties might include master control operation of the videotape center and/or maintenance. It is essential that additional duties do not interfere with operation and monitoring of the transmission system.

On duty at master

If the operator will be assigned master control switching, various routine procedures should be understood. A legal station identification must be made at the beginning and end of each span of operation, that is, at the beginning and end of each program. During extended program material, the ID occurs on an hourly basis or as close to the hour as possible during a natural program break.

If the program source does not provide specific times for the station ID, the identifying announcement may be made visually (keyed or supered), aurally supered or by a combination of both. In any form, an official ID contains the station's call letters, immediately followed by the city of license. Only the station's frequency or channel number may be inserted between the two items. Stations serving more than one community may include the other communities in the ID announcement. However, the city of license must be first in such a list.

A second program log event of interest to engineers is the weekly EBS test transmission. Emergency Broadcast System announcements must be transmitted once a week on random days and at random times between 8:30 a.m. and local sunset. The EBS test must not be transmitted when severe local weather conditions exist so the signal will not be mistaken for a storm indication.

The traffic department should be instructed to include the test each week. If traffic fails to schedule an EBS transmission, the operator should remind them of the legal requirements. (See FCC rule 73.961[c]). A transmitter operator charged with on-air switching duty is, in effect, the quality control manager and should make every possible effort to keep the station within rule compliance.

Along with EBS transmissions, the operator must note when a test is received from another station. The dates and times of the tests must be kept in the official station operations log.

All stations participating in the EBS program must monitor an assigned broadcast facility and must receive a test from that source weekly. Failure to receive a weekly test should be communicated to the chief operator.

If the station being monitored did not transmit a test, you cannot be held responsible. You are held responsible, however, if the failure to receive a test is the result of faulty equipment at your station.

Make it a habit to initiate an EBS equipment check each day. All EBS tone generators include checking circuitry. The dual tone from the generator is fed directly to the decoder circuit, bypassing the tuner. If the decoder fails to sense the presence of the tones within 10 to 15 seconds, report the problem to maintenance.

The real EBS message

The primary purpose of the EBS signal is to alert viewers in the event of a national emergency. The plan also allows use of the network by the National Weather Service, civil defense and local and state governments.

In the event of a national alert, an emergency action notice (EAN) will be released by the White House to all major radio and TV networks. They will relay the EAN message to their affiliate and member stations through established internal communication systems.

If an EAN message is received, the operator must continue to monitor the network for further information. Before further action is taken, however, the validity of the message must be checked through the authenticator words. Such words are verified by opening the *red envelope* that is provided to the station at 6-month intervals. The red envelope must be available at the operating position at all times.

Inside the envelope are lists of code words for activation and termination of a national alert condition. A different pair of two words are used for each day. If an alert had occurred on July 4, 1985, the EAN activation would have been authenticated with the words *Hotel Yankee.* Termination of the alert would have used *Juliett Lima.* These words are from the military communications phonetic alphabet. You should become familiar with the entire list, if you do not already know it.

The white envelope that accompanies the red envelope contains voice authenticator words that are to be used in the event that the normal EBS procedures cannot function. Both envelopes *are to remain sealed* unless an alert occurs.

For normal operation, the standard EBS weekly test message cart should be kept at the operating point or at the location where all spot announcements are played. A second cart, containing a message for an actual alert, must also be kept available to the operator. However, steps must be taken to assure the alert message is not played accidently. The public and the FCC would not view the accident kindly.

Four priority levels of programming for EBS exist and must be aired accordingly. These levels by priority are:

- presidential messages;
- operational (local) area information;
- state programming;
- national programming and news.

Presidential messages must take precedence over any other information that is being broadcast and must be carried *live.* National programming can be recorded for broadcast at the earliest opportunity consistent with local area requirements.

The check list

All of the procedures involving EBS activities are explained in the EBS checklist booklet. The station must have a copy of the checklist. Failure to have the checklist available at the operating point can result in a citation.

Why the big deal about a program that is voluntary? The EBS system is the best program that has been devised to disseminate information in a national emergency. Stations must request authority to participate. Once authorized, you must participate.

The crux of the matter is simple. In the event of an emergency, listeners depend upon the broadcast stations for instructions. The correct information could spell the difference between life and death.

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The FMX system

By Emil Torick

The potential for FM sound broadcasting as a high-fidelity medium has been recognized since the earliest commercial FM radio broadcasts in the 1940s. Because of its relative immunity to electromagnetic interference and the capability to provide full audio bandwidth with low noise, frequency modulation also was selected as the transmission method for TV sound.

Although FM radio was hardly a universal success in the commercial sense when stereophonic broadcasts were first authorized in 1961, it was not long before the attraction of 2-channel high-fidelity sound helped elevate FM to the status it enjoys today. But although stereophony adds a new acoustical dimension to radio reception, it does so at the expense of a serious degradation of another high-fidelity parameter, the signal-to-noise ratio.

This noise penalty in stereophonic broadcasting is well known. However, less obvious is the restrictive influence that this phenomenon has on station coverage. It is not unusual for the stereophonic reception limits to be one-fourth or one-fifth the area of monophonic broadcasts.

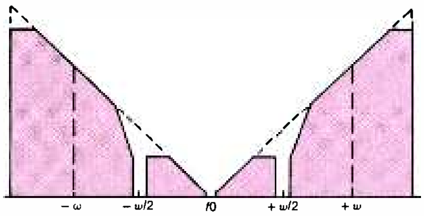

Figure 1. *In FM, the noise spectrum increases 6dB per octave with the increasing frequency of the FM composite signal.*

The noise penalty

Several factors contribute to the higher noise levels and coverage losses resulting from stereophonic transmissions. When a station converts to stereophonic service, monophonic coverage is reduced because signal power must be divided among the various components of the more complex baseband signal. The stereophonic S/N is less than the monophonic S/N because of the wide bandwidth of the composite signal.

As illustrated in Figure 1, the so-called triangular noise spectrum increases 6dB/octave with increasing frequency of the composite signal. Audio de-emphasis counteracts this somewhat (as shown) but the noise problem is still severe. After demodulation, the noise components of the difference channel subcarrier are added, statistically independent, to the noise already present in the monophonic signal during audio dematrixing.

A calculation of the S/N degradation in stereophonic broadcasting was published by Parker and Ruby in 1962. In the report, Parker and Ruby assumed the transmission of the peak monophonic power available, that is, no modulation of the subcarrier (L−R=0). Although their conclusion of 23dB degradation has received widespread acceptance, this figure is not completely representative of typical programming.

Under EIA auspices, the National Quadraphonic Radio Committee (NQRC) studied the subject in greater detail. In its final report, the NQRC reaffirmed the 23dB penalty for a monophonic test signal. By using a wide variety of audio test signals, it also demonstrated that 26dB is more representative of stereophonic programming with wide audio separation. For monophonic receivers, the NQRC data predict noise degradation of 1dB to 7dB, depending on the particular type of test signal used.

Such losses of S/N also cause a reduction in the effective area of coverage for an FM broadcast station. Figure 2, based on NQRC data, illustrates this effect for a representative set of transmission and reception conditions. For reception with a 50dB S/N, the limit of station coverage would extend to a radius of 128 miles when only monophonic transmission is employed. However, with stereophonic transmission, monophonic reception is reduced to 100 miles, and 2-channel reception extends only to a 60-mile radius. It should be pointed out that under typical operating conditions a station's service area is often limited by co-channel and adjacent-channel interference rather than by noise.

Next month we will look at the FMX transmission system and show how it helps overcome the loss in stereophonic coverage.

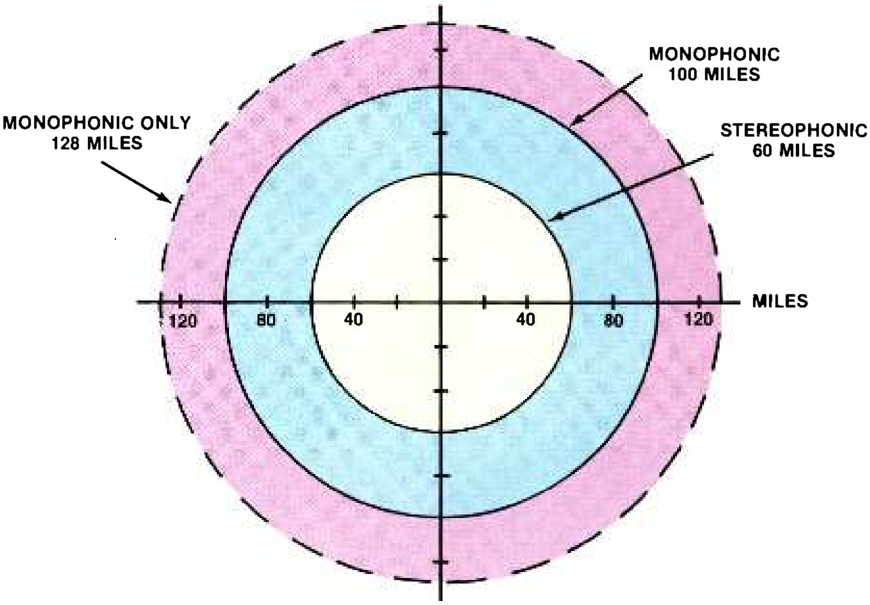

Figure 2. *As the S/N ratio decreases, so too does the effective range of the FM signal.*

Torick is vice president, audio technology, for CBS, Stamford, CT.

Editor's note: This material was adapted from an Audio Engineering Society paper presented by the author at the 70th AES convention, Oct. 12-16, 1985. Torick presented an update on the latest field tests of FMX at the 1986 NAB convention. A copy of his paper appears in the 1986 edition of the proceedings, which is available from NAB.

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Part 2

Satellite technology

Transmitting data

By Elmer Smalling III

Last month we investigated FDMA (frequency domain multiple access) systems used in connection with satellite communications, as well as various error-correction schemes. This month, we will consider the most efficient multiple access system, the TDMA (time domain multiple access) and discuss spread-spectrum technology.

The FDMA method of transponder sharing assigns a different frequency over the width of a transponder to each user. These preassigned frequencies are separated by guard bands (areas of unused frequencies) to prevent cross-modulation and other types of interference between neighboring signals. Because of the guard bands and separate frequencies for each user (regardless of the data rate), FDMA requires a good deal of terminal hardware in addition to a great deal of transponder bandwidth, which is becoming more precious as the geostationary satellite belt fills.

TDMA is an efficient multiple access scheme that requires much less bandwidth than FDMA. Because all users of a given transponder use the same frequency, but at different times, the need for guard bands between each user's signal is eliminated. Within any given second, it is theoretically possible for hundreds of users to access a transponder, depending upon the speed of their data. For example, 10 users, at 20Mb/s each, require the same bandwidth as 100 users at 2Mb/s each.

Because all users share the frequency of a particular transponder, the only differentiation of data during transmission is by exact control and monitoring of time. Accurate computer clocks are required at both ends of the transmission path.

TDMA transponder time is broken into millionths of seconds. Each user gets a piece of each second every second until the transmission is complete. A receiving station identifies its own data by checking and identifying the precise time within each second that its data is scheduled to be transmitted. Data to be sent over the satellite often is configured into short bursts of data or *packets*.

Because many users are sharing a single frequency, each user is given a turn each second at a fixed time, based on the data load or the number of users. With fewer users, any one user may send more data in a given period.

FDMA
For any transponder frequency XMHz

X + 1MHz	X + 2MHz	X + 3MHz	....	X + 32MHz
User 1	User 2	User 3	....	User 32

TDMA
For a transponder frequency XMHz

Time	Second 1	Second 2	Second 3	....	Second n
ms 1	User 1	User 1	User 1	....	User 1
ms 2	User 2	User 2	User 2	....	User 2
ms 3	User 3	User 3	User 3	....	User 3
....	....	....	....	....	....
....	....	....	....	....	....
ms 999	User 999	User 999	User 999	....	User 999

CDMA
Frequency

User 8 address	User 15 address	User 7 address
User 1 address	User 5 address	User 14 address

Table 1. *Comparison of multiple access methods.*

TDMA pros and cons

TDMA transmission has certain advantages:

- There is no intermodulation between each user's data, because only one user's data carrier is present at any given time;
- A TDMA system may easily be software-reconfigured with respect to data rates and the number of users; and
- Uplink power is not critical for TDMA transmissions.

TDMA also has disadvantages:

- Both transmitting and receiving stations must have equipment capable of accurate timing; and
- More computer hardware and software is required for both transmission and reception.

CDMA/SSMA

Code division multiple access (CDMA) or spread-spectrum multiple access (SSMA) transmission separates user data carriers by assigning a specific address to each. When more than one station transmits on a transponder using CDMA or SSMA, they share the same frequency and transmit on top of one another. Signals are separated at the receiving location with equipment that selects a carrier by detecting its address.

CDMA signals are called spread spectrum because their addressing waveforms spread signals out into wide bandwidths. Interference, such as crosstalk, occurs only when proper address separation does not happen. Two types of CDMA transmission are DS (direct sequence) CDMA, in which data addresses are modulated directly on the carrier, and FH (frequency hopped) CDMA, in which the address continually changes the frequency of the carrier. The latter application often is used for military communications because of its inherent anti-jam characteristics.

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

Editor's note: If you have satellite information that you would like to share in this column or wish to have some particular aspect of satellite TV explained, write to **BE** in care of "Satellite Technology," Box 12901, Overland Park, KS 66212.

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Part 1

Circuits

Power amplifier neutralization

By Jerry Whitaker, editor

An RF power amplifier must be properly neutralized to provide acceptable performance in broadcast applications. The means to accomplish this end can vary considerably from one transmitter design to another.

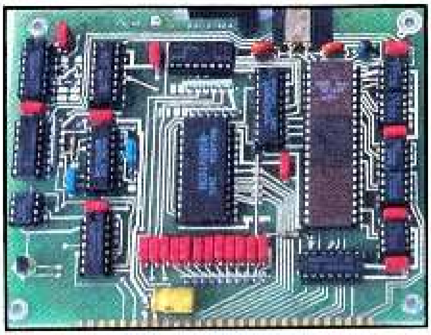
An RF amplifier is neutralized when two conditions are met. First, the interelectrode capacitance between the input and output circuits must be canceled out. Second, the inductance of the screen grid and cathode assemblies and leads must be completely canceled. The cancellation of these common forms of coupling between the input and output circuits of IPA and PA tubes prevents self-oscillation of the system.

There are a variety of methods that may be used to neutralize a stage. Generally speaking, a grounded-grid, cathode-driven triode can be operated into the VHF frequencies without external neutralization components. The grounded-grid element is sufficient to prevent spurious oscillations. Tetrode amplifiers generally will operate through the AM band without neutralization. However, as the gain of the stage increases, the need to cancel feedback voltages caused by the tube interelectrode capacitances and external connection inductances becomes more important. At FM and TV frequencies, it is generally necessary to provide some form of stage neutralization.

Circuit designs

For operation at frequencies below the VHF region, neutralization typically employs a capacitance bridge circuit to balance out the RF feedback caused by residual plate-to-grid capacitance. This method assumes that the screen is well bypassed to ground, providing the expected screening action inside the tube.

Neutralization of low-power push-pull tetrode or pentode tube stages can be accomplished with cross-neutralization of the tubes. The neutralization capacitors are small. In some cases, neutralization can be accomplished with a simple wire connected to each side of the grid circuit and brought through the chassis deck. Each wire is positioned to look at the plate of the tube on the opposite half of the circuit. Typically, the wire (or a short rod) is spaced 1 inch to ½ inch from the plate of each tube. Fine adjustment is accomplished by moving the wire in or out from its respective tube.



In the case of a single-ended amplifier stage, neutralization can be accomplished using either a push-pull output or push-pull input circuit. Figure 1 shows a basic push-pull grid neutralization design that provides the out-of-phase voltage necessary for proper neutralization. It is usually simpler to create a push-pull network in the grid circuit rather than the plate because of the lower voltages present. The neutralizing capacitor, C_n, is small and may consist of a simple feedthrough wire (described previously). Padding capacitor C_p is often added to maintain the balance of the input circuit while tuning. C_p is generally equal in size to the input capacitance of the tube.

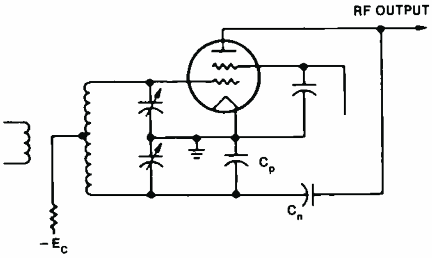


Figure 1. Push-pull grid neutralization in a single-ended RF tetrode stage.

Single-ended tetrode and pentode stages also can be neutralized using the method shown in Figure 2. The input resonant circuit is placed above ground by a small amount because of the addition of capacitor C_{in}. The circuit designer specifies that C_{in}, the input circuit bypass capacitor, is somewhat smaller than normal. The voltage to ground that develops across C_{in} upon the application of RF drive will be out of phase with the grid voltage, and is fed back to the plate through C_n to provide neutralization. In such a design, C_n is considerably larger than the grid-to-plate interelectrode capacitance.

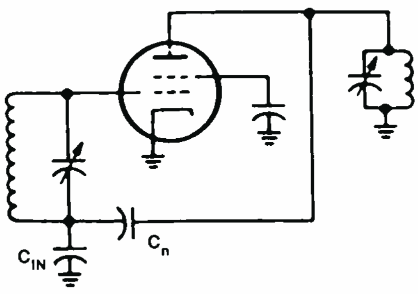


Figure 2. Tetrode grid neutralization.

The single-ended grid neutralization circuit is redrawn in Figure 3 to show the capacitance bridge that makes the design work. Balance is obtained when the following condition is met:

$$\frac{C_n}{C_{in}} = \frac{C_{gp}}{C_{gf}}$$

Where: C_n = the neutralization capacitance
C_{in} = input circuit bypass capacitor
C_{gp} = grid-to-plate interelectrode capacitance
C_{gf} = total input capacitance, including tube and stray capacitance

A single-ended amplifier also can be neutralized by taking the plate circuit a small amount above ground and using the tube capacitances as part of the neutralizing bridge. This circuit differs from the usual RF amplifier design in that the plate bypass capacitor is returned to the screen side of the screen bypass capacitor.

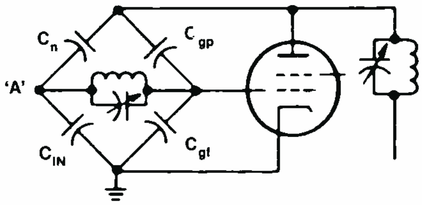
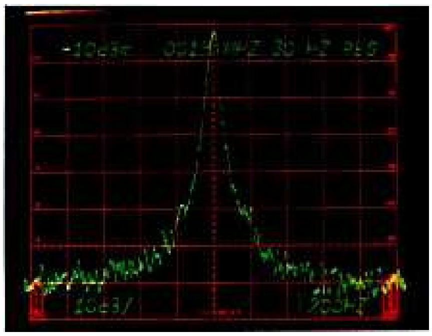


Figure 3. The Figure 2 circuit redrawn to show the elements involved in neutralization.

It should be observed that in each example given here, it is assumed that the frequency of operation is low enough so that inductances in the connecting leads of the tube assemblies can be ignored. This is basically true in AM radio applications, but not in the VHF bands and above, especially in single-ended tetrode and pentode stages. At VHF frequencies, small RF voltages developed in the residual inductance of the screen circuit can be enough to provide neutralization.

Editor's note: This column is based on information contained in the publication, "The Care and Feeding of Power Grid Tubes," prepared by the laboratory staff of Varian Eimac, San Carlos, CA.



Using power tubes

By Jerry Whitaker, editor

The power tubes used in a broadcast transmitter are perhaps the most important, and least understood, components in the system. With this column, we begin a series of articles that examine how power tubes should be operated for peak efficiency and long life.

The best way to gain an understanding of the capabilities of the power tubes used in your transmitter is to secure copies of the tube manufacturer's data sheet for each type of device. These are available either from the tube or transmitter manufacturer. The primary value of the data sheets to the end-user is the listing of maximum permissible values. These give the transmitter engineer a clear rundown of the maximum voltages and currents that the tube can withstand under normal operation. Note these values and avoid them.

An examination of the data sheet will show that a number of operating conditions are possible, depending upon the class of service required by the application. As long as the maximum ratings of the tube are not exceeded, a wide choice of operating parameters, including plate voltage and current, screen voltage and RF grid drive, are possible.

When studying the characteristic curves of each tube, remember that they represent the performance of a *typical device.* All electronic products have some tolerance among devices of a single type, and so operation in your particular transmitter may be different than that specified on the data sheet. This effect is particularly noted at higher operating frequencies.

Tube dissipation

Proper cooling of the tube envelope and seals is a critical parameter for long tube life. Deteriorating effects that result in shortened tube life and reduced performance increase with increasing temperature. Excessive dissipation is perhaps the single greatest cause of catastrophic failure in a power tube.

Tubes that operate in the VHF and UHF frequency bands are inherently subject to greater heating action than devices operated at lower frequencies (such as AM service). This situation is caused by larger RF charging currents into the tube capacitances, dielectric losses, and the tendency of electrons to bombard parts of the tube structure other than the grid and plate in high-frequency applications. Greater cooling is required at higher frequencies.

The technical data sheet for the tube should specify cooling data. The end-user is not normally concerned with this information. It is the domain of the transmitter manufacturer. The end-user, however, is responsible for proper maintenance of the cooling system.

Power tubes used in radio and TV applications can be cooled using one of three methods: forced-air cooling, liquid cooling and vapor-phase cooling. In radio and VHF-TV transmitters, forced-air cooling is by far the most common method used. Forced-air systems are simple to construct and easy to maintain. Maintenance for the station engineer usually involves ensuring that the transmitter intake and output ports are adequate to meet the cooling requirements of the system, and that the air-handling system is free of dirt and other particles that might restrict air flow or impede the proper operation of blowers and fans.

Establish a regular maintenance schedule for the transmitter cooling system. Check the air intake filters and replace them when necessary. Carefully check the airflow paths through the PA and IPA (if used) chassis. Cooling air for most power tubes flows through the socket base. Clean the socket as needed to keep the insulators and airflow directors free of contaminants. This work is important for proper cooling of the tube and to prevent arcing between high-voltage contact points on the tube socket.

Perform any cleaning work around the socket with extreme care. A vacuum and clean paint brush are generally all you will need. Do not use compressed air to clean out a power-tube socket. Blowing compressed air into the PA or IPA stage of a transmitter will merely move the dirt from places where you *can* see it to places where you *can't* see it. Use a vacuum instead. When you are cleaning the socket assembly, be extremely careful not to disturb any components in the circuit. Visually check the tube anode to see if dirt is clogging any of the heat-radiating fins.

In your effort to keep the power tube and its socket clean, do not go overboard. If the system is working well and the compartment is clean, leave it alone. You can cause more problems than you solve by needlessly disturbing a PA stage that is working fine.

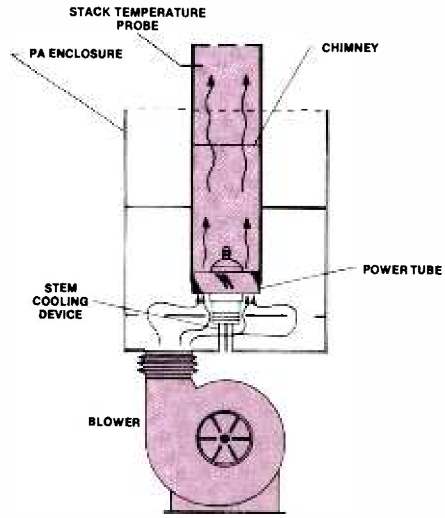


Figure 1. *Typical PA stage cooling system.*

Stack temperature

An effective method of evaluating transmitter performance as a system is to monitor the PA exhaust stack temperature. This can be easily accomplished and provides valuable data on the cooling system and stage tuning.

Purchase an accurately calibrated thermometer that will measure up to 100°C and locate it directly above the PA stack exhaust within the airflow from the tube. This is a simple procedure. However, it must be done with great care.

The thermometer can be a standard laboratory unit or a solid-state temperature-sensing module. A temperature-sensing device offers the advantage of being able to tie into your remote-control system and provide feedback on the PA stack temperature from the studio control point. Care should be taken in selection of a solid-state device for such applications, however, because of the effect that high levels of RF energy may have on the accuracy of the device.

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Management *for engineers*

Get ahead by learning to delegate

By Brad Dick, radio technical editor

Remember the rabbit in the film "Alice in Wonderland"? He was always running wildly around looking at his watch and saying, "I'm late, I'm late for a very important date." No matter how hard he tried, no matter how fast he ran, he was always late. He could never seem to get caught up. Is that similar to how you feel in your job? Are you always running as fast as you can, only to find that you are still behind? Do you never seem to accomplish as much as you need to?

Need help?

We all would like to have some help in our tasks. Unfortunately, additional personnel are not added to our staffs just because we feel busy. However, through an examination of what you currently do, your work load can be lightened.

Have you ever thought of delegating some of your work to others? The delegation of tasks may seem inappropriate to your particular situation. But even if you are the only engineer on the station staff, delegation may be possible.

Delegation is the act of granting, conferring or the giving of *authority* and *accountability* to a person. Delegation is usually done with respect to a particular project, but it can apply to much broader areas. Delegation is more than just permitting someone to help complete the work. Delegation also requires that sufficient authority be provided to see the work completed. One of the most common mistakes in delegating is holding someone accountable for poor results who was never given sufficient authority in the first place.

Almost all of us can delegate some of our work. Don't confuse delegation with dumping extra work on another. The work delegated must be appropriate to the other person's skills. You also must not be perceived as trying to get out of work. If this happens, the results will seldom be positive.

I can't delegate

When discussing delegation, someone usually says that it won't work "because" and continues with a long list of reasons. These reasons usually center on a couple of areas.

We engineers tend to be overly protective with respect to our knowledge. We pride ourselves on our ability to work magic with electronics. Unfortunately, some engineers don't want to

share that knowledge. One typical excuse for not delegating is that it takes longer to train someone to do the work than it does to "do it myself." Although that may be true, what happens if you have to complete that task several times a week or a month? In this case, the time spent training someone to do the work could pay large dividends in time saved.

> *"If you want the job done right, you have to do it yourself."*
>
> *"It takes too long to train someone else to do the job, so I'll just do it myself."*
>
> *"Nobody knows how I want the job done except me."*

Another typical excuse is that the other person can't do as good a job. This kind of attitude inhibits professional growth for the less experienced staff and can result in high turnover rates.

The excuses for not delegating can often be traced to insecurity on the part of the manager or supervisor. These people may sometimes fear that giving others a chance might result in their own skills being challenged. Have you ever run into an engineer who was so insecure that he wouldn't share any of his secrets with you? These engineers deserve all of the headaches they create for themselves.

Advantages of delegation

Just think of the important (or fun) things you could do if you didn't have to...(complete the phrase yourself). If you have other people working for you, are any of them properly trained to fill in during your absence? Some companies avoid promoting people who have not trained their replacements. Instead of being threatened by another knowledgeable person, the wise engineer trains the staff to perform a variety of tasks. This practice tells your supervisor that you have prepared the way for your own advancement.

Another, and perhaps more important, element in delegation is that your staff develops new skills. People usually like to learn new tasks and develop new skills. Instead of feeling dumped on, many people will welcome the opportunity to try their hands at expanded opportunities.

Delegate to responsible people. You probably already know who they are. Delegate to those who have time. It may surprise you how busy people can find time for a challenge. Delegate to those who like more work. Some people don't like sitting idly by waiting for a break in the afternoon soaps. Identify them and let them help you with your work. They will probably appreciate having something creative to do, if nothing else, to help pass the time.

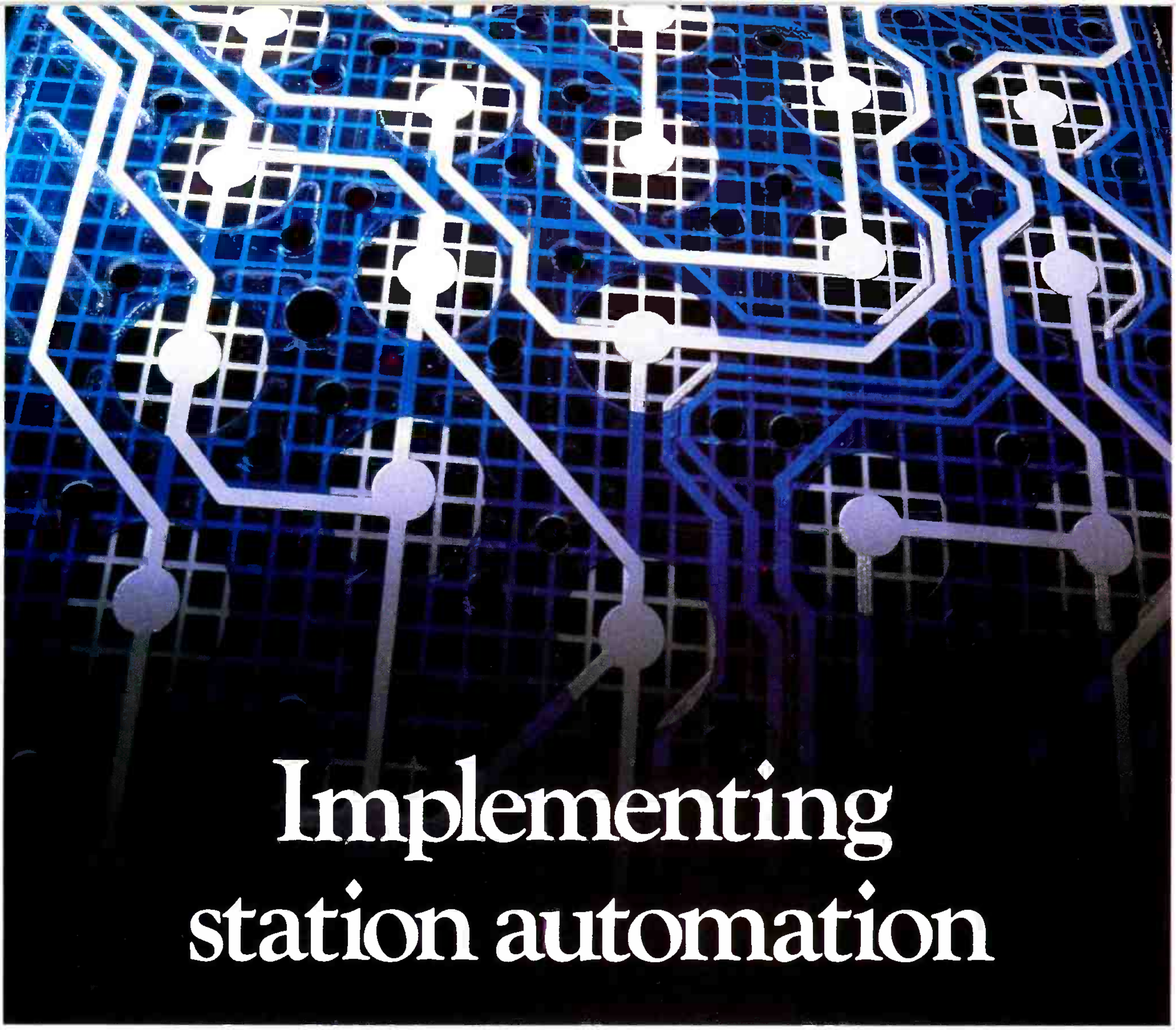
If you are the only engineer, look to the secretary for help. Are there recordkeeping tasks that could be performed by someone other than an engineer? Granted, it may take a while to teach a non-technical person the ropes, but it's usually worth the effort.

When to delegate

Knowing when to delegate is easy. Do so at every possible opportunity. When you find yourself doing a repetitive task, or something that another, less skilled person could do, delegate the work. When a new person is hired, try adding new duties to the job from the start. Just because a task has always been done in a certain way, doesn't mean the practice has to continue.

If a crisis arrives, delegate. This can be one of the best times to enlist the help of others. If the staff realizes that a crisis is at hand, they are likely to be motivated to help seek an answer. Let the staff become a part of the solution by delegating some of the tasks you would normally handle. First-line personnel can often identify creative solutions to problems because they are more familiar with the day-to-day environment. Managers and supervisors, on the other hand, are seldom as familiar with the capabilities of the crew and equipment.

Delegation can relieve you from performing repetitive duties and free you for important tasks such as facility planning and budgeting. Letting others grow through delegation ensures that the station will not be handicapped by the loss (or promotion) of key personnel. Properly used, delegation can stimulate professional growth for you and your staff.



Implementing station automation

By Carl Bentz, TV technical editor

The successful application of automation in broadcasting requires examination of hardware interfacing and system integration.

What is necessary for automation? Foremost, any automation system must have a computer with appropriate software. All devices that are to be operated by the system must be capable of remote control. And finally, the basic system must include the necessary interfaces between the computer and the controlled units.

Smart machines

The capability of a controlled device to respond intelligently to a system control command is what makes total automation possible. The local intelligence allows responses to changing conditions at the local level. For example, consider a VTR that has been sitting idle for some time without a tape loaded. The operator places a reel of tape on the hubs and threads it through the video scanner. When the operator indicates loading is complete by pressing the remote control delegation switch, the VTR could be instructed to proceed in play mode, find a tape identification signal and cue to the next video.

When the VTR indicates to the automation system that it is ready to run, the controller asks for the tape ID. If the ID currently in the VTR system memory does not match the ID in the controller memory, additional action is required and could be initiated automatically.

The EBU/SMPTE (ES) bus

Distributed intelligence is the basis for a standardized remote control plan devised by the SMPTE and EBU organizations. If all manufacturers design equipment control facilities in accordance with the standard, system integration of products from different manufacturers will be greatly simplified. About a dozen manufacturers are using at least parts of this standard system in a variety of video and audio products.

Let us first look at the terminology of the standard to gain a better understanding of the concept.

Any unit controlled by the system is a *device*. Each device must have an integral or external intelligent interface called a *tributary*. A number of controlled devices, through their tributaries, connect to a local control or *interface bus* to form a *local network*. (See Figure 1.) The local network is managed by the *bus controller*, which supervises communications among the devices connected to the network. The interface bus is the communication channel between each tributary and the bus controller.

Several local networks can be linked together by an *interconnection bus* communication channel, permitting interaction among tributaries (and devices) of several local networks. Each local network includes a *gateway* to translate local network protocol to the interconnection bus *coupler* protocol.

Communications theory

Any communication system may be viewed as a group of layers that combine to form the whole service. (See Figure 2.) Each higher layer adds value to the service provided by lower layers. The added value is established by an *entity* residing within the layer. Two entities operating in the same layer, but in different parts of the network are *peer* entities.

In designing a system, the aim is to permit communications between peer entities. Ideally, the communication path between the peer entities is *virtual*, that is a transparent connection that leaves the peer entities unaware of any lower system layers, as illustrated in Figure 2. In reality, however, the communication path passes through the lower layers and through a common physical wired medium.

As shown in Figure 3, a theoretical control system consists of seven layers. Layer seven, the *application* layer, applies to specific controlled and controlling equipment. This layer is not considered by the ES bus control system, as it may vary considerably among manufacturers. The proposed standard restructures the remaining six layers into four levels.

The *virtual machine level* or presentation layer is the entity that responds to defined data in a defined manner, regardless of characteristics of the specific machine. Distinct dialects of the control message language may exist for each type of virtual machine.

The *system service level* converts logical addresses to physical addresses. The dialect of each machine is identified. Messages are assembled (if the machine is a controlling device) or segmented for use (if the machine is a controlled device). Errors in the datastream trigger a request for the message to be repeated.

In the *supervisory level*, data synchronization and transfer services are provided. Again, detected errors initiate retransmission requests. An access point allows the network to be used by its tributaries and devices. Access by a tributary is allowed, if, after polling or interrogation by the bus controller, the network is free of other activities.

Finally, the *physical level* is the electrical medium of the communication channel or the bus.

Control messages

The goal of a standard remote control system is to interconnect equipment from different manufacturers as simply as possible. To reach the goal, basic electrical and mechanical characteristics must be standardized. At the same time all known control functions must use a set of control messages acceptable to all manufacturers.

Two major groups of messages are defined. *Virtual machine messages* are used to pass commands and responses between virtual machines. This group is further subdivided into *common messages* (applicable to all types of equipment), *type-specific messages* (applicable to particular categories of equipment) and *user-defined messages* (manufacturer-specific instructions not included in the type-specific subgroup). User-defined messages must fall within syntax rules of the control message architecture.

For any machine, the combination of the three subgroups of messages form the machine's *dialect*. Different dialects exist for VTRs, film chains, still-stores, switchers and transmitters. They do not all have a need to respond to the same set of commands.

The second major group of messages are *system services messages*. This group provides network housekeeping. Such messages are handled by the local network bus controllers.

Message structures

In a digital remote control system, all control messages are byte-oriented. Each consists of a number of bits represented by 1 or 0 signal levels, with the structure following a fixed format, such as:

message = keyword + argument.

A 1-byte keyword specifies the function to be performed. The argument includes one or more bytes of qualifying information and may not be required for all message functions. The VTR stop command, for example, needs only the keyword.

The VTR command for fast forward needs a keyword (shuttle), a parameter name (shuttle speed), and a parameter value (fast). In the case of shuttle, the parameter name is implied by the keyword, and the argument may be shortened to the parameter value. For example:

message = shuttle + fast.

Control messages to other types of equipment—switchers, mixers, digital-effects generators and still stores—will differ in the parameter names and qualifying information in order to differentiate between devices on the control bus.

Feedback

The totally automated system requires an ongoing conversation between the controlled devices and the master computer. Program verification depends

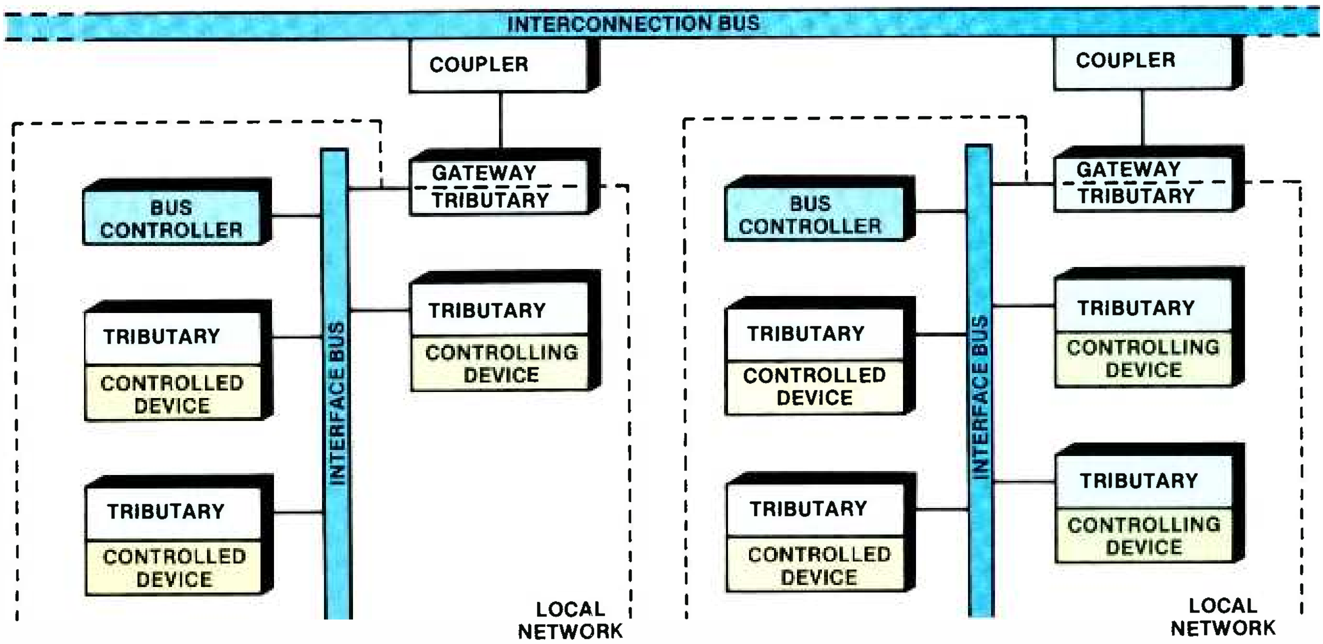


Figure 1. *Individual controlled devices (VTRs, ATRs, telecine, titlers and still-stores) converse with one another through the bus controller. Devices of one local network may talk to devices of another local network through gateways and the interconnect bus.*

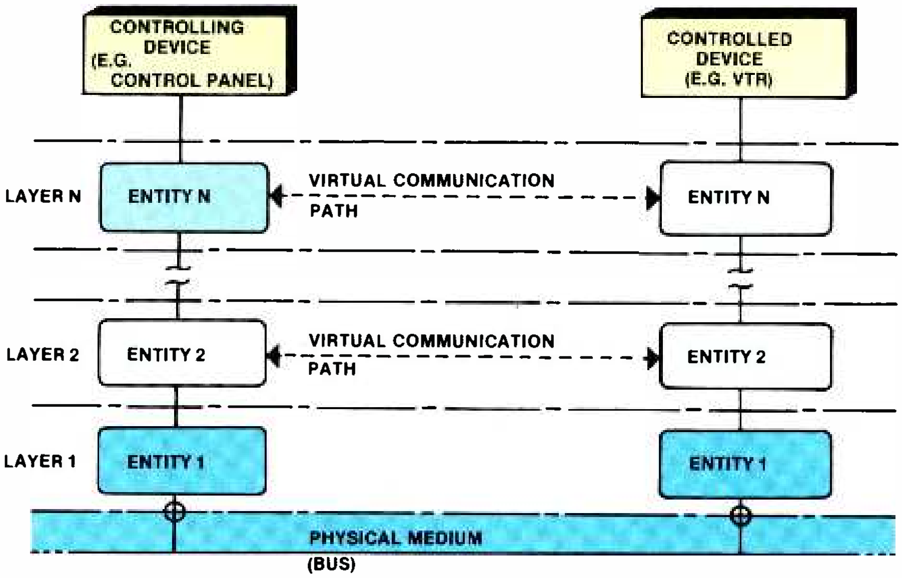


Figure 2. *An entity or function of one device appears to talk to an equal entity of another device through a virtual path. In reality, communications must pass through all lower layers and through the physical bus.*

upon feedback from intelligent source machines. The tape transport sends a message to the controller verifying that the current tape is the one requested. The production titler (without a message disk loaded in its floppy disk drive) responds with *disk not ready* when the master computer calls for "Tonight at 8" to be keyed over the trailer video of a VTR promo spot. The computer notes the discrepancy and avoids a potential on-air problem by avoiding the video-key instruction.

Such communications take only microseconds for the computer system to understand and respond. Operators, however, need more time. For that reason, computer system software generates English language messages or graphic descriptions on the CRT display screen. The automation controller displays a page of events that are to occur over a particular span of time. Each event is described by the program schedule entered by the traffic department. But as nosey outsiders to this system, we insist on some type of feedback status indication.

For the automation system controller, feedback is often displayed through the use of inverted video characters, blinking cursors or underlines. As each event is concluded, the indicator moves to the next event. For record keeping, a hardcopy printout also is provided.

The studio camera with computer setup already has built-in monitor screens both at the camera (viewfinder) and video operator position. As the control computer moves through its schedule of tests and checks, it may be programmed to indicate setup progress on the monitor.

Suppose that a production includes various complex configurations of the audio console, and the operator immediately needs to know how one of the channels is routed. At the touch of a button the video-for-audio CRT can show routing delegations. Another button can respond with level controls and threshold settings.

Information feedback is a requirement for true automation. But is it essential for the operator? Perhaps not, but it does ease our minds.

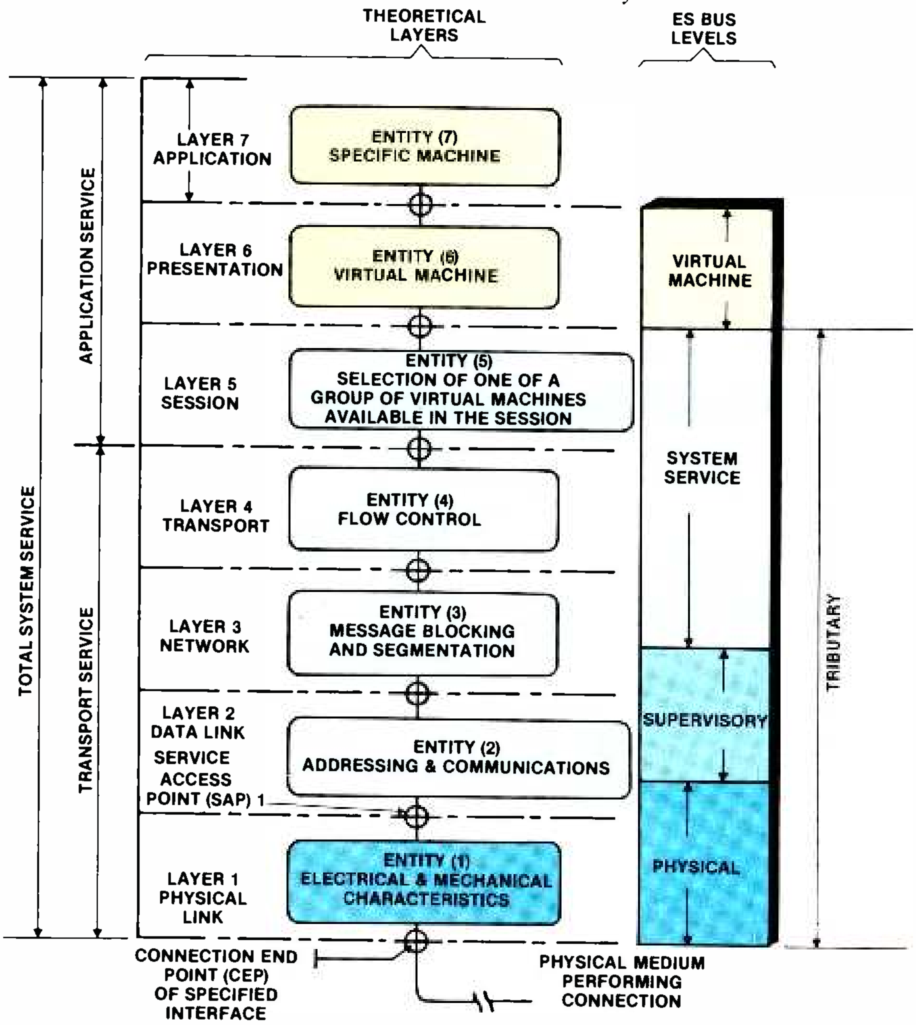
Automating ZDF

Can the ES bus concept work? A complex network of more than 37 computers,. involved in operating the ZDF production and transmission center in Mainz, West Germany, demonstrates that it can. The task of interlinking the system of computers and controlled equipment has been simplified by using the ES bus remote control concept.

The design goal for the ZDF center was to create the most flexible facility possible in terms of building layout, equipment, circuitry control and system operation. On Dec. 6, 1984, the 20-year project was inaugurated bringing all production, engineering and administrative departments of the Zweites Deutsches Fernsehen (ZDF, Second German TV Network) under a single roof.

Three main studios, a news studio and a presentation studio are all equipped for stereo or 2-channel sound. All equipment not requiring direct operator intervention (switching, amplifiers, equalizers and sync generators) is located in a centralized area and operated remotely.

Figure 3. *Communications theory breaks the remote-control process into seven layers. The ES bus concept redivides layers into four levels. Because the specific machine is a manufacturer concern that is resolved at the virtual machine level, no specification is made for the seventh layer.*



TRUTH... OR CONSEQUENCES.

If you haven't heard JBL's new generation of Studio Monitors, you haven't heard the "truth" about your sound.

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

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

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

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

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

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

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

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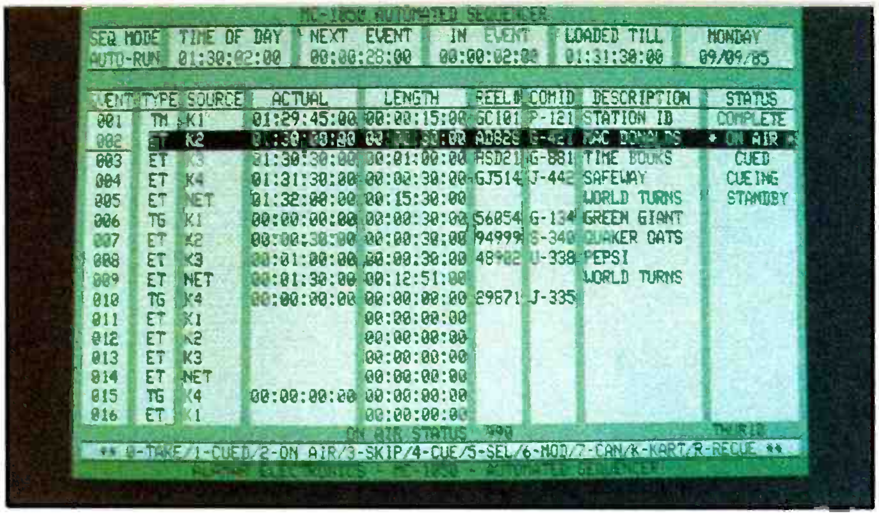
Circle (14) on Reply Card



The current event of the program log is often marked through blinking cursors, underscoring or reversed video.

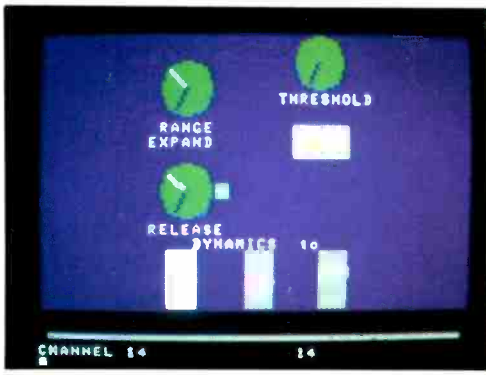
The master audio routing system involves 450 sources and 480 destinations. Computer assistance in operating the center was, therefore, considered a necessity. Video control needs are equally complex. Staff interaction with the computers is conducted through data terminal menus and monitors.

The areas with computer assistance are production facilities reservations and operation (facilities and test); planning, development and execution of program schedules (schedule); preparation and presentation of newscasts (newsroom); and video and audio editing (edits).

Facilities and test

All production activities, immediate or future, involve the facilities system. Production equipment and facility use must be reserved prior to use. By reserving equipment, conflicts in production and programming requirements are avoided.

The reservation process begins with a 3-page video order menu on the facilities work station terminals. Menu responses determine the equipment request, which includes film and tape equipment; remote-control connections for audio, video and cue; and signal correction equipment such as TBCs, synchronizers, color correctors and equalizers. Scheduling data are stored on magnetic tape for future use. An inventory of equipment, taken daily, constantly indicates status of



Current control settings and status of an audio mixer circuit routing can be shown through video graphics.

Feature article continues on page 32

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Circle (16) on Reply Card

Making automation work

By Douglas A. Hurrell

Broadcasters in increasing numbers are automating their facilities to reduce overhead and cut down on the number of daily commercial make-goods.

There are many levels of automation. From a simple switch closure, a preroll button on the switcher starts the tape machine. After a set time delay, audio and video crosspoints are switched to place the signal on air. For system automation, however, much more versatility is necessary.

What 2-inch quad cart machines first brought to broadcasting now has evolved into flexible ½-inch and ¾-inch cartridge and cassette systems. Self-contained or configured as individual machines with a controller, these systems allow prolonged programming periods without constant operator supervision.

The systems approach

True automation, however, requires more than a new cart machine. What about a link that interconnects the cartridge tape equipment, other VTRs, the telecine, audio playback decks, still stores, character generators and the master control switcher? This concept of system integration is the eventual goal of a number of manufacturers and equipment users.

System integration requires a standard control format. Ideally, the format provides a set of standardized machine commands to address all types of equipment.

In response to standards efforts, a number of manufacturers have begun to design equipment control systems that conform to the SMPTE/EBU format. Others are developing interfaces that translate the format of a particular piece of equipment to SMPTE/EBU.

IDs and cues

Another requisite for automatic operation is a method to identify, verify and/or cue the program material that is loaded on each machine in the system. Various methods can be used to identify or cue taped material, but not all apply to total automation.

The simplest approach to automatic cuing uses a tone recorded on an audio track. For example, when the standard cue or stop tone (1kHz) is sensed on an audio cart deck, the machine logic stops the tape aligned at the beginning of the message. Secondary 150Hz end-of-message and tertiary 8kHz cue tones can be used to initiate other events, but they contain no descriptive information about the tape content.

DTMF (dual-tone-multifrequency) tones may be used to identify individual tapes. For each spot, a series of DTMF tones are recorded to indicate cut numbers. This method is limited by the number of available DTMF characters. Touch pads are usually designed for 12 dual tones, although some contain 16 combinations. Multiple digit numbers may be used to expand the available library.

An FSK (frequency shift keying) sequence on an audio channel encodes characters as patterns of mark and space tones. The complete alphanumeric ASCII character set can be FSK-encoded for identifying data. Proper decoding of the tones limits tape movement to near-normal play speed.

SMPTE longitudinal time-code user bits may identify up to eight hexadecimal characters stored in the time-code signal per TV frame. For more than eight characters, however, LTC user bits may become cumbersome. A cross-reference between user bits and an external database is workable as a means to derive tape information. Unfortunately, SMPTE readers make such a system more expensive than a tone-based system.

Identification and cuing can be achieved by combining bar codes and time signals. With bar codes, tape ID can be determined prior to loading. Once loaded, the time code serves as a guide to specific locations on the tape.

Audio track ID/cue signals present a new set of problems now that stereo has become a consideration in TV broadcasting. Pertinent data, such as duration, reel number and cut numbers, can be recorded prior to the start of video, leaving both audio channels available for program material. Machines with a third audio channel or a separate time-code track can also solve the dilemma.

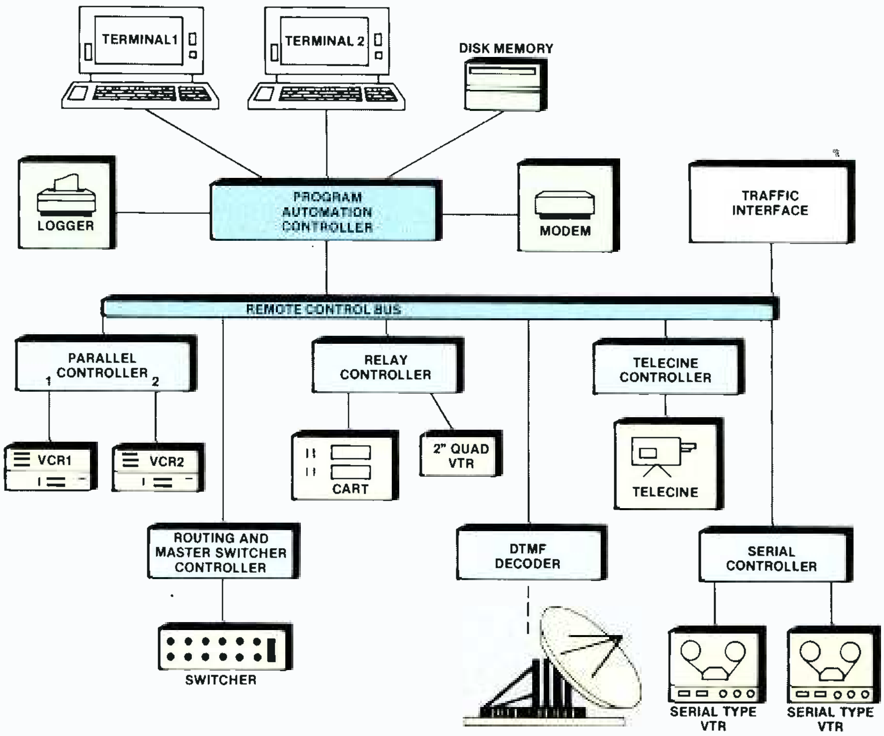
An alternative to audio-track identification is vertical interval time code (VITC) and user bits. Although more costly, VITC allows tape verification from still-frame to any speed at which a viewable picture may be recovered on VTRs with scan-tracking video heads.

Segment recording

Another consideration in the recording of program material is whether it is necessary to record more than one segment on a tape. If this is a requirement, then a system capable of random access will be necessary. Such an operation often means more expensive equipment and greater wear and tear on the transports. On the other hand, fewer transports are necessary and the system can run with less operator intervention.

Hurrell is president of Alamar Electronics (USA), Campbell, CA.

Different types of controllers or interfaces are required to translate a common set of command functions to all parts of an automation system.



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Circle (17) on Reply Card

If a single spot per tape is in use, an operator must be present to load the tapes. Additional space is required to store the increased number of individual tapes.

An alternate approach is that of prepackaging commercial breaks prior to on-air playback. This system assembles a single commercial reel by pulling segments from other sources. Only one VTR is needed for playback of all commercials, but there is little flexibility provided for last-minute changes.

Events and triggers

Many automation systems use a terminal or memory-mapped video display for data entry. A series of menu pages prompt the operator for the required information. Different display pages request engineering to set system parameters. Interface address, label and preroll times are all critical to system operation. Once the information has been entered, it may be offloaded to a peripheral memory device to prevent data loss, if power to the controller should fail.

Each event entry typically requests a source ID, duration time and other data pertaining to the program. If the scheduled item is a live feed, the event data indicates the appropriate switcher crosspoints to be activated at the event time. For tape playback, the control system cues the tape transport with a preroll, starts the VTR at the correct time and switches the VTR to the outgoing signal.

Automation systems can initiate an event or sequence in various ways. An event initiated manually from a local or remote keypad is a triggered event. *An event initiated automatically by the controller from a preprogrammed time command is a* timed event. *Software must take into account preroll times that may be required for use in timed event sequences. For example, timing of a spot scheduled to air exactly at 22:59:55:00 must take the VTR preroll time into consideration.*

To initiate an event sequence, end-tones *on one tape may be used to start the next tape rolling. Such chained or sequential events depend upon the duration times of previous events and are similar in function to timed events.*

An external trigger *can also initiate an event. The trigger could be a simple switch closure or a more complex series of DTMF tones, commonly used by CATV and LPTV programmers to signal commercial insertion.*

An automation system should allow for changes in event scheduling. If an event is to be inserted or deleted, the change should be automatically reflected in the following sequence of times.

With the increased use of computer control, additional automated machine control features have emerged. Net delay programming, automatic late-night recording and multiple-output channels have become a part of some automation systems.

Traffic system interface

Some approaches to integrated systems allow for automatic downloading of schedule information from a traffic computer. The additional step of re-entering data into the automation system is avoided. A problem of interfacing occasionally occurs, due to differing data formats in the traffic and automation computers. Data from the traffic system may be in the form of a disk file, a parallel or serial printer log transfer or a modem interconnect. A software transfer program can be used to convert the information from one format to another. With the conversion completed, the automation system runs the events and sequences.

The purpose of automation is to provide an extension of the operator, improving efficiency and accuracy while simplifying human requirements. In order to accomplish these ends, easy exchange of information must be provided between the operator and the system controller and between the controller and the controlled equipment. Without this interchange of information, true automation cannot exist.

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Behind the Scenes in Quality Television.

Tektronix
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Circle (19) on Reply Card

Continued from page 26
the equipment available for general use, transmission or news, or in engineering for evaluation/repair.

To reserve audio and video circuits, the user enters the source, destination and required correction equipment into the menu. From that information the computer develops an interconnection plan. In addition to normal video and audio connections, recording lines can be switched and spare circuits may be selected to bypass faulty audio and video paths.

Initialization of remote control interconnections between control points and equipment at the time of use also is done by the computer. Propagation time differences, resulting from switching of video between various destinations and the video mixer unit, are automatically corrected.

While the facilities system books switching, the test computer controls and monitors switching operations and performance. The monitoring functions include checking of quality parameters of the switched A/V circuits, inspection of connections in the switching matrices, localization of connection failures, inspection of wiring bundles to and from switching matrices, and inspection of sync adjustments.

The facilities and test computers are configured as simplex systems, each with two hard disks. Data written to the first disk are constantly duplicated onto the second. If failures in facilities occur, emergency capabilities are provided.

The data terminals, with monitors and printers, connect to the main computers through data concentrators. This plan relieves the main computers of menus and menu response duties. There are certain control function stations that link directly to the computer for reduced access times.

Facilities is an administration system with no immediate access to the equipment control level. Test accesses the main computer through an exchange connection, because of the large number of interfaces needed to communicate with controlled devices.

Throughout the production complex, computer-to-computer communication occurs through *mailboxes*. All other inter-work station communications occur through interlinked buffers, a user-addressable memory area through which all can communicate.

Schedule

The schedule computer assists the editorial and technical aspects of schedule development and execution. The genesis of a schedule begins with program format screens and menus to guide the step-by-step creation of weekly and daily program schedules.

Program items from extensive databases are selected and inserted into the schedule through menu responses. Constant tests catch input errors during data entry. A time calculation is made by the system to warn the operator of time overlaps or gaps.

From prompted facility definitions, the schedule system deduces equipment and switching orders to execute the program schedule. The facilities and test systems actually arrange for video and audio control. Constant tests avoid errors in equipment scheduling.

The schedule system handles program transmission from the schedule, including preparations, starting, supervision and ending of the programs (subject to program type). Execution may be automatic or under manual control. Program types are distinguished as:

- complete programs from videotape or film;
- programs requiring titling or audio tags;
- announcements, magazine, news, live performances;
- program trailers for shorter programs; and
- segmented programs of several rolls.

Program preparation involves establishment of remote connections, checkout of circuit switching, cuing and verification of runtime durations, setting
Continued on page 36

"Diet Be

tacam?”

First we took out the tubes and put in CCDs. Then we trimmed the excess circuitry associated with tubes. The result is the new Sony BVW-105 CCD camcorder.

Compare it to its tube-type cousins and you'll find that it's 14% lighter, 22% smaller and eats less than half the power. 510 CCD elements per chip generate amazingly sharp resolution. Registration error holds rock-steady at a miniscule .05% throughout. Add the virtues of F5.6 sensitivity, instant startup, and high resistance to burn-in and physical shock and you have the ultimate lean machine for ENG.

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For more information, contact your Sony Broadcast representative. Or call Sony Broadcast at (201) 833-5231.

SONY BROADCAST

Continued from page 32

of prerolls, calls for still images and titling, identification of programs from prepared carriers (program and reel numbers) and control of special video and sound needs.

The *program start* function brings the program to air. The schedule computer, meanwhile, cues talent, starts VTRs, telecines, audio transports and audio cassette decks, executes switching to the proper audio mode (mono, stereo, 2-channel), controls video/audio levels and actuates video/audio crosspoints in the transmission control switching matrix.

During the program, transmission supervision activities include:

- control of audio transports, with associated routing and mixing;
- execution of keys and fades, calls for titles, and control of character generators; and
- receipt of program end-cues from VTR and film transports.

The *program end* function controls necessary video/audio adjustments, stops transports, breaks remote control connections and concludes orders to the facilities and test computers.

A constant transmission time calculation routine informs the operator of the actual program time frame. Variations in program times within specified limits can initiate automatic time correction. Excessive compensations and time gaps are reported to operators on CRTs and printouts.

During transmissions, the actual time, operator interventions, interruptions and transmitted programs are automatically reported. At the conclusion of a transmission, schedule sends the compiled data to the facilities computer archive and prints a hard copy.

A manual function keyboard allows operator intervention for:

- start of a scheduled program;
- delay of an automatic program change;
- change of program order;
- program cancellation;
- replacement of program material;
- alteration of audio/video mixing orders and times;
- manual operation of audio decks; and
- handling of interruptions.

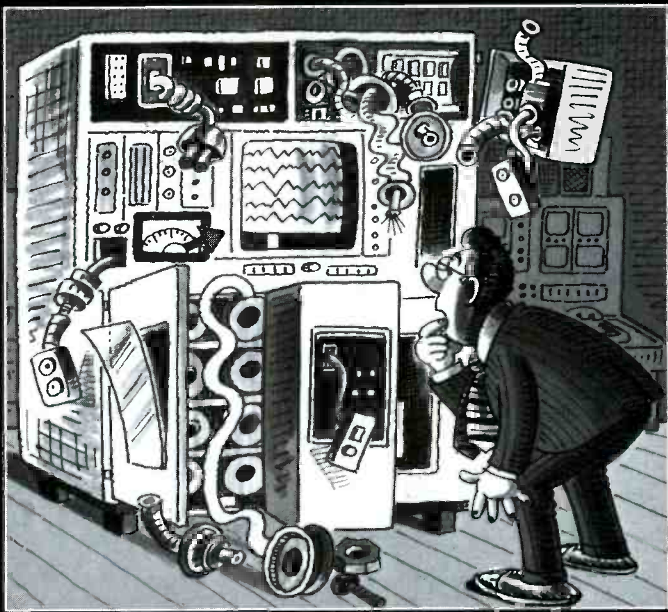
A test mode from the manual keyboard checks for possible malfunctions of peripherals (routing switcher and mixers) before actual transmission.

The schedule system is configured in duplex with a central electronic changeover switch that forms a parallel system at the hardware level. Peripherals and subsystems also are paralleled to both control systems. Switching from online to standby, if necessary, occurs without operator intervention.

Newsroom

Planning, preparation and presentation of news is assisted by the newsroom

THE SOLUTION TO YOUR OLD CART MACHINE IS NOT A NEW CART MACHINE!



IT IS THE PEGASUS 5100 COMMERCIAL COMPILATION SYSTEM!

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The Pegasus 5100 is a user-friendly, multi-user, real-time system utilizing the 68000 microprocessor. The 20 MB disk, multi-function keyboard and color status terminal makes the Pegasus 5100 the most reliable and economical system available for broadcast, cable and satellite TV operations.

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computer. News information coming into the center is sorted into four lists. These include:

- material without associated pictures, to be read by the talent in the studio;
- material with pictures from domestic and international representatives of ZDF;
- material available from international news agencies; and
- material exchanged several times daily by affiliates of the Eurovision network.

Newsroom is divided into editorial, organizational and technical sections. The editorial portion supervises the selection of news material from lists and coordinates pictures and titles. Function keys exchange, displace and cancel news material. As newscasts are developed, the information is stored in memory and automatic time calculations give the approximate running time of the compiled presentation. The computer archives all news with the required program data.

The organizational section plans the technical details for the newscast in conjunction with facilities and test. The technical section executes the news delivery with the schedule computer.

The news schedule is manually executed. However, newsroom assists engineers in remote control matters, signal switching and level control, cuing of film and tape, calling of titles and stills and managing of time, including control of the backtiming clock.

Newsroom is the largest system in terms of the number of associated work stations. The system includes D– (data) and A– (execution) levels, both in a duplex configuration.

Edits

Three editing suites provide video and audio signal control with an optional announce booth. Three edits computers editing systems assist the editing functions. Facility requests are made through the facilities network. Appropriate control of video/audio connections are established by test, as are video mixing requirements and signal monitoring. The edits computer is viewed as production equipment.

Special audio or video control needs are developed by menu forms on the edits work station. Entries for the edit list are made through function buttons, while commentary text is entered through the standard terminal keyboard.

Edit list decisions allow separate control of video and audio, which are arranged through the editing control panel by the facilities system. Manual video and audio adjustments are possible while the computer handles machine control functions according to time-code signals.

The edits computer aids audio processing through coupled control of video and audio transports and storing of level changes previously set for sound mixing. Any level changes are learned by the system for later reproduction.

The communication links through which all ZDF automation works were specified to be within the bounds of the EBU/SMPTE control concept. Not all aspects of the standard remote control format were fixed at the time of the ZDF implementation. The design allowed for minor changes to bring the system into conformation with the standard.

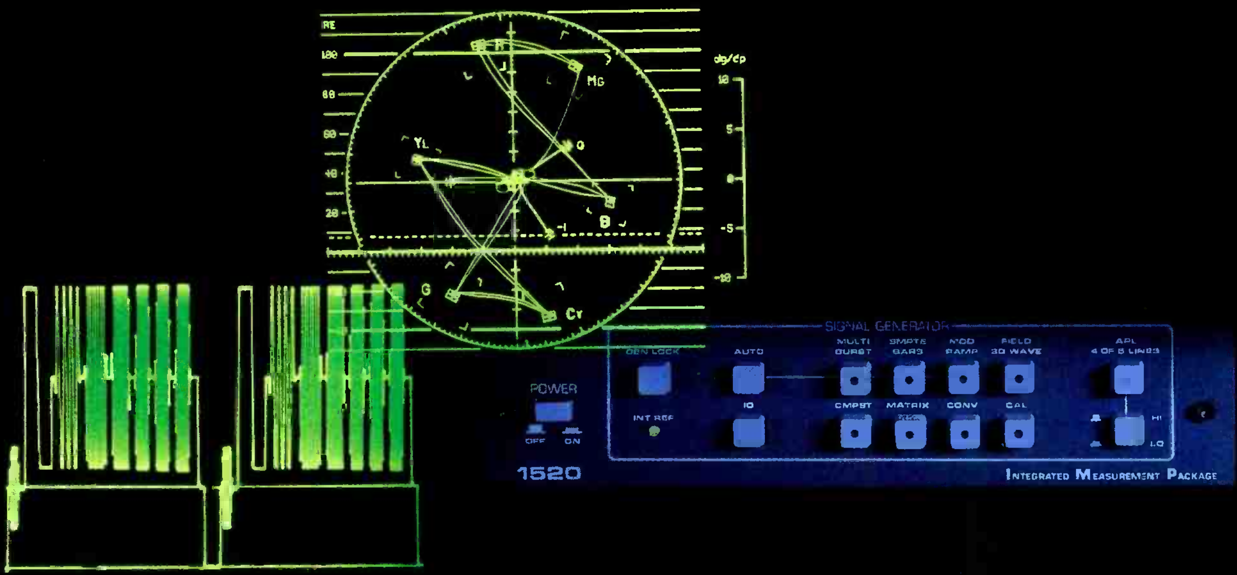
Here and now

System automation has come of age. Several small demonstrations of the ES bus have been shown at SMPTE conferences and a major demonstration was scheduled at NAB.

Now the requirement is to expand on the existing basics. More equipment designed to meet the control protocol or interfaces to intermediate at the tributary level are necessary. The increased signal qualities produced by today's products can only be enhanced by the flexibility that total system control can provide. These factors, combined with the yet undiscovered resources that computers and digital processing suggest, point to an exciting future for automation.

Acknowledgment: Technical assistance was provided by Alamar Electronics, Dynair Electronics, Grass Valley Group, SMPTE, Solid State Logic and ZDF.

Editor's note: This is only an overview of the ES bus standard remote control system. For additional information regarding this evolving standard, contact SMPTE, 595 West Hartsdale Avenue, White Plains, NY 10607.



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Managing automation

By Dennis Ciapura

The broadcast industry has embraced automation as a way to lower operating expenses. Is automation in your station's future?

In most industries, automation represents an opportunity to make a better product at a lower cost. It's simple. The capital cost of implementing automation is weighed against the projected production cost savings and the marketing value of whatever product improvement is expected. A decision on equipment acquisition is then made, based upon these criteria. It's just plain old-fashioned good business.

Unfortunately, first-generation broadcast automation projects often marched to the beat of a somewhat different drum. Unlike most business people, broadcasters sell a product that has virtually no cost in the classic accounting *cost of goods sold* sense. Electricity from the power company is modulated and radiated at a cost of perhaps $10,000 per month for a major facility with sales of $1 million per month, for a gross margin on sales of 99%. Most products yield a 50% to 75% gross margin.

Controlled expenses

In broadcasting, as in most service industries, after revenue, the major determinant of net profit margin is the station's operating expense. Nearly all expense is personnel-related. This is why broadcast station managers would rather walk on hot coals than hire an extra person. The revenue end of the equation is usually a function of the ratings, which can be considerably skewed by competitive factors and sampling conditions. Regardless of how confident the broadcaster is in the station's programming, the ratings, sales and revenue can be—and often are—affected by outside factors.

On the other hand, operating expenses are highly controllable. If you want less expense, employ fewer people. And so it was that the broadcaster's first application of automation was born with the goal of achieving total *walk-away*, minimizing the number of required operators and announcers. Most industries employed automation to improve productivity, so that the labor time required to produce a given volume of product was reduced.

Ciapura, BE's consultant on radio technology, is president of Teknimax, a San Diego-based telecommunications consulting company.

The broadcaster's goal was total elimination of certain classes of personnel. After all, it was hardly possible to speed up time to finish airing 24 hours of broadcasting in eight and cancel the second and third shifts. It's a real-time business, so minimizing personnel meant eliminating functions entirely.

The radio station manager's dream was a totally automated system with the chief engineer loading it up with syndicated music while the traffic person fed it some spots. TV managers were equally ambitious, but faced more complexity and usually settled for just automating commercial spots. After a while, radio broadcasters ad-

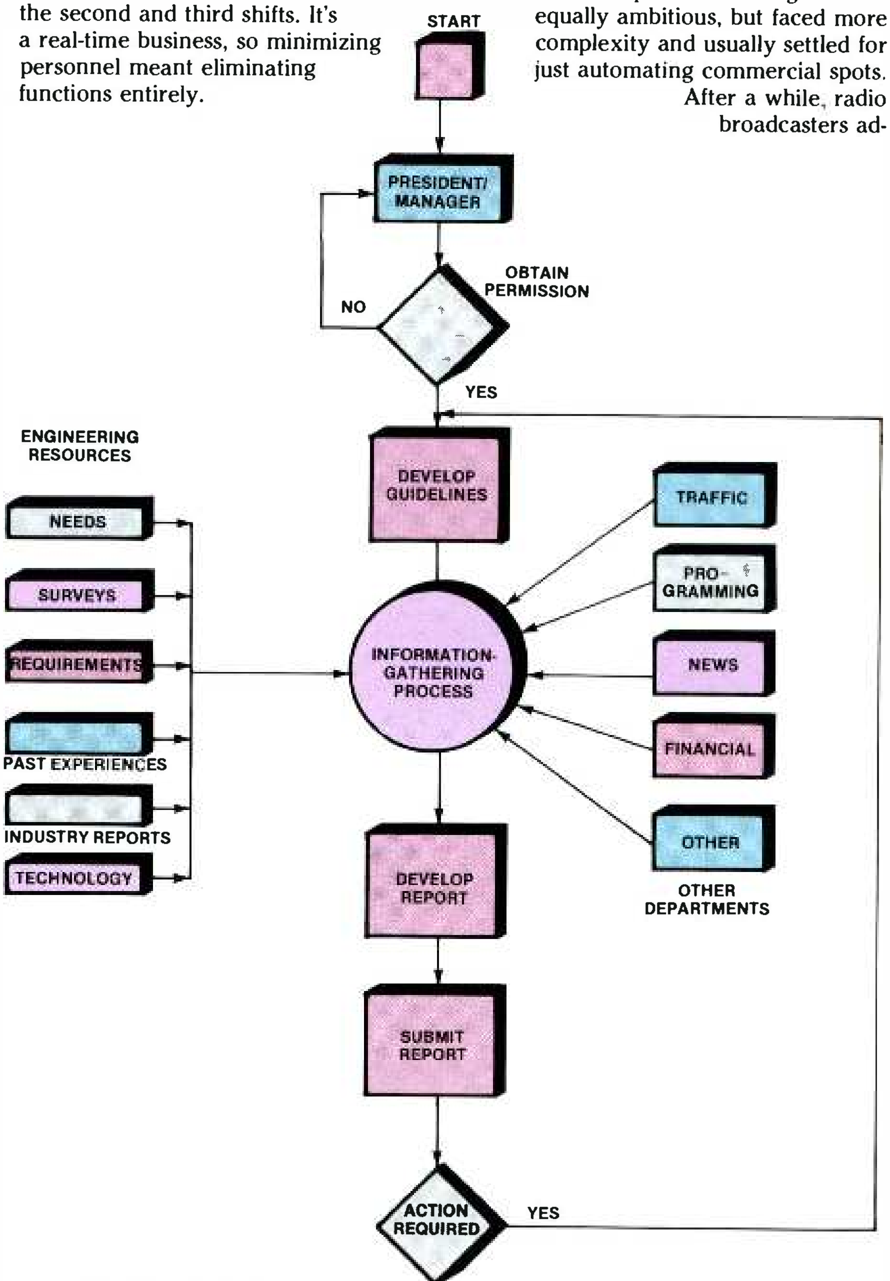

Figure 1. *Although the interview process seems fairly straightforward, a carefully planned set of steps must be taken if thorough results are to be expected.*

mitted that there was, indeed, such a thing as *automation sound*, and TV broadcasters discovered how expensive it was to miss a spot. Then came live assist. Announcers were back in business and a few more operators were tolerated as broadcasters sought to avoid appearing automated, while trying to be as automated as possible.

At about the same time, the introduction of low-cost data processing technology made it practical to integrate the station's business systems with program automation. Many kinds of businesses found it economically attractive to automate their accounting systems. Broadcasting was no exception.

For a while it seemed as if a whole new industry was springing up to help broadcasters automate the books. It was a relatively natural and simple course to take the process a step further by letting the business automation system talk to program automation, so that automated traffic management could become a reality. And that's about where the state of the art is today, although relatively few broadcasters have installed a completely integrated system.

Clues to the future

It's important to retrace how we got to where we are today with broadcast automation, if we are to gain a better understanding of where automation is going in the immediate future. History has taught us that the trends that survived were those that sprang from down-to-earth requirements.

Although we don't normally think of it as automation, remote-controlled transmitter facilities were the beginning of the trend. In those days, many of us wondered why comprehensive remote control couldn't take the place of the transmitter operator altogether. More often than not, the operator was really an announcer or some other staff member who resented keeping the log, was inept at handling emergencies and knew very little about what the remote indications meant. Eventually, automation came about because there were powerful and practical reasons for it. Are there other practical considerations that we can detect today as harbingers of automation trends for the next decade?

No one can know in detail exactly what technical improvements will be required in the years ahead, but some estimates can be made. Automation can be a major capital item, so it is important to be able to forecast what will be needed. Engineering managers should try to gain a clear understanding of their company's operating profile, including its accounting and traffic systems. To do so requires an internal study. Armed with the results of this internal study, the engineering manager will be in a good position to evaluate the station's needs in light of industry trends.

The engineering manager can then develop an impressive capital forecast relative to the station's automation requirements. Senior management and parent companies in any business like nothing better than well-researched future facility requirements.

The trends

Most broadcasters now favor some form of live-assist automation. Those stations that now use live assist are likely to continue to do so. The stations that are not yet using live assist will likely move in that direction. Live-assist automation provides many of the advantages of automated operation with fewer of the disadvantages. There is less of the automated sound that developed from the early automation systems. For television, live assist usually means using cart machines or videotape decks tied to a computer for spot playback. Modern tape equipment can be easily tied to a computer and spot playback is relatively easy to implement.

Future automation systems will likely be more versatile than today's equipment. As the source equipment becomes more sophisticated, computers will be able to randomly select spots or even complete programs from a variety of sources. Radio stations will be able to purchase automation systems capable of running almost any format. If the station


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changes formats, a change in software is all that will be required. The hardware will be flexible enough for all formats.

Source technology

Digital technology will continue to invade the broadcast arena. Two factors weigh in favor of more digital equipment in the broadcast station. First, material stored in a digital format retains its original quality. No longer will the listener or viewer have to endure background hiss or poor quality resulting from multigeneration copies. Second, digital technology allows the source material to be randomly accessed. It will no longer be necessary for an analog tape recorder to play cuts from a tape in a particular sequence. The computer will be able to direct the storage medium to find any particular song, program or commercial and play it back in any sequence. Access time to this material will be measured in milliseconds, not seconds.

Digital source equipment will find its way first into the major markets. As vendor competition and storage device improvements drive the price down, digital equipment will find even broader application. Hard-disk-based random-access audio storage devices already on the market do a super job of handling short segments such as spots, PSAs and jingles. The industry also needs inexpensive multiple-deck CD players. The simpler syndicated formats can be distributed and aired on current professional CD equipment, but multiple decks in the cost range of current tape equipment are required to execute more complex formats.

Interactive automation and slaved-satellite affiliates are exciting concepts that await proving in the field. If such interactive systems allow enough local input to preserve local identity, they may offer smaller stations the most effective cost control device ever. However, the key to their success will be simplicity. Many small market operators were burned by early attempts at automation, which often turned out to be more trouble than it was worth.

The big picture

Overall, it seems that we can draw some pretty definite conclusions about the directions that the industry will take in its maturing quest for realistic automation. First of all, it is apparent that larger market stations will continue to use automation more and more as a tool to provide improved programming at less cost than would otherwise be possible. This modus operandi is distinctly different than the original approach, which was to maintain a given level of programming sophistication with reduced numbers of personnel.

Radio and television in medium and large markets have become incredibly competitive. With this pressure has come an increased incentive to maximize the quality of the air product in order to protect revenue, as opposed to simply minimizing operating expense. The primary emphasis will be directed toward achieving the best possible air product. This is a natural evolutionary shift because major market advertising revenues have grown and the number of well-financed outlets in every market has increased.

Smaller market stations striving to make the best of limited revenues also will be driven to increased automation, but for more traditional reasons. These stations will find that the latest versions of total *walk-away* systems deliver the reliability and ease of operation that the small facility must have for automation to be practical. For these stations, the financial analysis is more straightforward, and is based on personnel and programming cost savings vs. capital equipment costs.

The latest generation of broadcast automation equipment offers tremendous flexibility and consistency, and costs less per unit of capability than the older systems, primarily because of improvements in computer technology. This capability has put complex formats into the hands of many more stations. Cost justification is now based on com-

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petitive prowess, and your long-range planning should take that factor into account. You must assume that your competition will be using *agile program automation* as a competitive weapon.

An automation plan

Good management includes conducting an internal automation requirement survey. Submit the survey results to your station management, even if no one is even thinking about automation at the present time. Interviewing the company's programming, traffic and financial managers about their anticipated requirements will yield several benefits:

- Engineering management will have a better understanding of how the business operates. Engineering also will be less surprised by unexpected requests for facility changes.
- The survey will force other managers to consider the short- and long-term requirements for their departments. The process may lead them to decisions on important topics they otherwise might not have considered.
- Senior management will appreciate the effort and foresight that engineering management shows by conducting such research. Station management may also recognize the critical role that engineering can play in the station's overall business plan.

Follow the steps

Interview the program manager. Discuss what future formats the station might be required to implement. How much and what kinds of flexibility would be required by the hardware? What is the expected source material?

The next step might be to interview the traffic manager. What does that person see in terms of business volume? Will a format change impact upon this area? What are the limitations of the current system?

The business or financial manager should be able to give you a good idea of the station's current operational status. Ask how much revenue is lost because of operational errors. The same questions on format changes should be raised. Again, ask if there are any limitations with the current accounting system.

The review process needs to be completed with an open mind. Don't approach the survey with any preconceived conclusions. Examine each department's responses to similar questions. Is there any common ground? Are there similar complaints or needs? If anyone suggested interfacing current or new equipment, can that be accomplished? Is there an opportunity to improve the air product by adding some automation equipment? Could the addition of automation reduce errors? It may be that automation could reduce errors in the business area (billing), as well as in the on-air operation. Finally, is there an opportunity to reduce operating costs through automation?

After you have answers to these questions, you are ready to develop an automation system plan that meets the requirements suggested by the survey. It may be that implementation of the total system can be carried out over several years. If so, what will be the effect of partial implementation?

After the specific equipment needs have been determined, contact the various equipment vendors to obtain cost estimates. If the entire system will not be installed at one time, what are the projected cost increases?

The report

Your report to senior management should be complete in all details. Begin by explaining the purpose of the survey and state that it includes a forecast of possible capital requirements—not a budget request. Provide a brief summary of the interviews you conducted. These interviews form the basis for your conclusions so it's important that they be included. Describe the review and survey process.

It also is important to bring in some outside expertise in the form of supplementary data. Reports on industry trends are excellent materials to include. If others outside your station are coming to the same conclusions as you, your opinion will be more respected. Project

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the improvements that will have to be made to the current facility. This should be broad enough to include the specific needs, but not so specific that you have painted yourself into a corner.

It is dangerous to predict exactly what piece of computer-related equipment a station should purchase three or five years *before* the purchase. Finally, develop a cost forecast for implementing the plan. Provide a minimum and maximum range of costs. Rely on your vendors for help in this area.

The steps described here are similar to what would be completed by an outside management consultant looking at any company's growth and modernization requirements. Such a report should be well received by senior management.

Your company may elect to immediately modify its budget forecast to include your projections. Or, a departmental meeting might be called to discuss the forecast before deciding to modify the budget. Even if the report is filed with no immediate action taken, the engineering department will have performed a useful planning service for the company. At the very least, you will have improved the engineering department's image by showing your concern for the station's long-range business needs.

Acknowledgment: Assistance was provided by Dave Evers, Broadcast Electronics; Tom Ransom, Harris Broadcast; and Dave Collins, Microprobe Electronics.

Preparing for automation

By Bryan Boyle

It's no secret that there are many advantages to automating a radio or TV station. Increased profit results from lower and more effective labor costs. The reduction in required make-goods improves sales. No longer saddled with the drudgery of old routines, your operators have more time to spend on preventive maintenance, repair or other worthwhile projects.

You find you are comfortable with the decision to automate the station, but what is the best approach to take? How can you arrive at your final goal most effectively? Taking a cue from operations research, implementing an automation system is a 4-step process. You must plan the design, coordinate the installation, train the operators and consider eventual maintenance.

Design

Once you have determined where you stand and what you need, it's time to talk with the vendors. You want to identify those systems that can be integrated into your system without restructuring the entire station. If you

Continued on page 52

Boyle is an automation systems consultant in Overland Park, KS.

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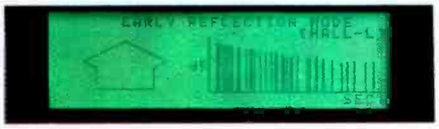
"EARLY REFLECTION" display mode showing room size and relative level and time of discrete reflections.


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"REVERB TIME" display mode showing difference in reverb time in each of four frequency bands.


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And there are 30 additional ROMs with factory preset sounds. Many of which can be completely edited (as can the user-programmed sounds) by using the LEDs to tell you the set value or indicate in which direction to move the control so you can easily and precisely match the value of the originally programmed sound.

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We could go on about the REV-1. Tell you about its 44.1 kHz sampling rate that provides a full 18 kHz bandwidth to prevent the natural frequency content of the input signal from being degraded.

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Continued from page 48
are looking for a simple tape playback sequencer, it is not necessary to include a traffic computer, sales computer or transmitter controllers in your plans.

If your analysis indicates the need for an automated switching system for multiple studios, net feeds and commercial playback, then traffic, logging and transmitter control should be considered in the overall design phase. You also will want maximum possible verification of actual on-air events as your eventual goal.

Most major vendors of automation packages can provide a full range of services. Carefully consider what the sales representative promises. Also talk to the vendor design team to find out what its particular hardware and software package will do for you. Look for the advantages to be gained in a particular implementation.

Installation

Once the design has been set and the purchase orders have been signed, the job of installation can begin. You must start by preparing the physical plant for the new equipment.

Something that is sometimes overlooked in the development of an automation system is the area in which the equipment will be installed. It makes no sense to buy thousands of dollars worth of automation hardware and then look for a place to put it. Usually space is available in an unused studio, the back room or even master control. Complete elevation prints for the systems under consideration will help to determine where to provide power, how to route cables and how to configure HVAC equipment. As with any project, initial planning will pay dividends in later phases of the project.

Training

Another critical part of implementing station automation is the training of operations personnel. No matter what has been said about the acceptance of automation, most people view the coming of computer control with some trepidation. Non-technical discussions with the staff by both station management and the chief engineer will smooth the transition to this new way of approaching daily operation. These discussions will help staff members understand why the decision was made to automate and help them to better understand their jobs in relation to the new operating environment.

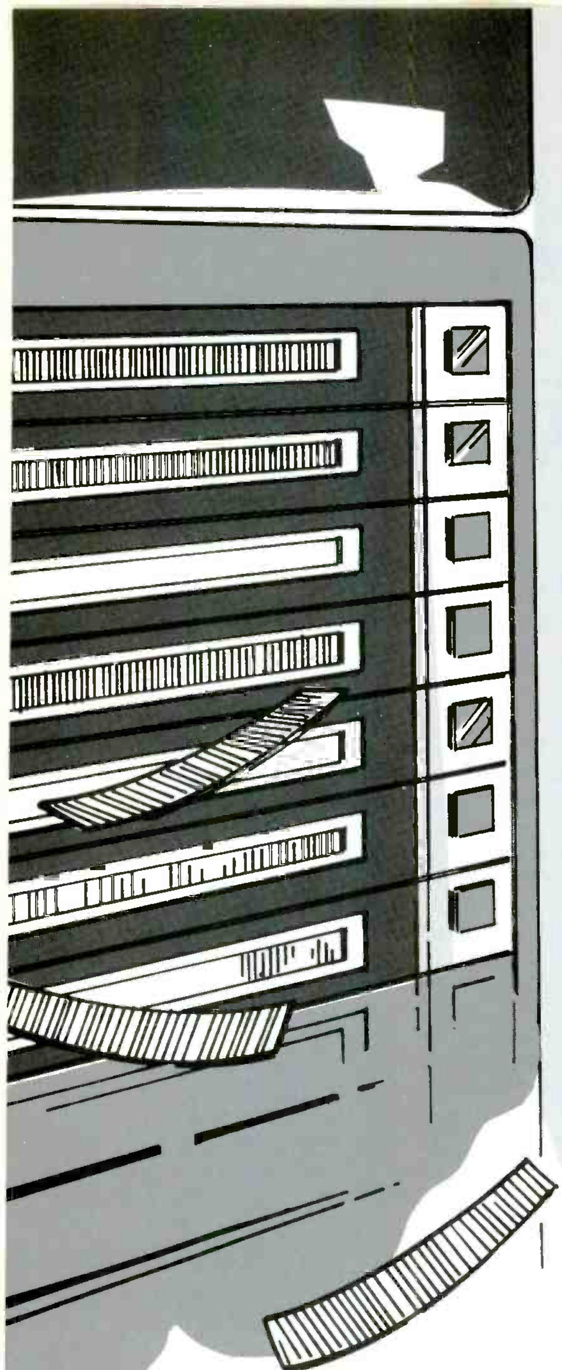
After the equipment arrives, installation should proceed quickly, consistent with good engineering practices. Physical location is the first step, power next, then incremental tests of each subsystem of the overall system. This method allows small problems to be isolated during the installation phase when the solutions may be easily determined and relatively painless to implement.

Once the individual subsystems have been tested and verified, final tests can be conducted. These tests should encompass total system verification using live data, and run in parallel to the operation on-line. Insist on proper system operation.

Maintenance

From a hardware standpoint, maintenance of the system should consist of ensuring the availability of a constant supply of clean ac power, changing air filters (on CPUs and drives), cleaning tape heads and stocking spare parts or assemblies for the most used or most critical items in the system. In general, today's automation systems, with their heavy use of CMOS logic and other IC circuits, have reduced the need for a large inventory of small parts. Usually the engineering manager need only maintain a stock of replacement boards, swapping out modules as required.

Most systems operate reliably over long periods of time with little more than normal preventive maintenance. A regular maintenance plan is important, because it will decrease the amount of missed commercial playbacks, decrease programming miscues and provide a consistent air product for listeners and advertisers.



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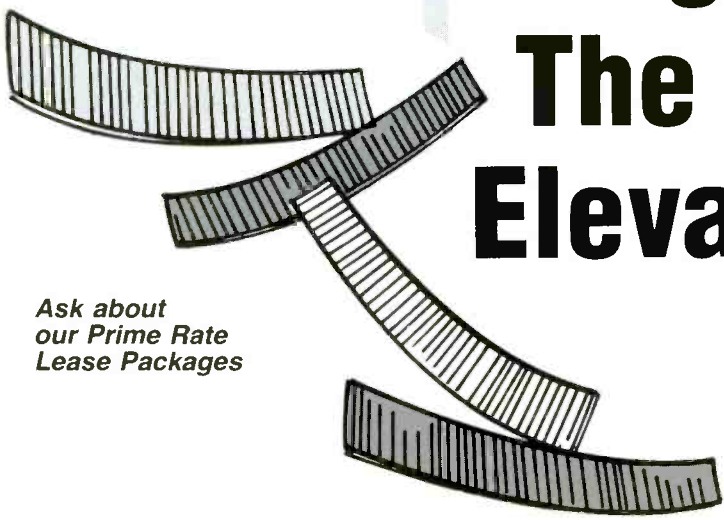

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Automating monitor setup

By Brad Dick, technical editor

Automating the alignment process of the video monitor can greatly improve the quality from any TV studio.

Today's technology is placing additional demands on the TV studio monitor. The advent of satellite-delivered programming probably did more than any other factor to make stations aware of the need for quality monitoring equipment. With satellite-delivered programming, TV stations were able to see the high-quality video available from the networks.

Other technical advances also are placing more demands on the TV station to maintain high production standards. Consumers are no longer content to settle for green faces on the 10 p.m. news. Many viewers now have sophisticated home video equipment including Super Beta and HQ-VHS videotape recorders. Coupled with direct-to-home satellite programming and greatly improved video monitors, viewers now expect similar high levels of performance from the local station.

Broadcast technology

In order to meet some of these new quality demands, TV stations have come to rely on automated systems in a number of different forms. Many pieces of broadcast equipment from videotape recorders to studio cameras use computer technology to obtain the best possible images.

Some of this new equipment depends on computer-controlled automation techniques. Without the capabilities of microprocessors and digital-controlled circuits, little of the automation we see today would be possible. It has become common to see microprocessors and computer logic built into broadcast equipment.

One area that has recently received much attention in terms of computer-assisted enhancement is the video monitor. For a number of reasons, video monitors have continued to rely on analog circuitry and manual control systems. As we will see, computer-controlled automation is soon going to bring exciting new features to the broadcast video monitor.

One of the first broadcast tools to take advantage of computer automation was the studio camera. Today many cameras rely on microprocessors for special performance features in addition to labor-reducing functions. These cameras provide automatic level settings, balance and registration and other features. It is no longer necessary to *chart* a camera prior to its use in a production setting. Simply press a few buttons on the CCU and the camera practically aligns itself.

The video monitor, on the other hand, requires manual adjustments. In a TV production setting, the monitor is a key element both in terms of the objective and subjective evaluation process. Directors use the monitor to subjectively determine if the camera angles are correct and to set the scene lighting and shot composition.

Engineers, on the other hand, rely on monitors to evaluate practically everything else in the broadcast plant. If it looks good on the monitor, then it is assumed to be operating properly.

To carry out these functions, the monitors in any given installation must be carefully aligned. Just as important, the monitors must be carefully matched. If the scene on one monitor appears to have more light (be whiter) than another monitor using the same camera source, it becomes difficult for the director to make subjective evaluations. Matching monitors can often turn out to be a difficult alignment problem in the station.

Early monitors

Early TV color monitors were plagued with a number of problems. Most monitors in the early 1960s suffered from poor dc restoration. There was no back-porch clamp or method of promulgating the dc pedestal from the camera to the monitor. As the scene lighting changed, so did the black level.

Early monitors also exhibited poor phosphor uniformity. The separate red, green and blue phosphors were often contaminated with other colors, producing impure combinations on the CRT. The problem was compounded as multiple cameras were used in a production and viewed on several different monitors. Because the monitors were difficult to match, it was sometimes hard to determine what monitor was properly representing the desired scene.

Color stability was also a problem for the early color monitors. As the units aged, the balance and color intensity changed. The monitors also often changed colors in response to vibration or temperature variations.

Perhaps the most critical problem for early monitors was the lack of white uniformity. Because the white balance is so critical to faithful video reproduction on any CRT, monitors were usually adjusted to some fixed white value. Unfortunately because of the many problems listed previously, setting the monitors in a single facility to a uniform white level was difficult at best.

Modern solutions

Today's monitors solve, at least to a great degree, most of these problems. The old problem of dc restoration is seldom encountered today with modern cameras. As the scenes and lighting levels change, the monitors properly track the different levels. The black level does not shift as it did with the old monitors.

Improved manufacturing techniques allow the production of carefully matched color phosphors. Consumer grade monitors may have an aim point tolerance as high as $\pm$.020 CIE units. A professional studio monitor, however,

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requires tolerances of ±.005 CIE units (D6500 standard). This standard requires much tighter phosphor tolerances than those encountered in consumer equipment. As the phosphors are more closely controlled, the monitors are more easily matched and it becomes easier to consistently meet industry standards.

As late as 1979, the majority of monitors relied on delta gun technology. Today's monitors, however, often rely on precision-in-line (PIL) CRTs. Among the advantages of this design is the elimination of active-convergence circuitry. This design allows the use of a less complex yoke assembly, thereby simplifying convergence and increasing monitor stability.

Other improvements in monitors include beam current feedback (BCF). BCF prevents the decreasing cathode output that normally occurs as the electrons are boiled away over a period of time. BCF is now a commonly used technique to improve the long-term stability of monitors.

Modern mask design helps address the problem of poor white uniformity. Typical errors in white uniformity show up as mottling or shading, usually in the corners of the CRT. If the corners of the CRT lack white uniformity, then we see a color temperature change across the different areas of the CRT face. Today's precision CRT manufacturing process can usually eliminate this problem.

Need for a reference

In the typical production studio, there are several color monitors. These monitors must be as closely matched to a uniform standard and to each other as possible. The *subjective* evaluations for all of the facility's productions depend on these monitors. The maintenance department uses the monitors to make *objective* evaluations of other equipment. To meet these needs, the monitors need to be adjusted to a uniform standard. Coupled with this requirement is the desire to be able to *transfer* any desired standard from monitor to monitor.

Typically, a station might have a number of color monitors. Several different engineers might be involved in their alignment. With the combination of several monitors, several engineers, no measurable reference and human perception errors, accurate alignment from monitor to monitor (i.e., matching performance) is difficult, if not impossible.

Golden eyeballs

A few stations may be lucky enough to have an engineer on staff with golden eyeballs. This somewhat less-than-precise definition pertains to a person with the ability to properly evaluate color, especially CRT-displayed color, and make the necessary adjustments.

Even if a person has this unique ability, there are many factors that can affect how the CRT color is finally perceived by the eye-brain combination. This perception can be dependent upon such things as room color, medication and other seemingly unrelated factors.

Even with the golden eyeball approach, it is difficult to guarantee accurate, constant and uniform monitor alignment. The solution lies in using some form of mechanical or electrical assistance.

Alignment aids

There are at least two mechanical aids to aligning monitors. One aid is the optical comparator. This external reference device consists of a viewfinder and eyepiece. When placed against the CRT, it measures the light emitted from the CRT face. Filters inside the unit alter the brightness from the CRT face as it is projected onto one-half of a split-screen in the eyepiece. The other half of the eyepiece is illuminated by a reference, carefully regulated, internal light source. The engineer looks through the eyepiece and adjusts the monitor until the two halves of the eyepiece match as closely as possible. Although this technique is a significant step toward eliminating the human error factor, it still suffers from the fact that human interpretation is required. The process also requires that the engineer manually make the necessary adjustments on the monitor.

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The photometer is placed against the center of the CRT during the measurement period. The alignment typically takes less than a minute.

Another method for aligning monitors relies on an analog or digital meter (color analyzer) to measure various CRT parameters. The color analyzer goes a long way toward reducing the influence of the human perception on the alignment process. However, sometimes the inconvenience of using the device hampers its use.

For example, if the monitor is located 15 feet up in the air over a studio, the engineer may not be as concerned about getting the correct settings than if the monitor were located on a test bench. There is also the possibility of human misinterpretation of the information provided by the color analyzer.

These methods of measuring a monitor's performance suffer from one common and major drawback. They rely on human interpretation of the results. With this limitation, it is difficult to transfer any reference (or standard) from monitor to monitor. In other words, the station still has not been able to guarantee uniform performance from monitor to monitor.

Even if you assume that some techniques of properly measuring the performance of the monitor are available, what happens next? The engineer may still have to perform several manual adjustments to bring the CRT into proper alignment. If the CRT needs several adjustments, such as RGB low light, RGB high light, contrast and CRT bias, then there are several more areas for potential adjustment errors. Because it is seldom possible to accurately align a monitor in less than three passes, a significant amount of time also can be consumed in the adjustment process.

Required features

What is the solution? First, some accurate, portable standard measuring instrument must be available. Second, some means to automatically align the monitor is needed. With an automated alignment process such as this, the human element (and potential for error) is practically eliminated.

The monitor's performance can be more uniform. It can be set up more quickly, thereby saving time. And a single performance standard can be applied to each monitor, which ensures repeatability.

Some industry research indicates that monitor users are less concerned about the absolute precision of the monitor than they are about consistency among monitors. This again reflects the need for a transportable standard.

Any automated alignment technique must have certain characteristics. It must be fast. The human interaction and interpretation must be reduced or eliminated. The system must be able to align monitors to not only the American D6500 standard, but also to any other reference that may come about. The automation system should allow this new reference, once captured or stored, to be promulgated throughout the broadcast plant. The end result is monitors all aligned to a common standard and providing consistent performance from monitor to monitor.

Any automated monitor should be able to automatically adjust to RGB, NTSC or PAL signals. This feature allows a single monitor to quickly adapt to different production situations. Automatic alignment should eliminate as many points for human interaction as possible, with

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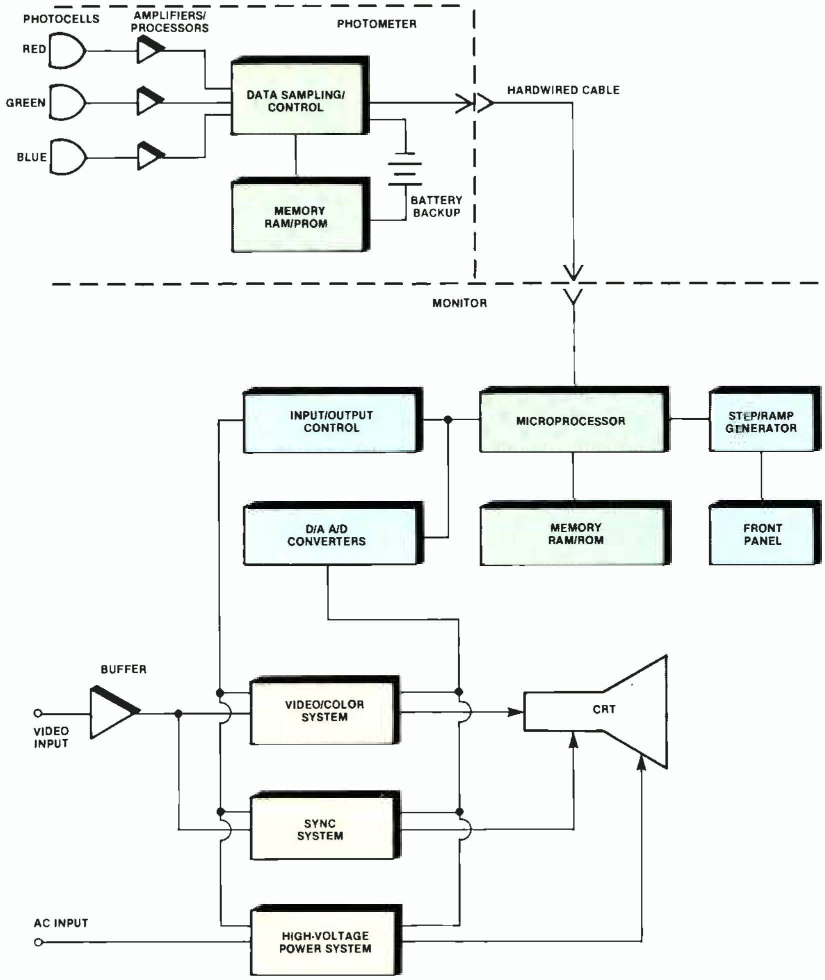

Figure 1. *Block diagram of an auto-setup monitor.*

selected standards stored within the system and all adjustments performed by the automation system, not the operator.

A solution

One recently developed automated monitor setup system uses a photometer as the feedback element in the adjustment loop, instead of relying on the human eye to capture CRT performance. (See Figure 1.) The photometer is an easily transportable unit that reads the output from the CRT. Comparing the CRT output with the standard stored inside the monitor, the photometer communicates the results back to the monitor for further action. (See Figure 2.)

The photometer contains a microprocessor for housekeeping purposes. It measures the CRT's performance with photocells, formats the resulting data, and responds to commands from the monitor for further measurements. The photometer may even store information from another monitor if desired. This feature allows the creation of a new standard. In other words, the photometer can look at another monitor that has been aligned to some standard, store the results and then communicate this performance criteria to another automated monitor. The two different monitors now appear the same.

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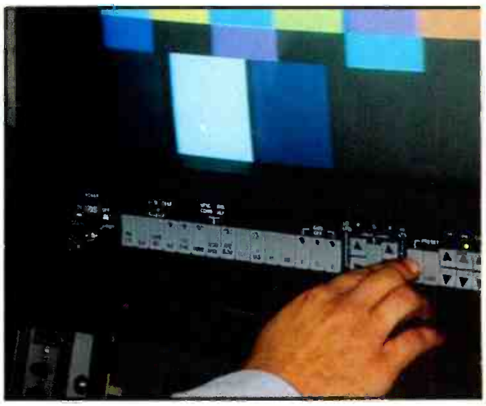
Before monitor alignment can be accomplished, the photometer should be zero-calibrated to establish a reference point for the photodiode *dark current*. As the lens of the photometer is covered to keep outside light from upsetting the adjustment, an internal microprocessor automatically compensates the internal photodiodes for ambient temperature. If the zero-calibration point were preset with no adjustment provision, the monitor's alignment would be a function of temperature. If the zero point is reset prior to monitor calibration, ambient temperature will not affect the accuracy of the results.

The photometer is next placed against the CRT to measure performance of the monitor. The system shown in Figure 1 captures information from the guns simultaneously. After the data from the CRT has been sampled, it is fed to the photometer microprocessor for processing, formatting and transmission to the monitor.

The photometer has battery backup for the CMOS processor, thereby protecting any stored data. On-board PROM contains the necessary programming software. The monitor's on-board PROM can be modified to accommodate new industry standards, additional monitor capabilities and special features.

Intelligent circuits in the monitor use this data to make the appropriate adjustments in the monitor circuits to complete the actual alignment process. As adjustments are made by the automation circuits in the monitor, the results are detected by the photometer and fed back to the monitor microprocessor. This closed-loop action allows the monitor to be aligned in a matter of seconds.



Manual adjustment of the CRT parameters can be completed through front-panel-mounted switches that interact with the monitor MPU. Up to 256 discrete steps of control are available in an 8-bit system.

Monitor microprocessor

A key element to automated monitor setup is microprocessor control over the functions of the system itself. The 8-bit microprocessor (MPU) shown in Figure 1 contains both on-board RAM and ROM in addition to the necessary I/O ports.

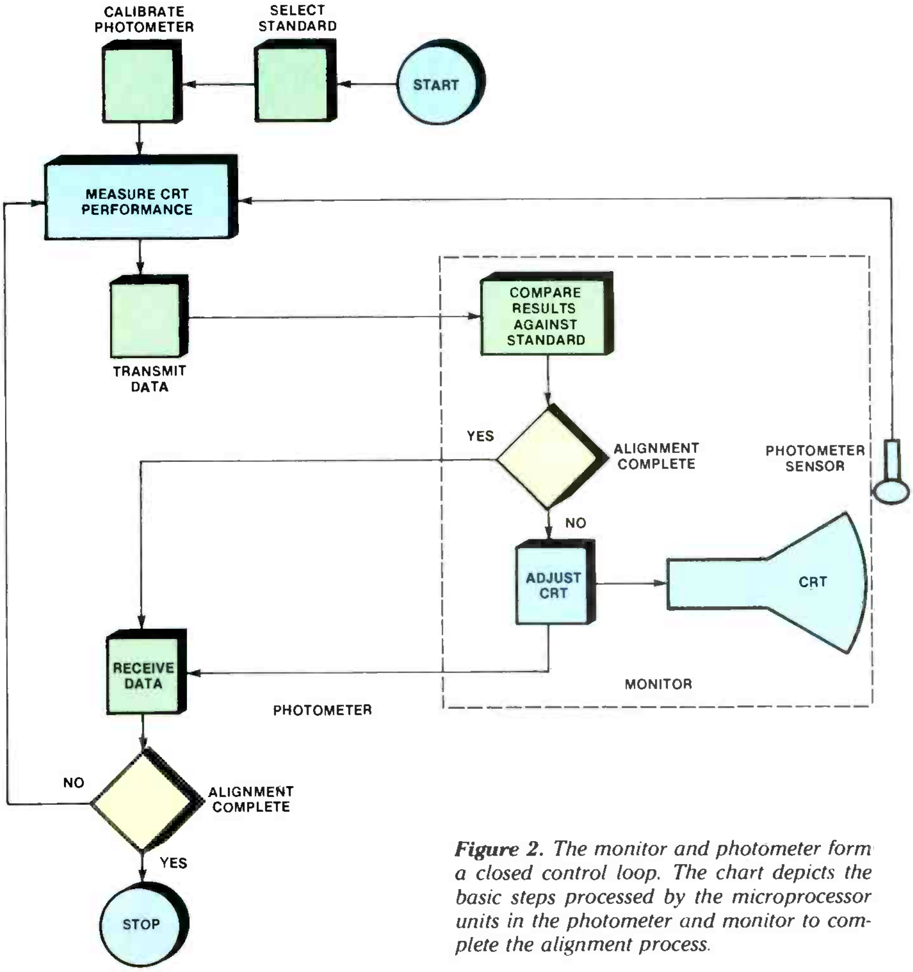
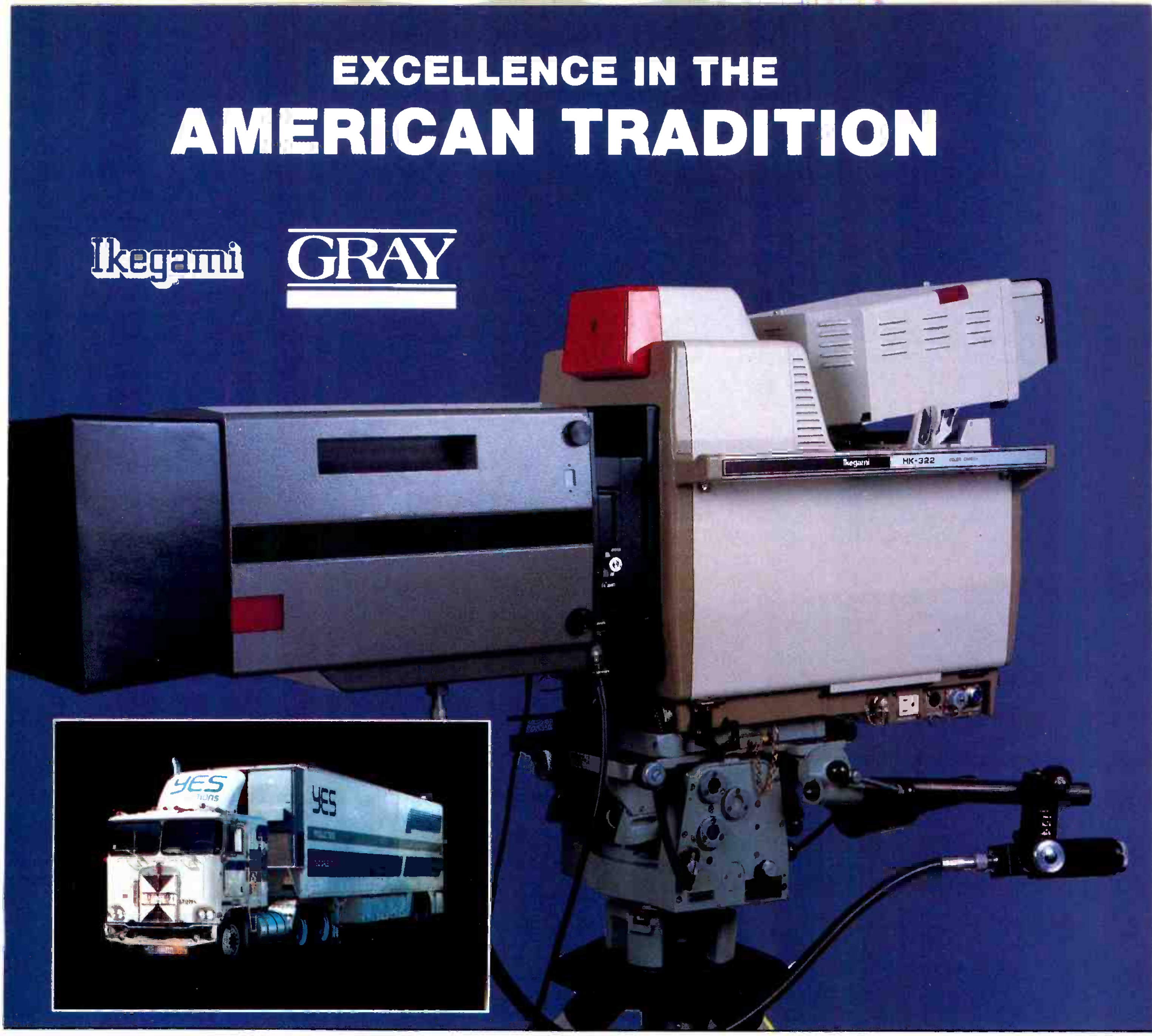


***Figure 2.** The monitor and photometer form a closed control loop. The chart depicts the basic steps processed by the microprocessor units in the photometer and monitor to complete the alignment process.*



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The MPU is the supervisor of most of the monitor actions and features. The digital logic, D/A and A/D converters are only associated with the control aspects of the monitor. So far, there are no true digitally processed video displays. The MPU is strictly concerned with controlling functions of the monitor, not digitizing any of the video signals.

One of the advantages of microprocessor control lies in the resolution that can be obtained. An 8-bit processor can provide 256 discrete steps of control over such parameters as contrast, low and high light settings and other important adjustments. In order to allow the operator to manually set various parameters, yet do so in an efficient manner, a ramp function is coupled with digital control in the system shown in Figure 1.

For instance, if a control switch is pressed momentarily, one step-change will take place in the desired setting. If the switch is held closed for a period of time, the ramp function takes over and the steps begin to take place at a faster rate. This feature allows the operator to vary the control from one range setting to the other in a rapid manner, while still having absolute 1-step control if desired. The repeatability of this kind of control is not possible with potentiometer circuits. Vibration and dirt also do not affect any of the desired settings as can happen with analog circuits.

Limitations

Automated monitors are not without their limitations. The level of sophistication involved in the monitor is greater than what is typically encountered in conventional units. Maintenance on such a device may need to be carried out by engineers familiar with digital circuits. In some advanced-technology monitors, factory-supplied troubleshooting software may even be required.

The photometer also is not immune to problems. Ambient lighting may affect the results obtained by the photometer, especially when a low-light adjustment on the monitor is made. If the monitor and photometer are located in a well-lighted room, some of the ambient light may reflect from the CRT mask back into the photometer. If so, the photometer is fooled into thinking the monitor is putting out more light than it really is. The problem is really a form of S/N measurement error. In this situation, reducing the ambient light eliminates the potential for error. Because most monitors are used in critical viewing environments (low-level lighting) this type of error is unlikely.

One of the most important elements in the construction of a high-performance CRT is the purity of the phosphors. If the CRT phosphors are not properly matched to the correct standard and as pure as possible, the monitor will never be able to produce the quality picture required for an automated monitor.

The CRT shadow mask can also limit the quality available from a monitor. If the shadow mask is stretched in the manufacturing process, then the color purity will change across the face. This change represents a shift in color temperature and cannot be corrected by electronic circuits.

Aging can affect the performance for a high-quality monitor. The constant bombarding of the lead shielding in the glass causes the lead shielding to oxidize, giving the glass a yellow tint. The slight yellow tint does not affect the red and green colors, but does affect the color blue. With modern CRTs this is less of a problem than it used to be.

As new technology continues to advance into broadcasting, we can expect to see more equipment controlled by automation. TV monitors are only one of the areas just now taking advantage of modern digital technology. As circuits become more sophisticated and broadcasters become more quality conscious, we can expect to see even more automated equipment. The results provided by this new equipment will mean a higher-quality product, a more consistent product and the requirement for maintenance engineers trained in digital technology.


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Distributing data via satellite

By Richard T. Cassidy

Several broadcast networks are improving network-to-affiliate communications through innovative use of satellite technology.

For most TV and radio engineers, the era has passed when receiving a network video or audio feed simply meant keeping in regular contact with the local phone company's operating center to maintain a single video or 3.5kHz or 5kHz monaural audio channel. Stations relied on land-based network feeds, bicycled tapes and local origination for their programming.

Today, the situation is more complex. Most stations use at least one satellite dish to acquire programming. This programming originates not only from the established major networks, but also from many specialized networks. These networks offer a diversity of services and formats that allow stations to make program choices tailored to the needs of their local audiences.

Broadcasters are increasing their use of satellite facilities to receive numerous data services for later retransmission. The channel capacity available to radio and TV networks allows the transmission of data in addition to regular audio and video programming.

Satellite-acquired programming, however, is not without its problems. The station operations staff must contend with a whole range of new requirements generated by satellite-delivered programming. The local staff must become familiar with the various formats supplied by programmers and adapt to these new operational routines. Seldom will a program supplier change its ways to meet the needs of a local station. Local staffs have to be able to cope with time-zone corrections, commercial scheduling practices, changing local availabilities and even transponder and channel assignments. No longer is it possible to simply *pot up* the net and know what is going to happen.

Cassidy is vice president of The Chesapeake Group, a telecommunications satellite and computer company.

Direct data communications from broadcast network headquarters to station affiliates also is becoming increasingly important as network schedules multiply. A number of networks have established their own message delivery or electronic mail services. These data delivery services are the key to successful implementation of any satellite-delivered program service.

Brief history

In 1970, the Public Broadcasting Service (PBS) developed the dial access communication system (DACS) to send messages to PBS affiliates. The system employed a computer in the Washington, DC, PBS transmission center that stored messages about program schedules, operations traffic and other affiliate-related information. The computer was programmed to call each PBS station daily using dial-up phone lines and a low-speed modem to print messages on a station teletypewriter.

National Public Radio (NPR) used a similar system until 1979. By then, both non-commercial networks had completed the transition from terrestrial to satellite program distribution. Data communications with affiliates via satellite was established shortly thereafter.

Today, both PBS and NPR rely heavily on these systems. Each PBS station is now equipped with a microcomputer for receiving messages via satellite and for access via dial-up modems to the PBS station database in Washington.

Radio and TV networks have traditionally kept affiliates abreast of program and operating schedules with detailed mailings of upcoming programs and talk-ups during non-program time for last-minute scheduling updates. Now, however, many networks have chosen other methods of alerting stations to program changes and updates. TV networks can hide data in the horizontal lines of the vertical interval. Radio networks often use in-band multitone signaling or slow-speed subaudible FSK datastreams to alert affiliates that program advisories or EBS alerts are being transmitted.

In addition to transmitting messages and message alerts, some networks transmit audio tone combinations to control local station equipment. This hardware allows automatic network joining and the insertion of local commercials. The Mutual radio network transmits a low-level in-band multiple-frequency tone for this purpose. CBS uses a multiple-tone system, NetAlert. NPR inserts control signals in the data communications message stream. These control signals can be used by stations to tune receivers, operate tape recording equipment and perform a variety of audio switching functions.

Network electronic mail

Although the scope of data communications between networks and affiliates includes alerting, control and commercial information services, a key ingredient of network operation today is the distribution of hard-copy information from networks to affiliates via electronic mail systems.

NPR's electronic mail system, used to keep member stations informed about programs transmitted over the network's 12 satellite channels, is a typical case. Through the NPR computer facilities in Washington, messages from program producers, regional networks and affiliate stations can be received, stored and forwarded to individual stations and station groups. Operational schedules listing time and channel assignments for

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various programs, program offerings and descriptions, promotional copy and program segment contents and timing also are transmitted. Stations are equipped with a satellite receiver, decoder and printer. Each decoder has a specific address code so that stations can receive individually addressed messages, as well as all-station messages.

Public TV stations also have a versatile message delivery system. This high-tech version of the original DACS system features a microcomputer located at each PBS station and a mainframe computer at the PBS headquarters. Messages can be composed at each station and forwarded to PBS headquarters, where they are stored and then distributed to other stations via dial-in modems. Later, the messages are transmitted over the satellite message delivery system. Because the messages are received electronically over the PBS satellite DACS, they can be stored on the station's disk for later display, sorting, review and hard-copy printing.

Brookmont Communications, Nashville, TN, is currently installing a similar data communications system for its affiliates in Tennessee, Kentucky and South Carolina. Brookmont provides a variety of news, sports, agricultural and special regional programming to approximately 150 affiliates on three satellite program audio channels. Brookmont also intends to provide complementary information services to affiliates, plus a dedicated single-channel-per-carrier (SCPC) satellite data channel. The Brookmont system illustrates the capacity and flexibility of a system designed around standard microcomputer equipment and readily available microprocessors.

The origination system

The functions that must be performed by the origination system include: capturing and storing data for preparation of station messages; formatting messages with specific information regarding subject and destination; queuing messages according to established transmission priorities; addressing messages to all affiliates, groups of affiliates or individual stations; and assembling message data packets for transmission to affiliates.

The heart of the origination system is a desktop multitasking multi-user microcomputer configured to perform several tasks simultaneously. Brookmont wanted to provide its stations with weather information from the National Weather Service (NWS). In many cases, this service would eliminate the need for stations to order local loops and teleprinters to be used exclusively for receiving weather-wire information.

Working with NWS, Brookmont developed a method to extract the various types of weather information from the incoming weather wire. Because NWS offers a wide variety of reports (national forecasts, state zone forecasts, local forecasts and flood and hurricane warnings), Brookmont wanted to give stations the option of choosing the specific weather messages they wanted to receive on a regular basis. Each affiliate received a questionnaire and was asked to select from the list of available weather services and reports.

All weather messages sent by the NWS weather wire begin with a *header* identifying the type of service and originating forecast center. A computer can easily scan this information and determine whether the incoming message has been requested by any or all of the Brookmont stations. If even one station has requested that service, the message is first stored and later forwarded to the appropriate station(s) over the Brookmont electronic mail system.

The list of all desired NWS reports and the stations wanting to receive them is stored in the files of the originating system computer. The files contain station call letters, station decoder address codes, station service request lists and weather service message headers. All of this information is reviewed for each message. Messages are transmitted only to the stations that have signed up for the particular service.

The origination system computer and a word-processing program are used to generate network messages at the

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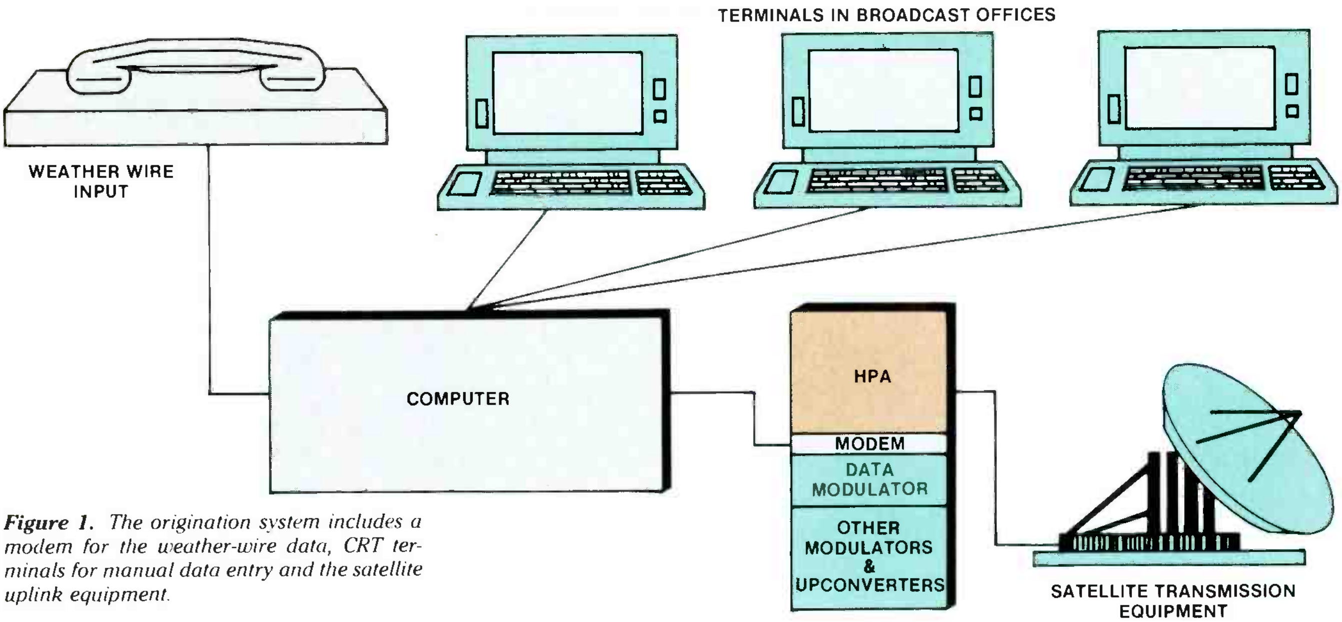


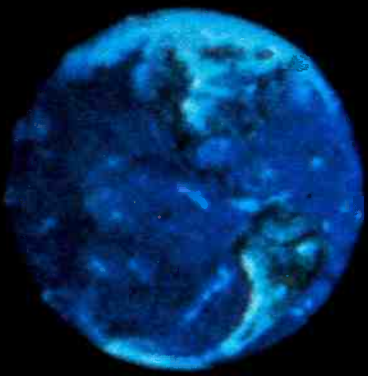
Figure 1. *The origination system includes a modem for the weather-wire data, CRT terminals for manual data entry and the satellite uplink equipment.*

Brookmont headquarters. With terminals located throughout the Brookmont offices, program schedules, news bulletins and special advisories are generated for transmission to the network stations. Through the use of a message header, the station or group of stations are sent only those messages that concern their operation. Affiliates are not burdened with printouts of messages that do not affect their operations. The text files containing lists of affiliates, station address codes and services offered by NWS can be readily changed as new stations and services are added to the system.

The Brookmont data transmission system relies on a low-power satellite channel for the communications link to local stations. There are a number of protocols, modulation methods, transmission speeds and transmission carriers that could be used.

Other networks and communications companies have chosen one or more of these methods to meet their respective needs. Based on the projected traffic requirements of the Brookmont system, a 1,200-baud system was selected as optimum. Because Brookmont uses single-channel-per-carrier (SCPC) program

Continued on page 74



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CHATTANOOGA	NOT AVBL					
KNOXVILLE	MOCLDY	60	87	NE5	30.05R	
TRI CITIES	DRZL	53	86	NE6	30.04R	

Figure 2. Each National Weather Service transmission is preceded with a unique header. Contained within this header is the code used by the Brookmont computer to either select the message for transmission to affiliates, or bypass the entire message.

Continued from page 71

transmission, the throughput satellite carrier power, channel bandwidth and modulation scheme were optimized for a low-power data channel.

This design allowed low-cost SCPC receivers and 3.3m satellite terminals to be installed at each station. The communication link relies on a 10dBW 25kHz channel, frequency-modulated with a 1,200-baud FSK datastream.

Some networks use SCPC subcarriers with the data transmitted above or below the modulated audio or video. Sometimes unused horizontal lines within the vertical blanking interval on a video carrier are used. PBS inserts 9,600-baud datastreams in this manner. The major radio networks employing time domain multiplex (TDM) audio transmission reserve a 32kbps channel within the satellite carrier for data. This scheme provides up to three 9,600-baud data channels.

The station equipment

The functions that take place at the affiliate station include data reception from the satellite, demodulation and electronic storage or message printing. For the Brookmont system, each affiliate is equipped with a satellite receive terminal including a 3.3m parabolic dish, LNA, downconverter and SCPC program channel demodulator. An FM receiver is used to capture the data channel and deliver the demodulated 1,200-baud FSK datastream to its output. The data decoder consists of a modem, microprocessor and DIP switch assembly (which determines the station's *address*). The decoder determines if the incoming message is intended for the particular station. If the station's address code is contained within the message header, the data is routed to a printer. Station personnel can then monitor messages on a regular basis.

Weather information

In order to capture the weather information for affiliates in all three states, additional computers are being installed in Kentucky and South Carolina. These computers will receive the weather data from their respective NWS centers, select the desired products and transmit the information on a time-shared basis with the main origination system in Nashville. The Nashville computer will act as a monitor and control access to the satellite data channel.

How it works

The block diagram in Figure 1 shows some of the major components of Brookmont's message origination system. The

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The center computer acts as the master controller for the local area network (LAN) system. The terminal on the right can be used to prepare messages and other distributed tasks.

heart of the system is a microcomputer equipped with a 63Mb hard disk, 10 serial ports, a parallel printer port and a multi-user, multitasking operating system.

Terminals are located in several departments for word processing, log preparation, operations and accounting. The computer is also configured to receive input from external sources such as the National Weather Service, other wire services, dial-in modems or other computer services. An RS-232 serial output port on the computer feeds a 1,200-baud Bell 202 compatible modem. The modem generates an asynchronous FSK signal feeding the input of a data-channel modulator. The modulator is incorporated into the satellite transmission system consisting of program channel modulators, upconverters, amplifier (HPA) and satellite transmitting antenna.

The major software components of the origination system include the operating system, a program for receiving and storing weather information, a program to transmit messages over the satellite in packet form, a program to send text files prepared with the word processor and the word-processing program.

The software handles the tasks of examining data, formatting messages, looking up codes and transmitting data packets. The process centers on the concept of byte-for-byte examination of the ASCII format digital bitstream and the writing of data packets according to program-specified rules.

Figure 2 is an example of a message from the NWS in Nashville. Each message is first scanned to find the header information. Then a decision is made about what happens next. In this case, MEMHRRTN is interpreted to mean that the message is a Tennessee zone hourly weather roundup originating from the Nashville forecast center. The program then examines a table to see if this header code is desired by any stations in the network. If so, the message is stored on disk in a text file for later transmission over the satellite.

The computer programs that receive the NWS messages, write word-processing text files and send messages to the satellite, communicate with each other by means of queues. Queues are analogous to an interoffice mail system with messages for workers in in-boxes and out-boxes.

:DEL: :DEL: :SOH:
:ADDRESS CODE: :STX:
:MESSAGE TEXT: :ETB OR ETX:
:BCC:

Figure 3. *The transmitted data packets are constructed from special blocks of information. Each data packet must contain the address code for proper reception at affiliates.*

After the weather program writes weather information to a disk file, it sends a message to the output program via a queue indicating that a message is ready to be transmitted.

In addition, the output program can be instructed to transmit files prepared by the word processor to the stations specified by the operator. The operator can designate that a message be sent to a named group of stations as well. Stations that want sports scores could be listed in

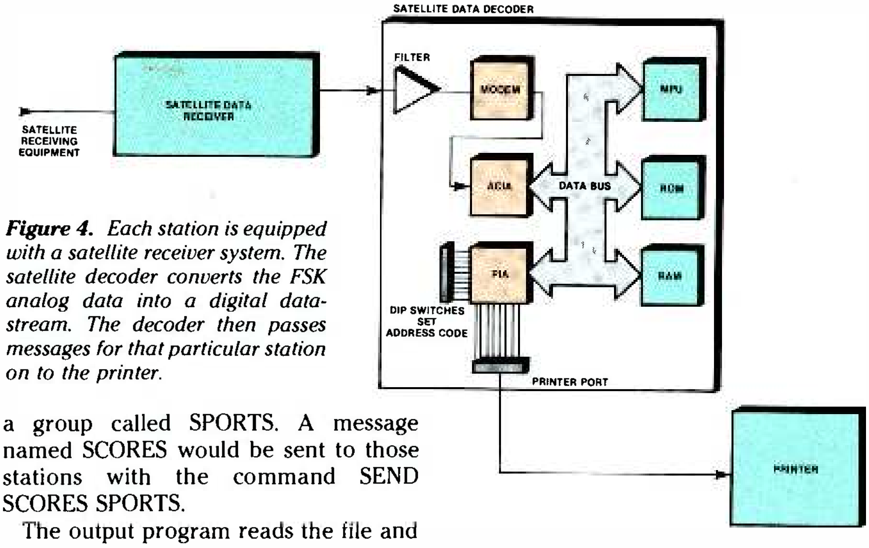

Figure 4. Each station is equipped with a satellite receiver system. The satellite decoder converts the FSK analog data into a digital datastream. The decoder then passes messages for that particular station on to the printer.

a group called SPORTS. A message named SCORES would be sent to those stations with the command SEND SCORES SPORTS.

The output program reads the file and determines what stations are to receive the file. It then prepares a header containing the unique station address codes for each station destined to receive the message. Blocks of data are finally transmitted, which include both header information and text. The generalized format of the message packet format is shown in Figure 3.

Packet construction

Each packet consists of several blocks of data, with each block up to 1,024 bytes long. Each block begins with two delete characters (DEL), a start of header character (SOH), followed by bytes of data representing the station addresses. The addressing information is followed by a start of text (STX) character, bytes of data, and end of block (ETB) or end of text (ETX) byte, followed by a block-check character (BCC).

Because the data are transmitted in a unidirectional manner, no error detection is possible. Therefore, an error-detection strategy is employed. The error-detection process involves performing a mathematical analysis on the data block according to certain rules. This analysis produces a unique number or numbers representing the previously transmitted data. These numbers are transmitted as the block-check characters.

In the station decoder microprocessor, a similar calculation is made on the incoming data. If the block check numbers do not match, a transmission error is assumed. A question mark then precedes each line of text on the station's printer. This question mark tells the operator that the data being printed contains an error. If the information is important, the operator can call headquarters and ask for retransmission.

A block diagram of the functions performed by the station reception and decoding equipment is shown in Figure 4. An SCPC data-channel receiver is connected to the output of the satellite reception equipment. This equipment includes an antenna, LNA and downconverter. The output of the receiver consists of an FSK 1,200-baud signal that is fed to the data decoder.

The data decoder includes a modem for converting the FSK signal into a serial 8-bit datastream. This datastream is coupled to a 6809 microprocessor through an asynchronous communications adapter.

The microprocessor program is stored in read-only memory (ROM). These instructions include rules for examining the data to see if the addressing information corresponds to the station address code. The station's address code is determined by the settings on the internal DIP switches of the decoder. If the heading address matches the station address, the data is buffered and transmitted through a parallel interface adapter to the parallel printer port on the decoder. The station printer connects to this port.

Future services

Networks may offer expanded electronic mail services to their affiliates in the near future. Public TV stations have come a long way in not only providing member stations a means of receiving large amounts of information from the network, but in helping them access, store, sort, edit and print the information. NPR stations receive timely information on public radio programs, schedules and issues. And some stations use personal computers to make the large amount of information sent over the NPR data communications system more useful for their local requirements. Stations are even planning to use personal computers to share information through bulletin boards and on-line databases.

Brookmont's data service demonstrates how today's readily available technology can assist affiliates in providing needed public services to their audiences. Offering stations important National Weather Service forecasts, bulletins and flood and tornado warnings is only a start, but a worthwhile one.

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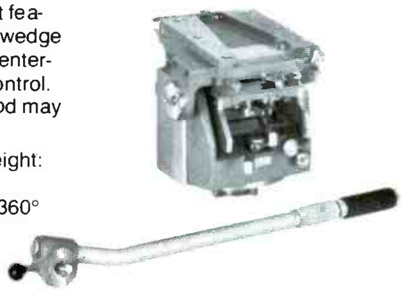

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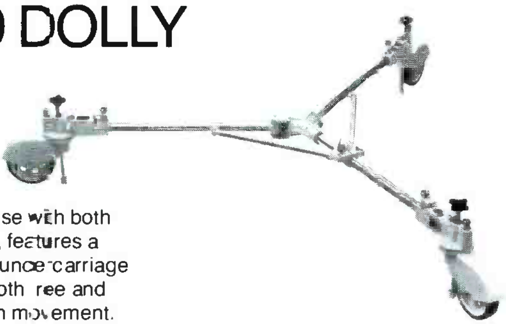

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AM improvement update

By Michael C. Rau

A number of projects are under way to improve the quality of AM broadcasting.

In October 1984, NAB's AM improvement subcommittee published a report listing eight recommendations to improve the technical quality of AM transmission and reception. During 1985, the subcommittee was occupied with implementing the report's principal recommendations one by one.

We witnessed the reactivation of the National Radio System Committee (NRSC). The joint committee, consisting of technical representatives of broadcasters and AM receiver manufacturers, is charged with developing pre-emphasis and de-emphasis standards.

Last year also saw the decision to develop two new technology AM antenna designs. If either of the designs proves successful, groundwave coverage would be enhanced while skywave would be reduced in certain chosen directions. With the completion of the NAB technical reference center, broadcast engineers can easily obtain valuable information on improving the AM broadcast signal.

Even the FCC recognized the need to improve the technical quality of the AM signal. Speaking before the IEEE, James C. McKinney, mass media bureau chief, noted the FCC's wish to improve AM broadcasting. He further pledged to produce an AM improvement report together with companion rulemaking proceedings, if necessary, to implement the report's conclusions.

With so many of these projects on a fast track, and a lot of activity taking place behind the scenes, there simply has not been enough time to keep everyone informed. This article updates NAB's effort to improve AM and, especially, explores the principal thinking behind two major AM improvement issues: pre-emphasis/de-emphasis standards and new technology AM antennas.

Rau is staff engineer at NAB, Washington, DC.

Pre-emphasis/de-emphasis standards

In October 1984, the AM improvement report declined to recommend establishing an AM pre-emphasis/de-emphasis standard. The main reason given was the nature of individual stations to choose their own degree of pre-emphasis. Engineers and program directors have traditionally tuned their stations to sound the way they want by listening on their own chosen radios. But in 1985, the AM improvement subcommittee met with representatives of AM receiver manufacturers under the auspices of the NRSC.

Following several initial meetings of the NRSC, the subcommittee came to believe that a *voluntary* pre-emphasis standard could be successful—but only if implemented *together* with a de-emphasis standard for AM radio receivers. As receivers incorporating the new standard become available, over a period of time broadcasters would have an incentive to pre-emphasize according

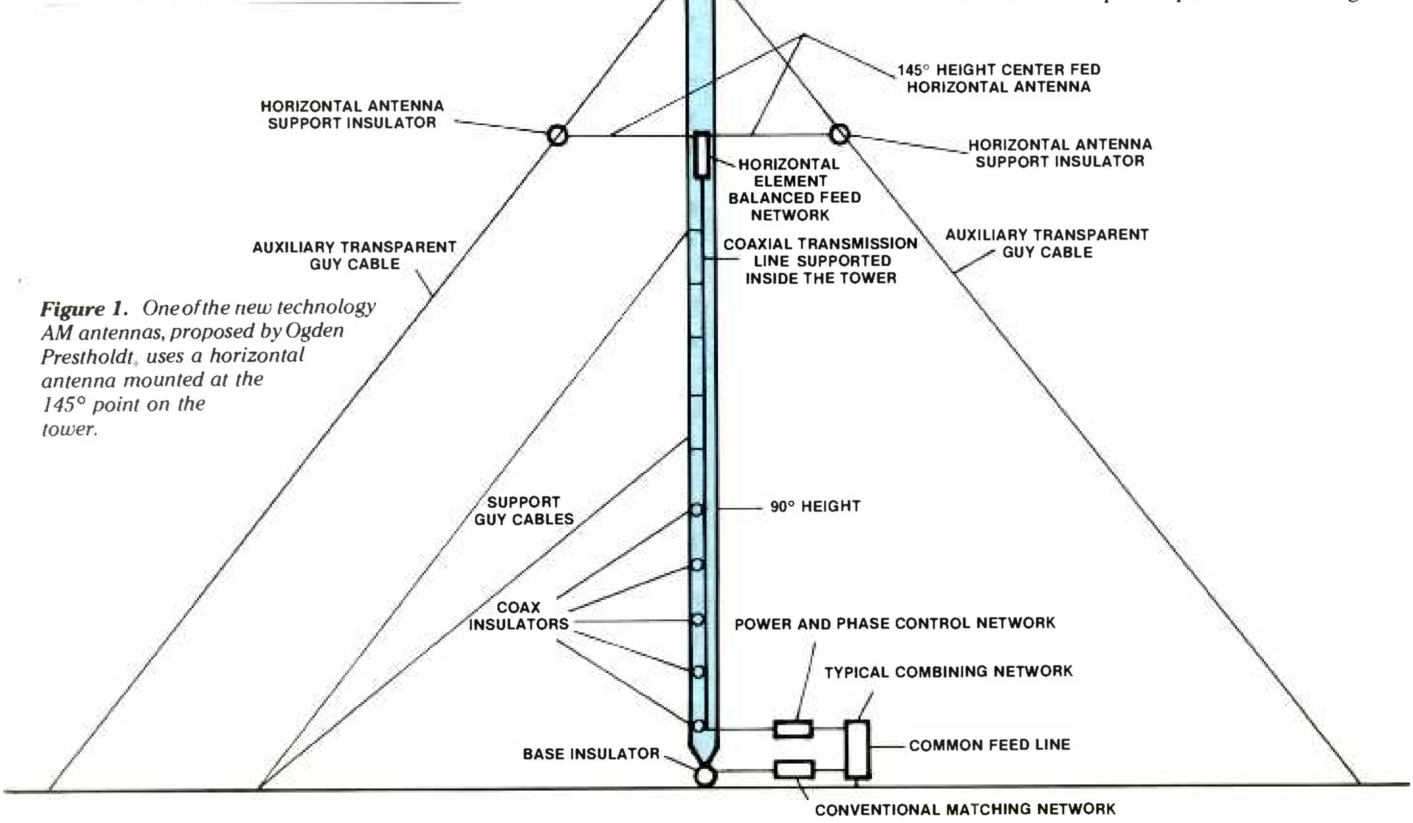

Figure 1. *One of the new technology AM antennas, proposed by Ogden Prestholdt, uses a horizontal antenna mounted at the 145° point on the tower.*

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to the voluntary pre-emphasis standard. It is this approach—a *package* standards proposal—that NRSC has taken.

It has turned out to be difficult to define with precision the nature, shape and subjective characteristics of a pre-emphasis/de-emphasis standards package that will withstand critical review. Because the standards package is strictly voluntary, each standard must be supported by rational, substantive technical analysis. Without such support, there would be little reason for stations to conform with the standard because it would appear as if the standard was issued by fiat rather than as a result of rational study.

Simply put, the greater the technical support for the standard, the less reason there is for stations to not follow it. This need for technical support requires the NRSC to ask some very tough questions, and then to search for answers.

Interference levels

The first question explores the real-world nature of AM service and interference. After the NRSC formed a subgroup to study these issues, the subcommittee prepared a memorandum that summarized the various classes of AM stations, power levels, FCC allocation criteria and applicable technical standards. During the day, an AM receiver sees desired signal levels as low as 0.5mV/m (for most stations) or 0.1mV/m (for Class I clear-channel stations). These signals receive 26dB protection from interfering signals on the same channel. At first adjacent frequencies, ±10kHz, overlap of the 0.5mV/m contour is prohibited (0dB protection). For stations spaced 20kHz apart, any overlap of the 2mV/m and 25mV/m contours is prohibited.

After careful consideration, the subgroup discovered that it is the second adjacent channel technical standard that really determines the required shape of a pre-emphasis/de-emphasis curve. The reason stems from the *channel* bandwidth of an AM station, 10kHz, compared to its *occupied* bandwidth, 20kHz to 30kHz. Stations spaced 20kHz apart are subject to the second adjacent channel technical standards and have sidebands that overlap in the first adjacent channel.

If either station is modulated with audio frequencies higher than 10kHz, interference might be caused to a wideband AM receiver tuned to one of the desired stations. The second adjacent signal can be considerably stronger than permitted by the 0dB first adjacent protection requirement. The bandwidth of the AM receiver determines the extent to which sideband overlap will cause in-

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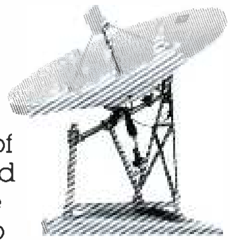
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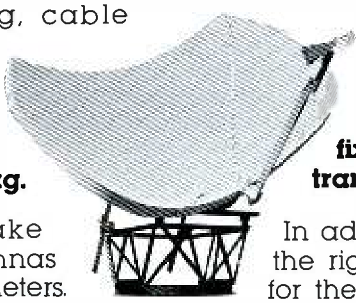
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terference. A narrow receiver, like many in use today, ignores the overlap. A wideband receiver, with the NRSC de-emphasis standard, will receive interference if its response extends above 10kHz.

Accordingly, in attempting to discover the proper nature of a de-emphasis curve, the NRSC must consider the extent that sideband overlap actually occurs. If it frequently occurs, a sharper cut-off (narrower) de-emphasis standard would be appropriate. If it occurs less often, a wider de-emphasis standard is warranted.

For these reasons, the NRSC is scheduled to conduct a technical study to explore how often the second adjacent contour overlap actually occurs. The results will help determine the appropriate shape for a de-emphasis curve.

Signal strength

Another tough question is whether AM listeners really expect quality AM reception even at low signal strengths. Receiver manufacturers argue that a listener expects to receive the desired AM station almost anywhere the signal can be recovered. Consequently, the passband of receivers is kept narrow to aid interference-free reception in low signal-high interference environments.

Broadcasters, on the other hand, often do not expect to serve listeners in fringe areas, at least not in areas beyond their FCC-protected service contour. The stronger the signal level of desired service, within the FCC-protected contours, the wider the AM receiver's bandwidth can be without receiving interference. Accordingly, a study detailing the relationship between AM listening and AM signal strength will help the NRSC determine whether accommodating fringe listeners is worth the bandwidth/quality tradeoffs. The study is currently under way and the results will be made available as soon as possible.

New technology AM antennas

One of the more exciting projects is the development of a new technology AM antenna. If successful, the new antenna will reduce skywave and increase groundwave signals. There is no guarantee of success. The antennas have never been built and the designs exist only on paper. However, because of the large potential benefit to AM broadcasting, a field test of these designs is worthwhile.

It appears that the technology of AM antennas—the applicable physics—has not been given a serious look since the 1920s and 1930s. With modern computers and an interest on the part of the engineers who have proposed these designs, we are now able to re-examine basic antenna theory with the specific objective of minimizing skywave and maximizing groundwave. The goal is to develop a usable antenna that is groundwave-intensive and has a minimal, or at least steerable, skywave signal.

Two antenna designs are being considered. One design has been submitted by Ogden Prestholdt, A.D. Ring and Associates, P.C., Washington, DC, and the other by Richard Biby, Communications Engineering Services, Rosslyn, VA.

The Prestholdt design uses a combination of vertical, horizontal and diagonal antenna elements to obtain significant separate control over the groundwave and skywave radiation. The Biby design is somewhat different. It uses a number of short vertical radiators (approximately 1/30 of a wavelength) and a circular

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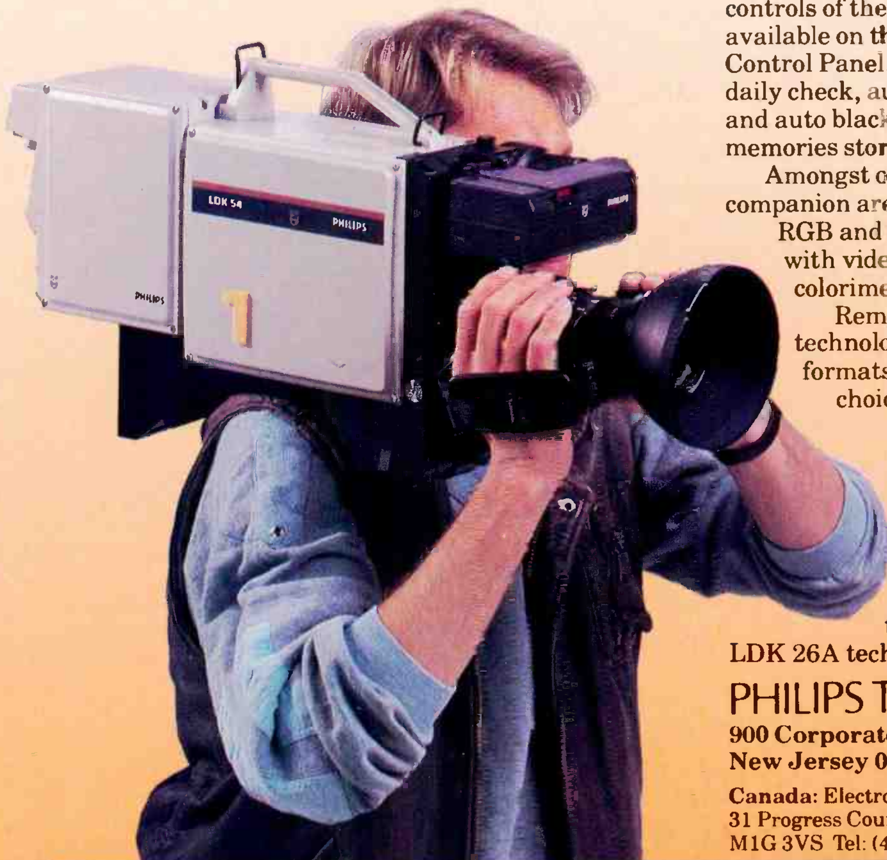

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electric screen located ¼-wavelength away from the antenna.

Both antenna designs are similar in that they employ additional loaded structures to achieve cancellation of skywave while increasing, or at least not affecting, groundwave. The technical details of these designs are beyond the scope of this article. However, any interested engineer may obtain them by calling NAB's Science and Technology Department at 202-429-5346. Ask for the new technology AM antenna papers.

The prototype antennas will be built at a location near Washington, DC, with an expected operating frequency of 1,650kHz. Once constructed, a thorough proof-of-performance will be conducted. These tests will comprehensively document the groundwave and skywave radiation characteristics of the new antenna. The skywave tests will be announced in advance and any interested engineer is welcome to participate at that time.

Other issues

Although the hottest issues now are the NRSC's activities and the antenna project, the NAB is also addressing other issues. Foremost of these is the difficult issue of electrical interference and RF lighting devices.

In October 1985, an AM improvement technical study on RF lighting devices was submitted to the FCC in support of an NAB petition for reconsideration of an earlier FCC decision. NAB asked the commission to adopt interim technical standards to prevent additional electrical interference from the widespread use of RF lighting devices.

Presently, the FCC is considering NAB's request. Several additional FCC regulatory proceedings on electrical interference to AM reception should take place this year. Also, the FCC's AM improvement report may address electrical interference as a subject for future rulemaking proceedings.

In addition, the subcommittee is sponsoring a series of demonstrations of wideband AM stereo radios. NAB is not demonstrating AM stereo as much as demonstrating the reception quality obtained by wideband AM receivers. As many engineers are aware, listening to high-fidelity AM reception can be a remarkable experience—AM sounds great. The subcommittee has presented the demonstrations to assorted NAB committees, principally composed of managers and owners, in order to call attention to the quality potential of AM broadcasting. These demonstrations have generally been successful. The more people who hear quality AM, the more support we generate for AM technical improvements.

This is just a brief summary of the current conditions regarding AM improvement. In 1985, considerable progress was made toward the goals and objectives outlined in the original AM improvement report.

This year should result in more success toward implementing those objectives. The FCC may continue to advocate changes that will benefit the AM broadcast service. The NRSC should complete its work on the pre-emphasis/deemphasis standards. And the new AM antennas should be close to the testing stage.

Combined, these efforts may revolutionize AM broadcasting as we now know it. The intent is to help make the service viable and successful—just as it once was.

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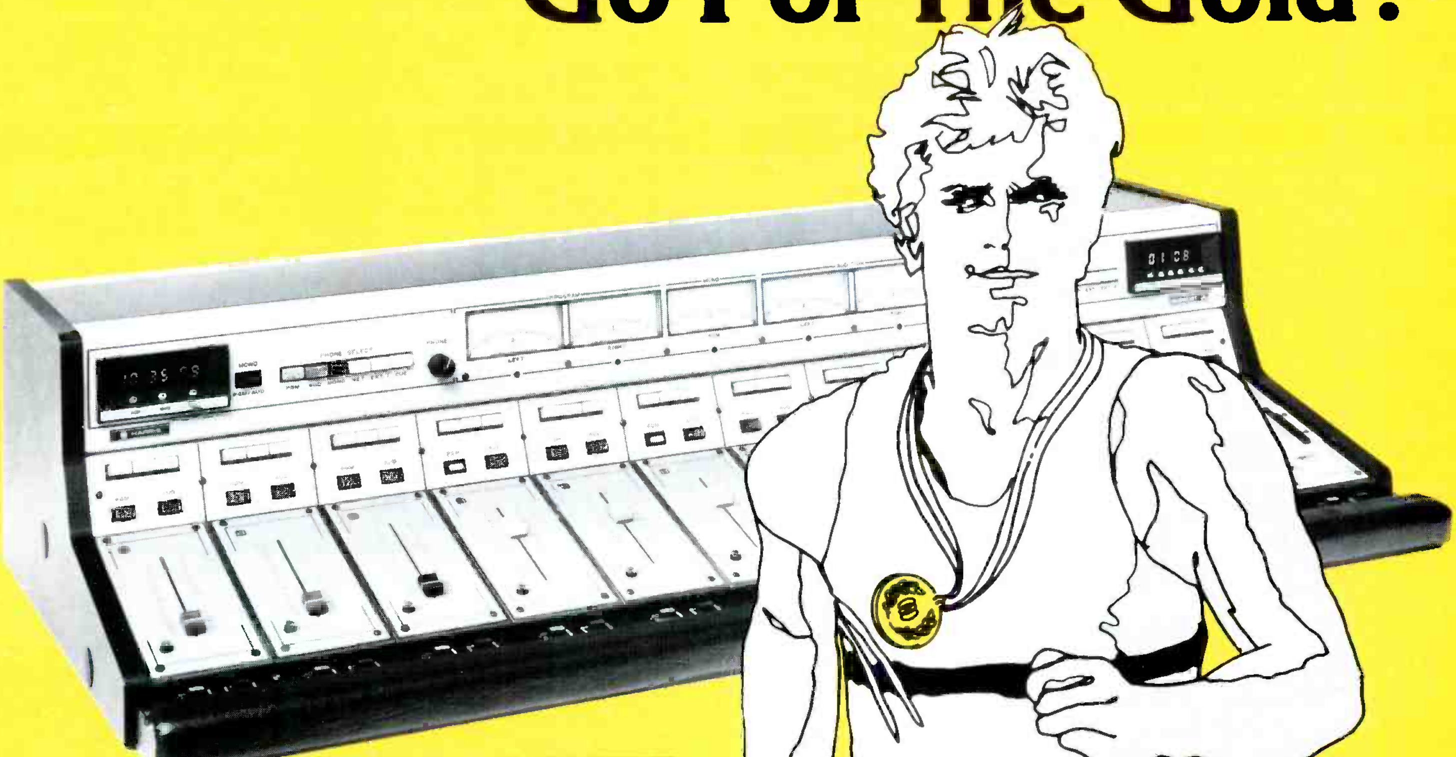

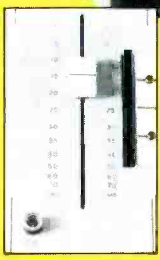

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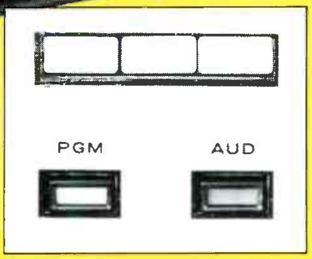

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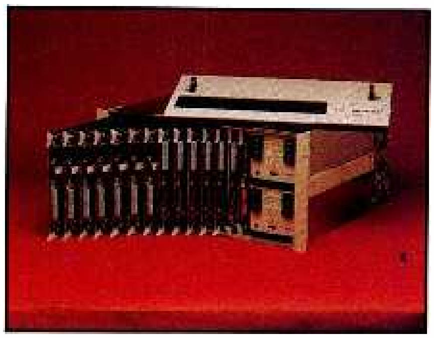
Bosch TVS/TAS-2000 routing switcher

By Richard Lehtinen



When we designed KSL's broadcast house, we had a once-in-a-lifetime opportunity to create a TV station from the ground up. We had a new building, would be expanding from two studios to three and would begin stereo transmission. The expansion required a lot of new hardware, including a new routing switcher. We selected the Bosch TVS-2000.

The unit was selected for two reasons. First, the switcher provided the features we wanted. Second, we had worked with Bosch before. This switcher would replace the TVS-1000 we had used in our old building, and we felt good about the new switcher's reliability.

There were several design strategies we wanted to incorporate into our station because we felt they would improve our position in the market as well as increase efficiency and profitability. The TVS-2000 helped us implement these strategies.

Inside the router

The TVS/TAS-2000 is built from standard rack frames, each 8¾ inches high. The number of frames required for the system is determined by the size of the matrix and the number of switching levels. Each frame has two detachable cooling fans, which can be serviced without interrupting power to the switcher. A pull-away front panel holds a removable air filter. Behind this panel are the switching cards. These cards mount to the motherboard with low insertion-force pin-and-socket connectors instead of the usual edge connectors. To the right of the cards are two identical power supplies. One supply can power the entire frame. Should the first supply fail, the changeover to the backup supply is automatic.

Connections to and from the router are made on the back panels. BNC connectors are used for video and push-in screw-lock connectors for audio (no spade lugs are required). The arrangement of the cards within the frames is determined by the size of the matrix. If signals must be passed up or down to other frames, high-reliability SMB connectors are used for video and ribbon connectors for audio. A large system may require a fair amount of daisy-chaining. In such cases, the company prefers to install the entire switcher into customer-specified equipment racks, and then test and ship the switcher as an assembled unit. Installation at the station is simple.

Performance at a glance

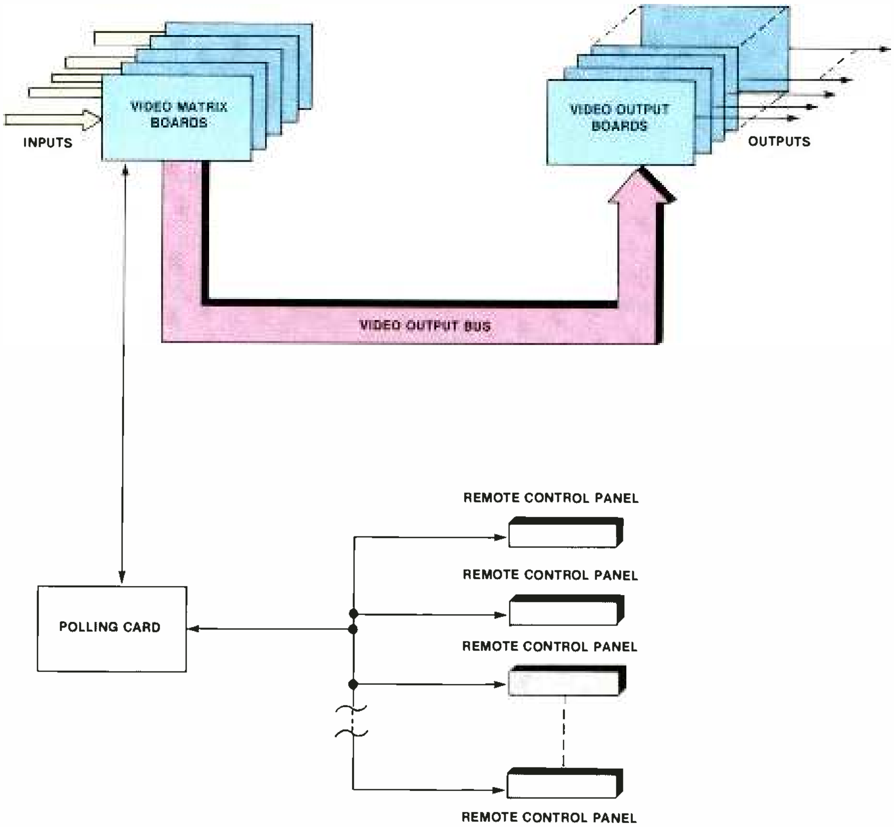
- *Broad range of user-configurable control panels*
- *Redundant control-card capability*
- *Coax party line or RS-422 control standard*
- *Vertical interval switching of video*
- *Clamped video inputs*
- *Output delay trim*
- *Field expansion of outputs without rewire*
- *Optional full-matrix status monitoring*

Switching cards

Like the power supplies, the cards in the TVS-2000 also are interchangeable within their species. DIP switches on the card determine where it fits within the system.

All matrix cards have 10 inputs and 10 outputs, providing 100 crosspoints. Audio crosspoints use CMOS analog switches; video crosspoints use an arrangement of diode gates and shunts specially configured to eliminate crosstalk. Matrix cards receive their con-

Figure 1. *The design of the TVS-2000 allows modular expansion and versatile remote-control operation.*



Lehtinen is studio engineer for KSL-TV, Salt Lake City.

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All adjustments can be made from outside the shroud. You have easy access to the tally light switch, back focus adjustment/lock, circuit breakers, and pattern projector level and chart adjustments. Data such as focal length and aperture is reported through viewports in the lens shroud. You can see if the 2X extender is deployed or not. And you can double the range from a remote demand unit, shot box or manually from the lens itself.

The 44X maintains its maximum relative aperture out to a 26X zoom and ramping can be avoided completely! You can limit the zoom range to match lighting levels for every production. And zoom speed control is smooth and steady regardless of zoom rate or camera angle.

The 44X also gives you Fujinon's traditionally better optical performance—higher MTF, better edge-to-edge resolution, freedom from flare, ghosting, distortion, absence of detectable longitudinal chromatic aberration, greater contrast and brightness.

All major components, such as the power supply and pattern projector, are modular. With motherboard construction and no wiring harnesses, trouble-shooting is simplified and field servicing is a practical reality.

Optically, electronically, electro-mechanically . . . in terms of performance, range, operation, setup and servicing, the new 44X offers advantages you can't get in any other field lens. Call your nearest Fujinon location for more information or a demonstration.

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F2.4 (18–470mm); F4.1 (800mm)

R44 X 13.5ESM
13.5–600mm (27–1200mm)
F1.8 (13.5–350mm); F3.1 (600mm)
Minimum Object Distance: 2.5m
Weight 25kg

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trol signals from an RS-422 bus. The bus is balanced, which suppresses crosstalk from control voltages into signal paths. The crosspoint outputs connect to bus drivers, also located on the matrix cards. The outputs are then gated and buffered prior to being coupled to the output cards.

Output cards

The output cards are fed by output bus drivers on the matrix cards. Each output card has 10 separate outputs. The video output cards then drive two lines with trimming controls for video gain, frequency response and delay. Audio output cards provide a balanced feed capable of driving a 600Ω load at +24dBm. The outputs are short circuit protected against both line-to-line and line-to-ground shorts.

Control polling cards

The control or *polling* cards handle communications between the switcher mainframe and the control panels. The control cards constantly poll the various panels to see if any buttons have been pushed and monitor the replies. The datastream travels down a bidirectional coaxial cable network called the *party line*. The polling cards also periodically send updated crosspoint status information out to the panels, for user display.

Custom machine control panels

A major design problem centered on how to control 20 or so tape machines and two film chains from any control room in the plant. It was apparent that our old method of running multiconductor cable to remote control panels in each control room wouldn't work. The tape machines are not all the same; therefore, the controls are different. Delegating control to one of several control rooms was cumbersome. Besides, we didn't want to clutter up the control room consoles. We needed a tape machine control system that would follow the routing switcher, presenting control for the selected machine only at the place needed.

Luckily, the TCS-1 machine control system solved the problem. The control panels were customized to meet our space requirements. Our KSL panels are universal and resemble the operating surface of a videotape recorder. The LED legends above each push-button change to match whatever machine is selected. The dial that shuttles the VPRs becomes the ACR's bin selector.

Smart tally

We also needed a fairly elaborate tally system. KSL serves viewers in seven states, one of the largest geographical ADIs in the country. KSL also provides network delay for two other states. We,


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therefore, needed a tally system that would flag a given tape machine as being *on the air*, even if that machine's output was routed through another control room on its way to the master. Fortunately, a tally system is available with the TVS/TAS-2000.

Ultimate bypass switcher

KSL also uses the TVS-2000 as a bypass switcher by making the input to the STL transmitter routing switcher-addressable. This allows any control room to be switched into the STL if the master control develops a problem. Because all the control rooms have access to the same sources as the master via the router, the switch is easy and glitch-free. This approach is rarely used, however, because there is an easier way. When we want to bypass the master control room, we just route the tape machine feeding the master directly to the STL. The routing command takes place with the press of a button.

Changes

As with any large system, there were a few initial problems that had to be ironed out. A few design changes were made between the time we ordered the switcher and specified the mnemonic PROMs and the time we actually went on the air. These changes came back to haunt us. Installing new PROMs corrected the errors that developed because we changed the original design.

Another problem centered on the type of wire needed for the machine control system. Each controller requires four wires, two twisted pairs. To allow for growth, we specified eight control points instead of the five we currently use. This required that we install 32-conductor cable. The cable seemed bulky and inconvenient at the time. However, in retrospect, it's clear that there was no simpler way to do it. Besides, nothing is as quiet and trouble-free as a straight piece of wire.

When we first connected our VPRs to the machine control system, the machine's reels took off like scared rabbits. The machines began to shuttle tape madly one way then the other and sometimes right off the reel. After a few tense moments, the problem was traced to a jumper inside the machines. Our VPRs had been jumpered to enter the shuttle mode when they detected movement of the shuttle pot. Unfortunately, the machines were just as obedient to the remote panels. If the knob on the remote control panel was anywhere except in *detent* when the panel acquired control, off they went. The jumper was changed so that an operator must press the shuttle button before the control became active. This solved the problem.

The switcher has experienced few problems. One or two crosspoints failed, but they were quickly repaired by exchanging a card. We keep a spare card on hand, but rarely use it.

Most of our problems centered on new users becoming familiar with the new router. As the users and their routers became familiar, the complaints quickly tapered off.

All in all, the TVS/TAS-2000 has performed admirably during its first two years. Our sister station, KSL-AM, purchased an audio-only version at the same time we bought ours and they report similar positive results.

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

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

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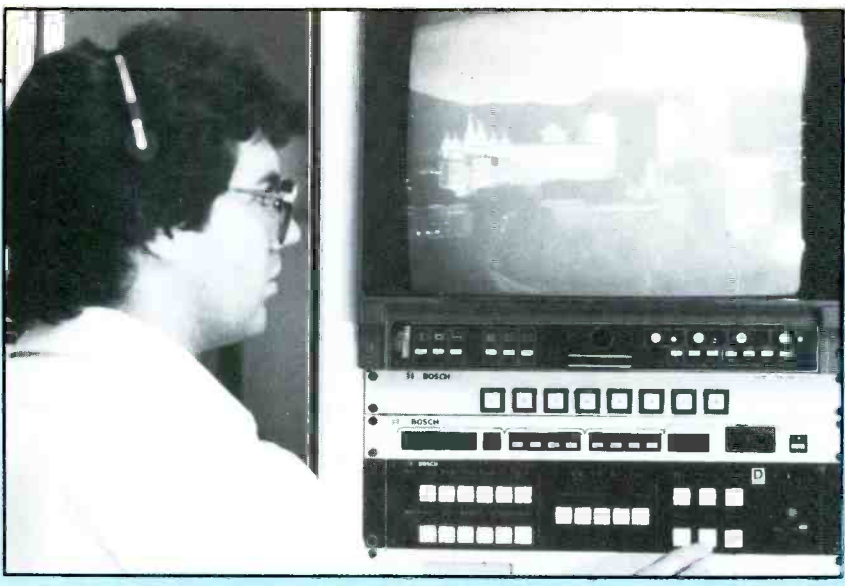


Photos by Lou Stuart

The custom control panels in the VTR room allow tape operator Tom Cook to select sources and control the VTRs from centralized locations. It is not necessary for him to run from machine to machine to make changes.

Shared equipment

At KSL, all videotape machines are located in one area and their outputs are fed to the various control room switchers via the routing switcher. Previously, each editing suite had its own dedicated VTRs. Unfortunately, if machine troubles developed, the suite had to be closed while repairs were made. With all the tape machines now located in one place, a control room or editing suite never has to be closed just because a tape machine is acting up. If a machine fails, the tape reels are moved to another unit and production continues.

By placing the inputs and outputs to the digital-effects system, the graphics computer, and the still-store system on the routing switcher, we can now access all of them from any control room. Because all mix/effect buses are available through the router, a bus can be isolated for keying or special effects without tying up the remainder of a control room. Each of the studio cameras is also available through the router. Therefore, it's not necessary to tie up a whole switcher simply to get 1-camera product shots. With the router, we can isolate the camera directly to the tape machine. Because the router makes all sources available everywhere, we also gain the ability to shift control of a production from one booth to another.

Soft switcher advantages

The new generation of switchers is built on the concept that a switcher is essentially an expanded routing switcher control panel. This integration of router and switcher makes every source in the router matrix *available to the switcher. We wanted switchers like this for our new facility. However, because these switchers were only available in master control configurations when we did our shopping, we selected the next option.*

There is no rule that says inputs to a production switcher must be hard-wired to the device. The production switcher will work just fine if the inputs come from a router instead of a VTR, as long as the timing is correct. This marriage of router and switcher provides cost advantages and can increase production capabilities.

With this design, you can use a smaller switcher. Because the router makes all the sources available, there is no need for a large number of switcher inputs. Under this concept, the switcher's power becomes a function of the number of mix/effects buses and the versatility of the keyers, not the length of the bus.

Combining a soft switcher with a pooled VTR room also results in cost savings. Instead of nailing down four or five tape machines in a given suite, the technical directors can select the machines they want from the central pool. This is cost-effective because if a given production needs only two tape machines, it uses only two tape machines. The other tape machines are available for other uses: making dub reels, on-air playback or net delay recording.

In addition to increasing machine productivity, the soft-switcher concept is an asset for maintenance people. All the machines that are working properly are available for use. Machines requiring maintenance are available for repair without having to interrupt editing sessions or distract clients. Keeping all the equipment in one place also helps keep the engineers and operators where the action is, instead of being spread out all over the plant.

External keys

Although we saw many advantages to this design approach, we couldn't completely adopt it. In the first place, it was not possible to just wire a routing switcher output to each production switcher input. Different switchers have different ways of handling external key sources, and sometimes the keys have to reside at certain positions on the keyboard. We wanted the layout of all our switchers to be the same because it makes it easier for the technical directors to change from room to room. To keep everything as closely matched as possible, we compromised at five routing switcher inputs per control room.

Sources that are normally used only at a given switcher, such as network to master and ENG receiving lines to news, are hardwired. These dedicated sources still appear on the routing switcher in case we have to shift control rooms in an emergency. This compromise provides the advantages of the soft switcher concept, preserves the capability of external keys, and also protects us from unlikely, but potentially devastating, routing switcher failures.

System timing

During the design of our facility, there was much debate about whether or not zero timing would work. Chief engineer Talmage Ball decided that it would, and we implemented it. Our success did nothing to quell the debate. Even after the project was finished and on the air, Ball still received letters telling him it would not work. Nevertheless, with proper attention to cable length and the judicious use of frame synchronizers, some of it routing switcher-addressable, zero timing is possible. In some rare cases, a 1-line delay is generated. But the keyers key, the faders fade and the transitions are smooth and roll-free, no matter what path a signal takes on its way through the plant. BE

The M-II format

By Philip Livingston

The success of small format analog component video recorders, Betacam and M, is well known. Both evolved from existing mass production consumer tape cassette and .transport mechanisms coupled with known electronic technology to produce high-performance and cost-effective systems. M format, using the bandwidth-limited I and Q chroma components, was uniquely oriented to the NTSC system. This is partly because its development began in 1978, prior to the bulk of the EBU and SMPTE work in component technology standards.

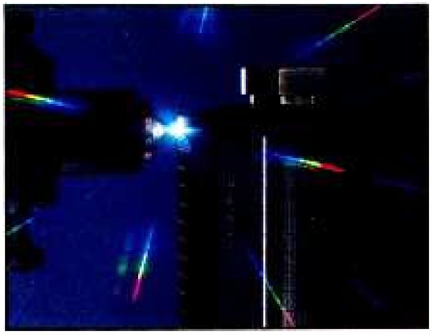
The Sony Betacam format originated at approximately the same time, using the equiband R–Y/B–Y approach and took an evolutionary step by introducing a time compression system in the chroma channel, rather than the traditional frequency multiplexing scheme. While the M format wrote I and Q onto the tape simultaneously, but separated in frequency, Betacam wrote R–Y and B–Y through a single channel, but sequentially. By 1979, it had become apparent that the international community, working toward a common standard, would rely heavily on R–Y/B–Y chroma components.

A current limitation of the two systems is program length. Because the linear tape speed was raised to provide writing space for the separate luminance and chrominance tracks and their guard bands, a conventional tape contains about 20 minutes of recorded material. A change in the tape medium to a thinner but sturdier material can increase the time to a more desirable 30 minutes.

Although both systems outperform ¾-inch U format, neither provides video performance that challenges the type C broadcast format, especially in the area of multigeneration degradation. Because the two systems were originally designed for ENG work, their portability, cost/performance ratios and improvements in applied technology are significant.

Editor's note: With this issue, we launch a new column titled "Applied Technology." This column will examine the technical details behind new developments in technology that apply to broadcast products. The first step in weighing the value of a new product is to understand how it works.

Livingston is manager of broadcast engineering and services for Panasonic Industrial, Secaucus, NJ.



M-II is another step in the chain of analog component evolution, resulting from a joint effort of NHK (the Japan Broadcasting Corporation) and Matsushita (the Panasonic parent company). This small format video recording system uses a metal particle tape medium with a somewhat different analog component processing scheme to reach 90 minutes of recording time per cassette with a signal quality rivaling the type C format.

Format footprint

The M-II tape format, shown in Figure 1, is a 2-channel component arrangement in which the component tracks are of equal 38μm (micron) widths. Between them, a narrow 4.25μm guard band is augmented by ±15° opposing head azimuths for the two channels to increase track isolation. Two linear audio channels, a linear time-code track and the traditional control track complete the signal footprint on the ½-inch tape medium.

The linear tape speed of 67.693mm/s (2.665 in/s) allows a 90-minute program length capacity with cassettes comparable in size to existing consumer products. The tape speed (approximately ½ of Beta and ⅓ of M) allows higher relative search and fast-wind speeds, but does not require excessively high absolute linear tape velocities that may place stress on the tape.

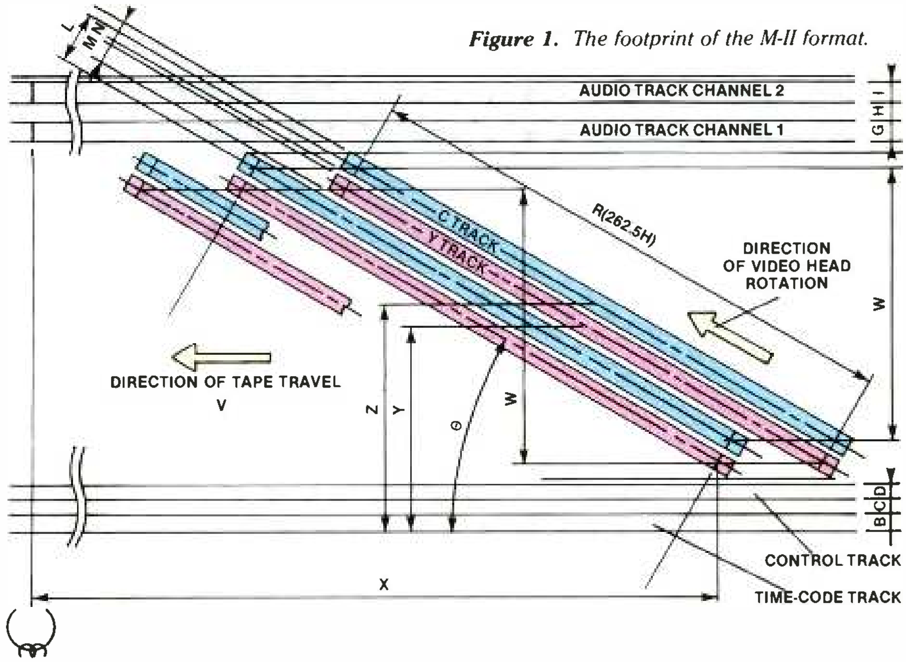


Figure 1. The footprint of the M-II format.

L: VIDEO TRACK PITCH 84.5μm
M: Y TRACK WIDTH 38μm
N: C TRACK WIDTH 38μm
R: VIDEO TRACK LENGTH . 118,254.3μm
W: EFFECTIVE VIDEO WIDTH 8.847.1μm
Y: HEIGHT OF Y TRACK CENTER 6,050μm
Z: HEIGHT OF C TRACK CENTER 6,092.1μm
Ø: VIDEO TRACK INCLINATION ANGLE ....4.2906°
X: CONTROL SIGNAL RECORDING POSITION 202,000μm
B: TIME-CODE TRACK WIDTH . . . 450μm
C: T/C GUARD WIDTH 450μm
D: CONTROL TRACK WIDTH 400μm
G: AUDIO TRACK CHANNEL 1 WIDTH 600μm
H: AUDIO GUARD WIDTH 500μm
I: AUDIO TRACK CHANNEL 2 WIDTH 600μm
V: TAPE TRAVEL SPEED . . . 67.693mm/s
RELATIVE SPEED 7.09mm/s
TAPE WIDTH 12.65mm

Modified multiplexing

In general, the chroma time compression multiplex (CTCM) system operates as shown in Figure 2. R–Y and B–Y color difference signals are compressed to one-half of their real time length through sampling.

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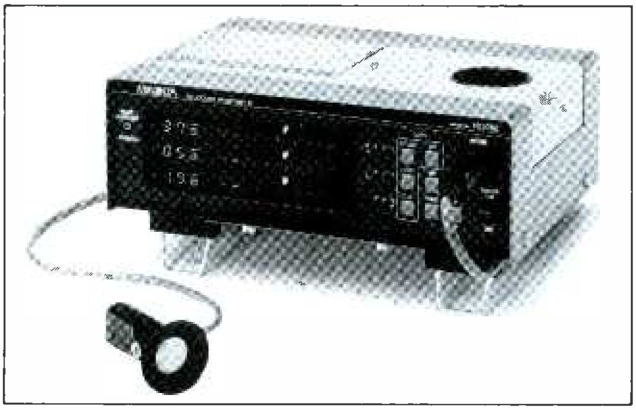

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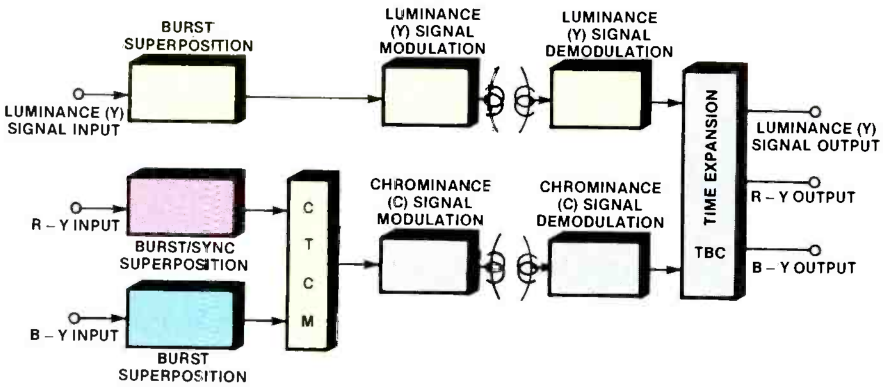

Figure 2. The signal processing system of M-II.

This is possible because the required bandwidth for acceptable chroma components has been recognized to be only 1.5MHz. As a result, the two compressed chroma signals occupy the same amount of time as the luminance signal.

The compression process requires a finite amount of time. Because R – Y and B – Y occur simultaneously in the camera output, the B – Y component is delayed an additional ½-line to allow a sequential arrangement in forming the CTCM chroma signal. The overall result is a delay or offset of the recorded chroma signal by one horizontal line from the luminance signal.

Given the uncertain variations of temperature, time and tension distortions of the tape medium and a differential jitter caused by the time offset and interchange variances, the basic CTCM method may show some instability when a recovered signal is reconstructed or dubbed. In a record-then-play instance, the error may not be obvious. However, following several generations, should the offsets consistently add in an adverse manner during each playback, image degradation will become obvious.

A method of reducing the offset effects is through the use of two time base reference signals in the CTCM system of the M-II format. The back porch of the Y signal and blanking period of the chroma signal are available for insertion of burst references. (See Figure 3.) A horizontally phase-locked 2.25MHz burst is added to the luminance signal Y, while a 1.125MHz burst is added to the R – Y and B – Y signals. Subsequently, when the chroma components are time-compressed, all burst frequencies become 2.25MHz.

Figure 3 shows the relationships between the signals, assuming a split field 75% color bar and 100% white window input. The use of the 2.25MHz burst follows the EBU and SMPTE work on multiplexed analog components, as it works well in either 525- or 625-line TV systems. For example, 144 x f_{H625} = 2.25MHz and 143 x f_{H525} = 2.25MHz.

To further control system variations, a 2μs H-sync pulse is added to the compressed chroma component to form the chroma signal. During recording, the leading edge of H-sync of luminance is coincident with the edge of the H-sync added to the chroma components.

At playback, gross Y/C signal timing may be provided through traditional sync comparator methods. Also, because the bursts were injected or superimposed upon the three components identically, fine timing correction of the components during expansion is possible through existing zero crossing detection techniques.

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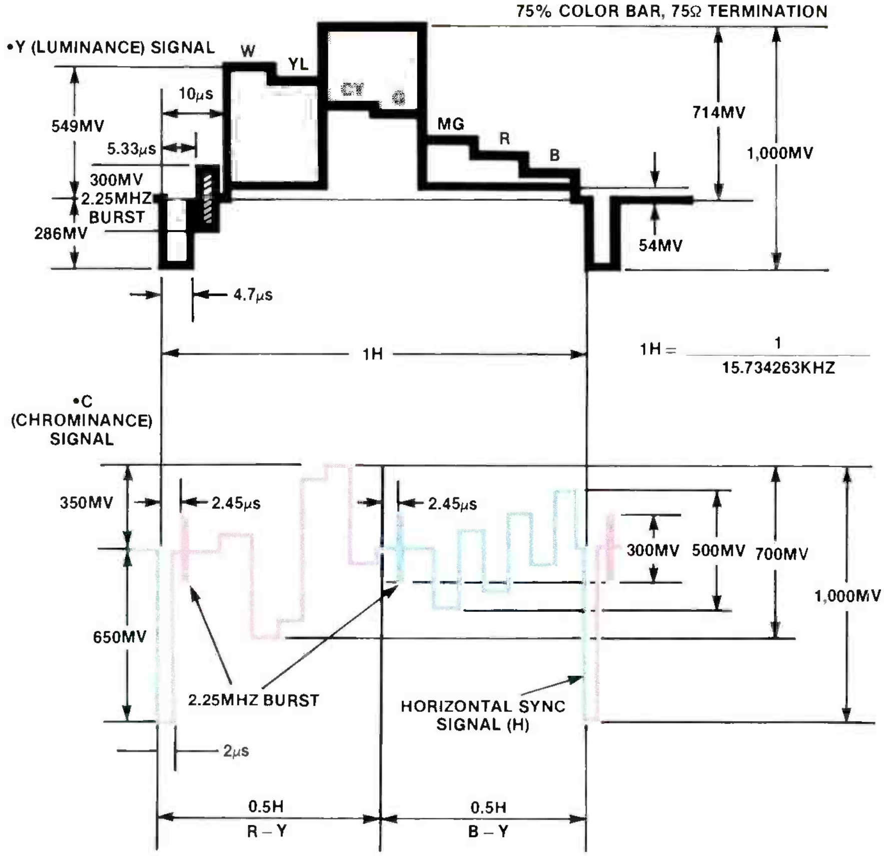

Figure 3. *The relationship between luminance and CTCM components.*

This approach to high-resolution error correction, especially for differential jitter error compensation, overcomes the occasionally troublesome drawback of time axis compression multiplexing methods.

While discussing signal parameters, it is worth noting that the FM carrier frequencies for M-II are slightly higher with wider deviations than in other half-inch systems. Nominal luminance and chrominance values are shown in Table 1. The signal handling technique results in video performance values comparable to C format, as indicated in Table 2.

	Luminance	Chrominance
Sync Tip	4.9MHz	4.2MHz
Blanking	5.5MHz	5.5MHz
Negative peak	....	4.8MHz
Positive peaks	....	6.2MHz
Peak white	7.0MHz	....

Table 1. *M-II FM carrier frequencies.*

IMAGINE WHAT YOU'LL FIND INSIDE

We've opened up the SP-3A to let you have a look inside this remarkable camera. Then maybe you'll understand why we can aim this camera directly at the sun . . . and still get the shot without burn or comet tail. It's because of what's inside: CCD chips instead of tubes.

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BANDWIDTH:	
LUMINANCE	30HZ-4.5MHZ +0.5/−3DB
CHROMA (R−Y/B−Y)	30HZ-1.5MHZ +0.5/+3DB
S/N RATIO:	
LUMINANCE	49DB
CHROMA (AM OR PM)	>50DB
DIFF GAIN/PHASE	<2%/2°
K FACTOR	<2%
Y/C DELAY	<20NS

Table 2. *M-II performance specifications.*

AUDIO RESPONSE	50HZ-50KHZ +1.5/−3DB
S/N RATIO*	>56DB
DYNAMIC RANGE	....
DISTORTION	<1.0%
CROSSTALK	50DB
WOW/FLUTTER (RMS)	<0.1%

*REF. 3% DISTORTION, WITHOUT NOISE REDUCTION

Table 3. *Audio channel specifications.*

Magic medium

Without a higher-density recording medium, the developments that have been described would not have been possible. Working under the sponsorship of NHK with the M-II research team, Fuji Photo Film has perfected a metal particle magnetic tape that began with earlier research into smaller format, higher-density recording systems. The tape speed, the video signal performance and the benefits of the modified CTCM system all were attainable only when a metal tape replaced the conventional enhanced ferric oxide formulations.

The tape contains microscopic pure metal particles, which are approximately one-tenth the size of conventional oxide materials. Because many smaller particles have a greater total surface area for a given weight, the BET value of the medium is about four times that of conventional tape. The iron particles are deposited on the film base in a super smooth calendering process. The smoothness of the tape yields a 4dB improvement in rubbing noise and modulation noise, both of which eventually affect the carrier-to-noise (C/N) ratio.

Heretofore, the use of iron rather than iron oxide has been stymied by the problem of oxidation, which reduces magnetic performance and increases head wear dramatically. (Several forms of iron oxide exist. Those with desirable magnetic properties are more complex than moisture-induced iron oxide.)

To manufacture this tape, the particles

are triple-coated prior to dispersion in the emulsion. The coating, in conjunction with other processes not common to standard tape manufacture, assures that no oxidation will occur even in the harshest environments.

The metal magnetic material provides a C/N ratio 10dB higher than achieved with typical cobalt ferric oxides. (See Figure 4.) The higher-energy particles have a coercivity about twice that of conventional tape and yield about 8dB more output. (See Figure 5.) A higher coercivity requires higher recording currents to write information onto the tape. These factors, in turn, called for a different alloy head material, because conventional ferrite heads will saturate before the tape material. The structure of the head uses both ferrite and metal alloy materials to minimize electromagnetic losses for maximum performance.

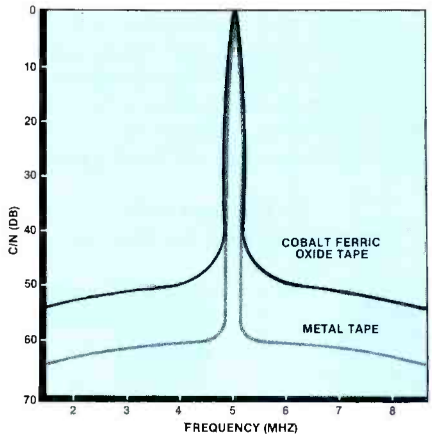

Figure 4. *A comparison of C/N characteristics for metal particle and cobalt-enhanced ferric oxide tapes.*

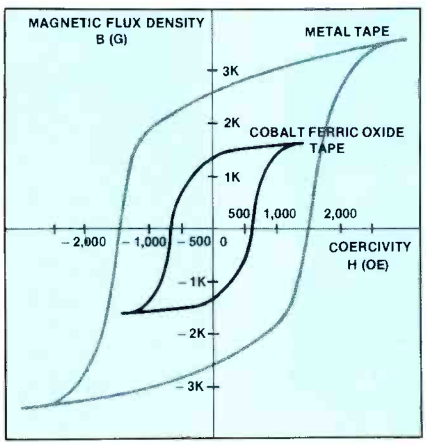

Figure 5. *A comparison of magnetic characteristics for metal particle and cobalt-enhanced ferric oxide tapes.*

In addition to signal performance, the tape and head development have other benefits. The combination of the smooth tape surface and alloy head produces a

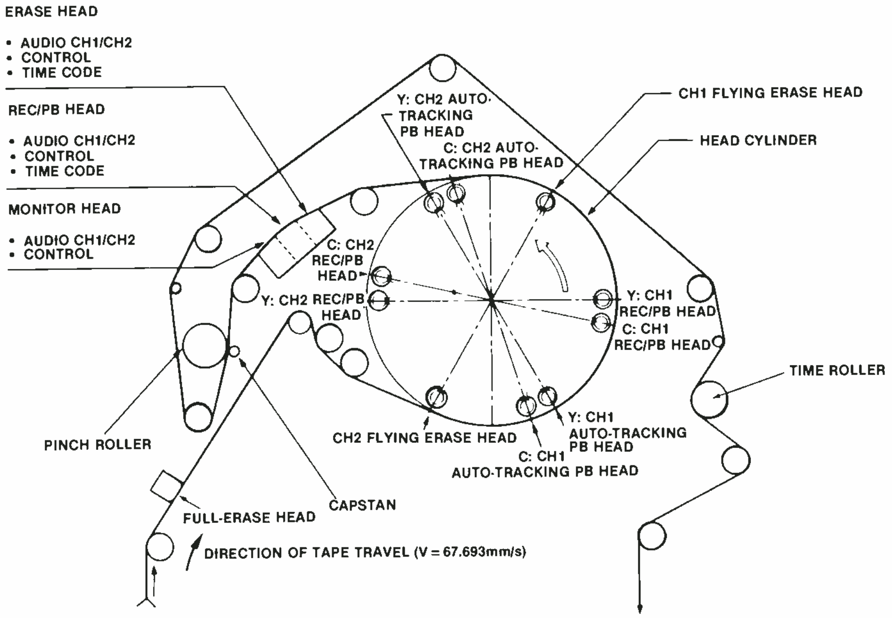

***Figure 6.** The tape path, showing head and guide positions, of the M-II transport.*

system in which only minute amounts of head wear occur. Tests show that head wear of a few microns (nominally three to 10) occurs during the first 500 hours. Then, one to three microns may be expected for every 500 hours thereafter. Therefore, head life can be projected to be as long as or longer than with existing devices.

Secondly, the combination of binder, calendering process and minute particle size yields a tape of high durability and fewer dropouts. For example, the carrier level decreases typically by only 1dB after more than 500 playback passes.

In the tape path

Figure 6 illustrates the tape path and head plan. Note that a large head diameter yields a long video track and a high writing speed. At the same time the physical space within the head allows piezoelectric automatic tracking playback heads. The inclusion of a set of deflectable video heads under microprocessor control allows the playback of usable color video pictures in still and nonstandard forward and reverse tape speeds, a feature found on many type C machines. The same set of heads may provide a video confidence function, if the playback heads follow the active record heads and actually reproduce the signal recorded a fraction of a second earlier.

Final analysis

How does this system fit into the scheme of TV production? A variety of configurations of the equipment is possible. In addition, a number of features have been added to the initial M-II designs for simplified integration into existing TV systems. These configurations and features are not, as such, part of the format, but rather are conveniences for format users. [BE]

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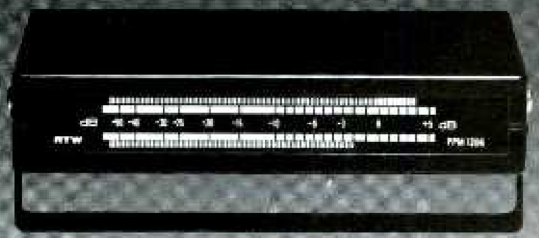

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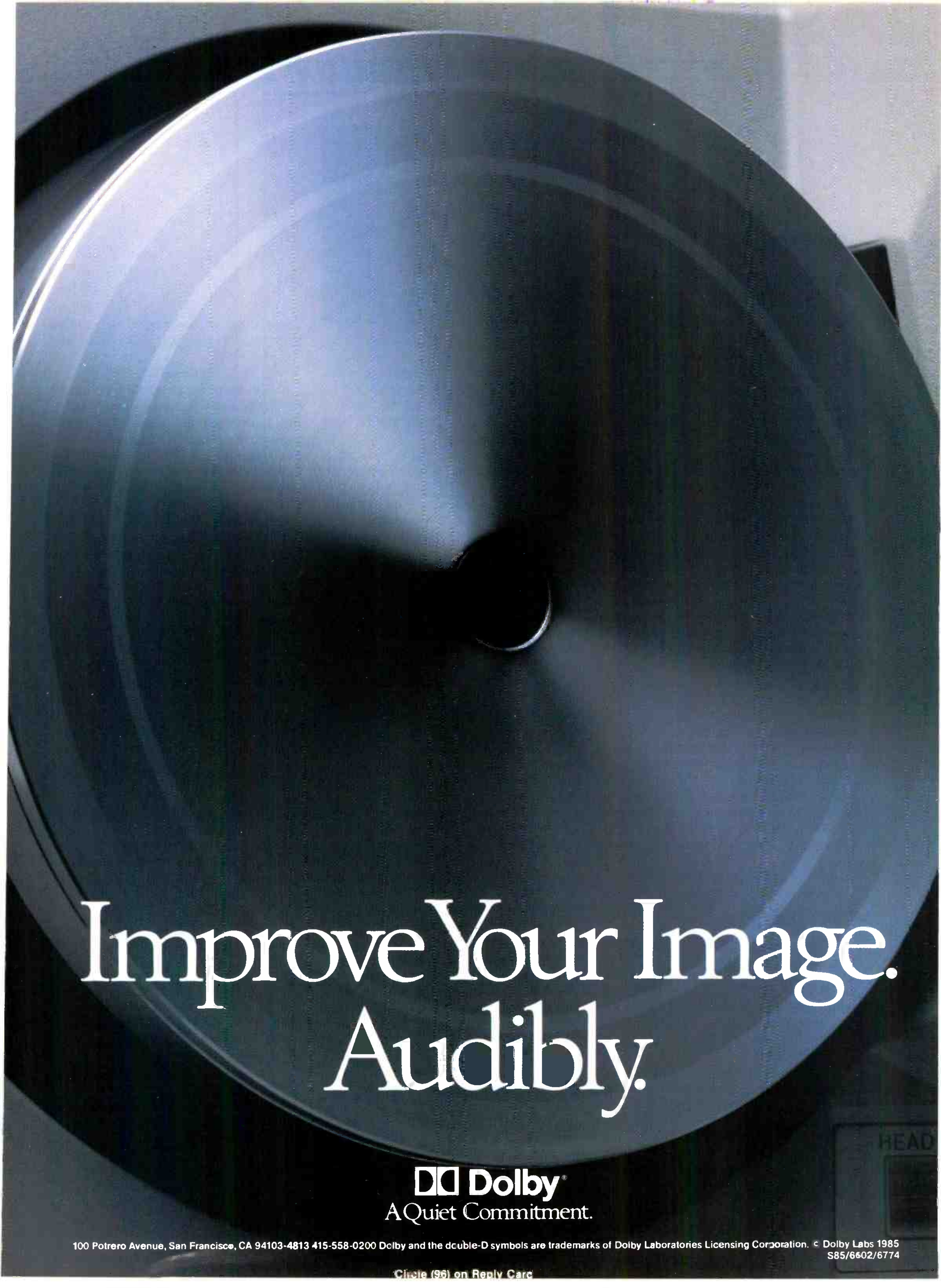
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News

Continued from page 4

record-breaking show held in Los Angeles in 1985. Approximately 900,000 square feet of exhibition space, an additional 50,000 square feet of outdoor exhibit area and more than 100 meeting rooms are available to the conference.

For further information about the conference or other SMPTE-related matters, the society may be reached at: SMPTE, 595 West Hartsdale Avenue, White Plains, NY 10607; telephone 914-761-1100.

NTA seminar planned

The National Translator Association (NTA) has scheduled a seminar to be held at the Capri Plaza from May 1 to 3 in Denver. The seminar will focus on the problems facing translator applicants and operators and information about translator equipment and operations.

NTA, a non-profit organization, is also hoping that it can increase its membership numbers. Interested individuals may contact Darwin Hillberry, president, at the National Translator Association, PO Box 628, Riverton, WY 82501; telephone 307-856-3322. The annual dues are $100.

Anyone interested in attending the seminar should contact NTA and should make reservations at the Capri Plaza; telephone 303-428-5041.

ATS approved for AM DAs

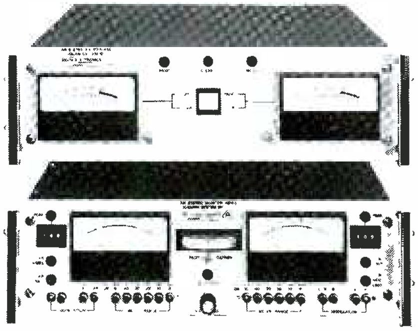
The FCC has authorized the use of automatic transmission systems (ATS) for directional AM stations. ATS operation was previously available for non-directional AM and all-FM stations only.

ATS operation allows the station to use automatic monitoring equipment that detects operating faults and takes corrective action to alleviate the fault. If the fault cannot be corrected within a preset length of time, the equipment must be capable of taking the station off the air.

The new rules do not allow stations to operate unattended, because of international treaty requirements. The operator on duty may leave the premises, however, if a means to close the station is provided. If the operator will be at a location other than the main studio or transmitter site, the FCC must be notified of that location within three days of its first use. If members of the station staff will be at the transmitter or studio, notification is not required.

The ATS installation must be certified as completed by the station chief engineer to the licensee in writing. The licensee then remains fully responsible for the proper operation of the station. If the ATS system does not prevent improper transmitter operation, the licensee is subject to disciplinary action and may not use the ATS system as an excuse.

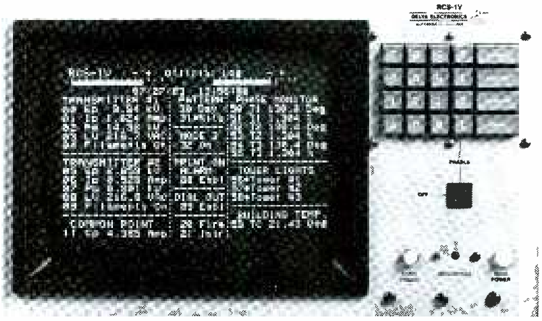
DELTA BROADCAST PRODUCTS



ASE-1/ASM-1

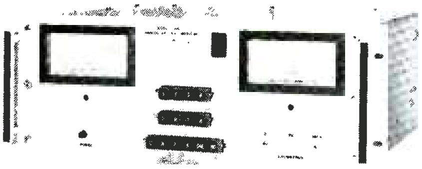
AM Stereo without compromise. The AM Stereo Exciter and Modulation Monitor provides a C-QUAM™ quadrature modulated stereo signal featuring low distortion and channel separation greater than 35 dB throughout the audio spectrum. The ASE-1 generates a signal to produce a phase modulated transmitter carrier. An L + R audio signal AM's this carrier to produce the C-QUAM signal, the only signal completely compatible with all C-QUAM, multimode and envelope detector receivers.

C QUAM is a registered trademark of Motorola Inc



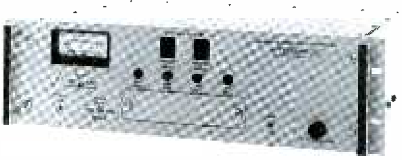
RCS-1V

This Remote Control System calls you when it needs help! The RCS-1 combines microprocessor technology with easy operation. Features include direct interface boards for antenna monitors, patented remote modulation bargraphs, automatic logging, and synthesized speech telephone interface. Additional input and control boards to expand remote control capabilities can be added at any time.



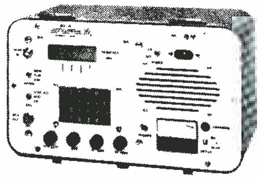
DAM-1/AAM-1

The Digital and Analog Antenna Monitors measure the parameters of directional antenna systems. Readings are: relative current; and current ratio and current phase to a reference antenna. The DAM-1 accepts samples from 12 towers with a ± 1° phase and ± 2% current accuracies displayed on digital readouts. The AAM-1 can monitor up to 8 antennas with ratio and phase measurements displayed on front panel meters.



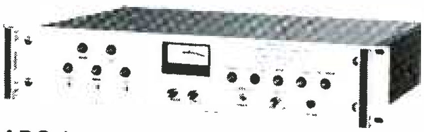
AMC-1/FMC-1

The only modulation control systems which provide a completely closed loop around the transmitter. The Amplitude and Digital Modulation Controllers sample actual modulation levels after the PA output network assures precise adjustment for optimum modulation levels. Both the AMC-1 and FMC-1 keep count of over-modulation bursts for signal control through a linear attenuator.



RG-4

High output Receiver/Generator. The Receiver/Generator combines a two-watt RF output and a correlation detector circuit that virtually eliminates interference problems. The RG-4 operates in the 100 kHz to 30 MHz range. It is designed as the ideal companion instrument for Delta's OIB-1, OIB-2, and OIB-3 impedance bridges.

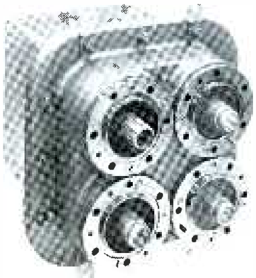


APC-1

Your insurance against over- and under-power operation. The Automatic Power Controller continuously monitors the transmitter output power, making automatic power adjustments via the transmitter loading control. The APC assures proper power levels at all times.

OIB-1/OIB-3/CPB-1

Full power impedance measuring. The Operating Impedance Bridges measure the impedance of radiators, networks and the like while operating under normal power. The OIB-1 measures VSWR and impedance up to 400 ± j300 ohms. The OIB-3 extends the range to 1000 ± j900 ohms, and has an RF amplifier for improved nulling. The Common Point Impedance Bridge is permanently installed for continuous monitoring of the common point during network adjustment. An optional TCA ammeter can be installed in its front panel.



6730E/6740B

Fast, efficient coaxial transfer switches. The coaxial transfer switches are designed to switch transmitters, transmission lines, antennas, dummy loads and auxiliary equipment quickly and easily. Either manually or remotely controlled, the switches are fully interlocked to prevent switching with RF power applied. The 6730E switch uses 1-5/8 inch connectors, the 6740B switch uses 3-1/8 inch connectors.

TCA/TCT

Simplifies antenna current and phase sampling. TCA Ammeter Systems provide accurate, modulation-free current readings on a variety of meter types. Torodial Current Transformers provide current and phase samples, and are available with three output voltage ranges, as well as high voltage models.

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New products

Troubleshooting system

Huntron Instruments has introduced the Tracker 2000 for troubleshooting analog, digital and hybrid devices using power off testing to isolate component failures. It features an improved pulse generator and automation of some manual controls.

Circle (350) on Reply Card

Power amplifier subsystem

Microwave Modules & Devices has introduced a solid-state power amplifier subsystem designed for FM transmitters. The OEM subsystem has 88MHz to 108MHz range, modular construction and has nine 500W amplifier modules using silicon FETs in a one-driving-eight configuration.

The unit is electrically self-protected. The eight thermally, individually packaged transistors are binarily interconnected through three levels of combining, the final combiner using 90° combiners. The subsystem offers 1.5:1 VSWR input and output, improved forward power delivery into a mismatched load, improved back IMD and reduced third harmonic levels.

Circle (351) on Reply Card

Audio connector series

Lemo USA has introduced a connector series capable of 500Vdc and 350Vac at 3A per contact and measuring less than one inch with a ¼-inch diameter. Maximum cable OD is 3mm.

Features include a connect-disconnect, self-latching system; screw-machined precision and gold-plated contacts, with valox insulators. Reliability can be tested for up to 5,000+ mating cycles while withstanding working temperatures of −55°C to 140°C. It also is available in a 2-contact version.

Circle (352) on Reply Card

Cart machine, distribution system

Broadcast Systems has announced the DC-8/EP video cart machine and the BJ-800 stereo audio distribution system.

The DC-8/EP is microprocessor-controlled and has most of the same features as the DC-8 including 2-second preroll, anti-head clogging, auto eject, auto cue recording and balanced +4dBm audio input and outputs.

The BJ-800 stereo audio distribution system consists of eight stereo audio distribution amplifiers prewired through two audio jack panels. All inputs and outputs of distribution amplifiers are normalled through the jack panels. The system occupies 10.5 inches of rack space and is designed to allow conversion to stereo using existing patch bay rack space.

Circle (353) on Reply Card

Time-code reader module

Convergence has introduced the TCR-4 time-code reader module. The reader chip has been modified and attached to a redesigned parallel input-output (PIO-100) board in the 200 series of editing systems. A time-code frame adapter, with four RCA audio inputs, plugs into the back of the electronics control unit and onto the PIO-100 board. Time code may be fed from the output of the VTRs to the edit-controller. A PIO connector is attached to the frame adapter next to the time-code inputs.

Circle (354) on Reply Card

Four-level controllers

Utah Scientific has announced three reprogrammable 4-level control panels for its AVS-1 and AVS-1B routing switchers.

Model CSP-30/4 has 30 button-per-source keys plus breakaway keys and can be expanded to a maximum of 60 sources with the model CX-30 expansion panel.

Model CSP-40/4 allows selection of 40 sources on a button-per-source basis with 20 selection keys and a program select switch. Four-character alphanumeric readouts in addition to the button LEDs provide status indication while breakaway keys permit switching and statusing individual levels.

Model CSP-260/4 provides selection of up to 260 sources, 256 by means of a 16-button keypad plus four direct-take keys. Breakaway keys permit individual or multilevel switching and statusing. Single keystroke switching of sources within each group is provided.

The controllers are reprogrammable as to source names, matrix sizes, matrix levels addressed and output buses controlled. Access to reprogramming is through a dumb terminal connected to an external port on the AVS-1B switcher.

Circle (355) on Reply Card

Machine control switcher

Quanta has introduced the Machine Control, a switcher that works in conjunction with the QCG-300 character generator. Designed for cable TV automatic programming, the switcher accepts up to 10 video and 10 audio inputs. These inputs can then be output in a programmed sequence at any designated time or date. The control switcher handles up to eight VCRs and other video inputs up to 10, including the QCG-300 and routes their outputs to any of four independently controlled channels.

Circle (356) on Reply Card

Digital sequencer

Polyphonic FX Systems has introduced the Polyphonic FX digital sequencer for storage and retrieval of sound effects for audio-video post-production. The software-based system provides a solution for frame-accurate layback of sound effects to SMPTE time code.

The unit is a 16-channel system for simultaneous or sequential playback. The system digitally records any sound and stores it on a hard disc.

The system also can store a list of sound effects in order of occurrence, automatically loading each sound effect prior to the time-code location where it is to be displayed.

Circle (357) on Reply Card

Frequency extender

Kahn Communications has announced a dual-line 50Hz to 5,000Hz frequency extender that incorporates circuitry that eliminates the hollow sound present in some multiline extenders. The gap-proof circuitry makes it possible for two conventional dial lines to provide sound quality with 5kHz telco program lines. The circuitry also eliminates frequency translation errors providing pitch sound transmission. It also has a line failure protection circuit that protects against program interruptions by horns and other crowd sounds that activate the telco hang-up signaling equipment.

Circle (358) on Reply Card

Battery strap

Anton/Bauer has announced the Powerstrap, a multipurpose battery strap designed for use with portable video recorders and low-voltage portable lighting equipment. The design enables the user to mount the strap directly to the existing VTR shoulder strap and can also be worn as a belt for lighting applications. Made of 1000 Denier Cordura, the 4-pound strap is supplied with a 14- to 16-hour charger.

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Distribution amplifier

BGW Systems has announced the model 2242 distribution amplifier. Features include digital performance in a stereo dual one-by-four configuration; eight independent output stages; +27dBm output capability and 50Ω load capability; gain change option and balanced or unbalanced operation; individual gain controls for each output; regulated power supply with toroidal power transformer; and .01% distortion.

Circle (360) on Reply Card

Converter system

Integrated Media Systems has announced the ADA-1000 laboratory reference A/D-D/A converter system for digital audio recording and signal processing applications. The self-contained system can provide up to four channels of A/D and D/A conversion in a 5¼-inch rack cabinet.

The unit is compatible with the AES/SMPTE/EBU/ANSI recommended practice. Features include linear phase filters; multiple emphasis selection; multiple clipping characteristic selection; real time input monitoring for accurate audio comparisons; 16-bit dynamic range; and flat frequency response.

Circle (361) on Reply Card

Pneumatic studio pedestal

Innovative Television Equipment (ITE) has introduced the ITE-P2 lowboy pneumatic studio pedestal, designed to accommodate camera/head loads up to 290 pounds. The unit features a modified Mitchell-type camera mount, a crab and tricycle steering mode and provides a minimum height of 24½ inches to a maximum height of 45½ inches.

Circle (362) on Reply Card

Universal counter-timer

The Apollo, a universal counter-timer from Britain, checks frequencies from 0.1Hz to 100MHz or carries out various event timing operations. Designed for use in measuring frequency, frequency ratio and time interval, the bench-top instrument offers stopwatch, rpm and count modes. They are electrically operated and have an 8-digit LED display.

Full signal-conditioning facilities are provided on both inputs, including x1/10 attenuation, slope control, trigger-level adjustment and switchable low-pass filter. A 10MHz time base provided by a crystal-controlled oscillator, gives temperature stability. An external time base facility is incorporated.

Circle (363) on Reply Card

Power amplifier

QSC Audio Products has introduced the MX-1500 professional power amplifier, which can deliver 750W per channel into a 2Ω load. The dual monaural allows each channel to operate as an independent amplifier. Features include power/protect, clip LED on each channel; active balanced ¼-inch and barrier strip inputs; front-mounted gain controls; ac switch and breakers; and flow-through fan cooling.

Circle (364) on Reply Card

Professional videocassette

Eastman Kodak has introduced an addition to its present videotape line. The professional videocassette (pro format, broadcast high grade) is available in the Beta format in PB5, PB20 and PB30 lengths, as well as in the VHF format in the PV20 length.

Circle (365) on Reply Card

Modification kit

Marcom has introduced the 701 modification kit and the model 730.

The 701 kit enables users to expand applications of the TFT 701/702 modulation monitor. The kit modifies the 701 or 702 to monitor total modulation. It does not affect the accuracy of the units and enables the measurement of total modulation to maintain legal responsibility. The kit consists of a 6-position front panel switch, wiring harness, PC boards and components. Installation time is approximately two hours.

The 730 model is a system consisting of an off-air tunable UHF/VHF/CATV receiver, TV stereo decoder, driving two VU meters and LED peak indicators for left and right channel audio level monitoring. The output is 600Ω balanced for audible monitoring.

Circle (366) on Reply Card

Offset probe

Tentel has developed an offset probe version of the Tentelometer tape tension gauge that can be inserted over a tape, inside a broadcast cart to measure the inherent tape tension of each cartridge. The gauge helps eliminate air time gaps caused by cart failures and can be used with an extra cart machine. The gauge can also be used for holdback and take-up tensions on ¼-inch reel-to-reel recorders.

Circle (367) on Reply Card

Time-code generator/reader

Fast Forward Video has introduced the F-102 time-code generator/reader. Designed for the professional ¾-inch editor, the unit generates and reads non-drop or drop frame SMPTE time code and includes a character inserter for window dubbing. The unit has the capability to generate continuous time code and will also generate time code in a free-run mode, whether an input video signal is present or not.

Circle (368) on Reply Card

Mounting assemblies

Omnimount Systems has introduced additional universal mounting assemblies. Each model has a complement of accessories and tube-bend configurations. Finished shelf units are available in eight standard sizes. The system is described as an isolating polymer ball, bonded to one end of a thick-walled steel tube. A clamp/flange joins with the ball to give the combined unit an infinite number of rotational angles.

Circle (369) on Reply Card

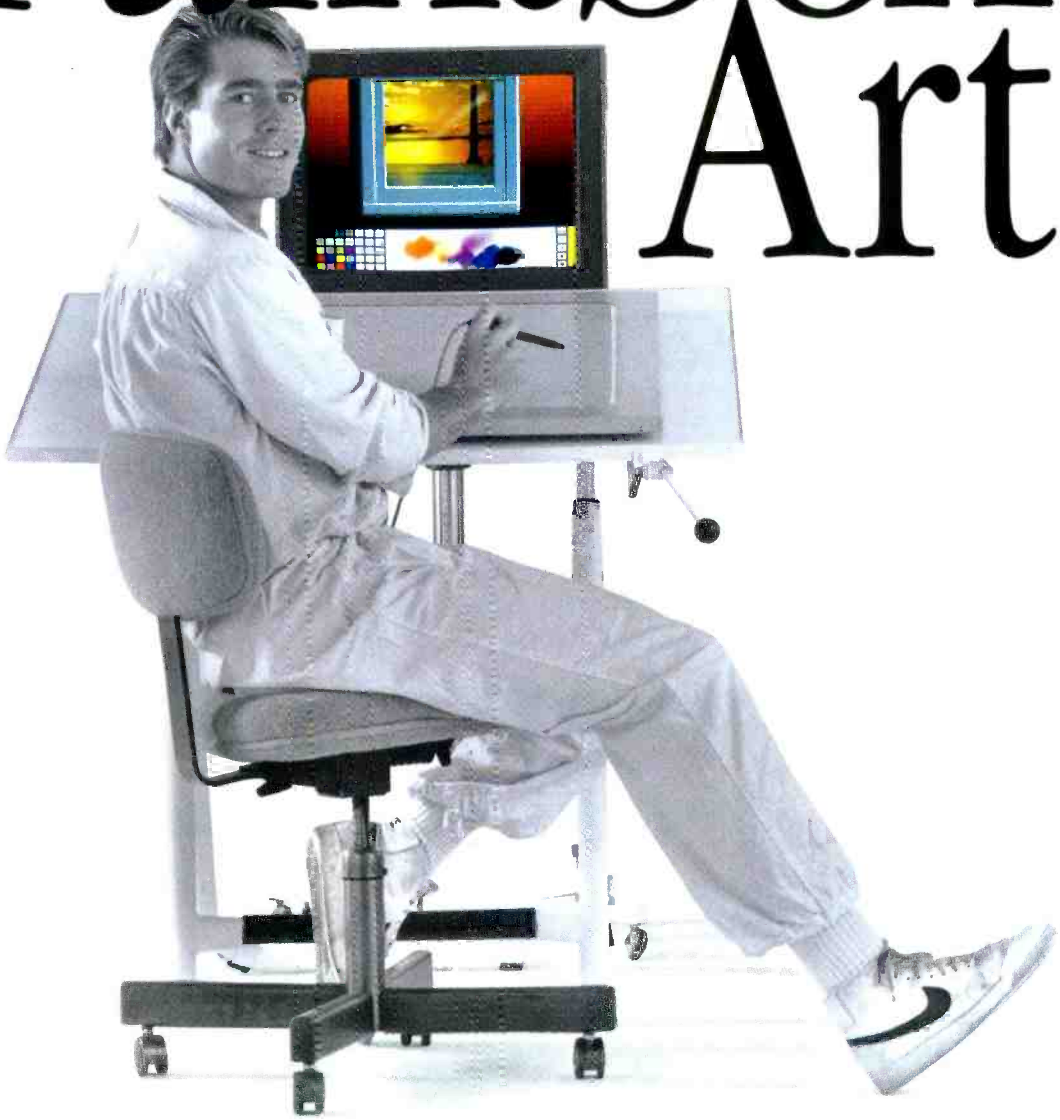
Hand-held BER analyzer

Intelco has introduced the 600 bit-error-rate (BER) analyzer for digital T1/DS1 equipment and systems. More than 25 error measurement and analysis functions are simultaneously performed on T1/DS1 signals, reporting status and results via a custom LCD display. These measurements can be made on frame, bit or BPV data in either D4 framed or unframed conditions, with either AMI or B8ZS coding.

The unit's error receiver automatically detects the bipolar coding scheme and synchronizes on it. The unit also automatically detects and indicates signal loss, frame loss, data sync, all ones, excessive zeros and yellow signal. An external clock input allows the user to apply rates other than 1.544MHz standard.

Circle (370) on Reply Card

Paintbox Art



For the designer and the art director the satisfaction of producing an original television graphic *perfectly* is everything. With the Quantel Paintbox™ you can create images with smoothly rounded curves and natural color mixing—at the same time choosing from a large selection of mediums and brush sizes. You'll never have to live with the "computer" look.

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Step closer to the digital studio

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Oscilloscopes and spectrum analyzers

Hewlett-Packard has introduced the HP8570A and HP8567A spectrum analyzers and the HP5180T/U and HP5183T/U digitizing oscilloscopes.

The 8570A bench-top analyzer covers RF signals from 10MHz to 22GHz. The unit includes a built-in peak-search function and can display the entire preselected 1.7GHz to 22GHz range in a single sweep. Resolution bandwidth, video bandwidth and sweep time are adjusted automatically.

The 8567A RF analyzer has a range from 10kHz to 1.5GHz. Up to four markers can be placed on the display to make simultaneous direct and relative measurements. An FFT function for close-in amplitude modulation, and Gaussian noise power density are measured with built-in functions. The unit can store up to eight 1,001-point traces in RAM and display them simultaneously. A built-in frequency counter provides a tuning accuracy of better than ±4.5kHz at 1,500MHz in a 100kHz span.

The oscilloscopes use automatic test equipment and provide digital waveform storage from which they can process waveform data to supply frequency, rms, volts, peak-to-peak, pulse and frequency spectra measurements. Both scopes feature a high-resolution 2,048 x 2,048 vector display.

Circle (371) on Reply Card

Digital effects system

Grass Valley Group has announced the Kaleidoscope DPM-1 digital effects system. Up to five channel effects may be created with multichannel systems.

The system may be configured to allow assignment of channels among as many as four control positions.

The video processor has 4:2:2 signal path, and the key path has full luminance resolution. NTSC systems include a hybrid, adaptive decoder and the PAL systems use an external decoder.

The unit can select both video and key inputs during an effect and allows selection of two video and two associated key signals in each key frame. The control panel may be mounted in the 300 series production switcher control panel or in a table top mount.

The unit performs translation, rotation, scale and perspective transformations and can accept composite video and analog component R, R−Y, B−Y, RGB and SMPTE/EBU parallel digital component signals. Input types may be mixed, and the input format will be accommodated automatically.

Circle (372) on Reply Card

Memory controller and cool beam light

The Great American Market has announced the ColorQ ColorMax memory controller and the MicroBrute LV9 cool beam 9-light. The ColorQ can cue up to 100 ColorMax cues plus 100 sequences of cues can be recorded and accessed instantly. The controller also may be operated manually for recording, editing and cue execution. The unit can be patched into a primary lighting control console.

The MicroBrute LV9 uses cool beam MR-16 lamps and features high intensity, high-color temperature and long lamp life in a lightweight package. The 12V MR-16 lamps are wired in series and the unit operates off 120V. The unit features three swivel stick lamp housings, a positive locking yoke and will accept any stud from ½-inch to ¾-inches.

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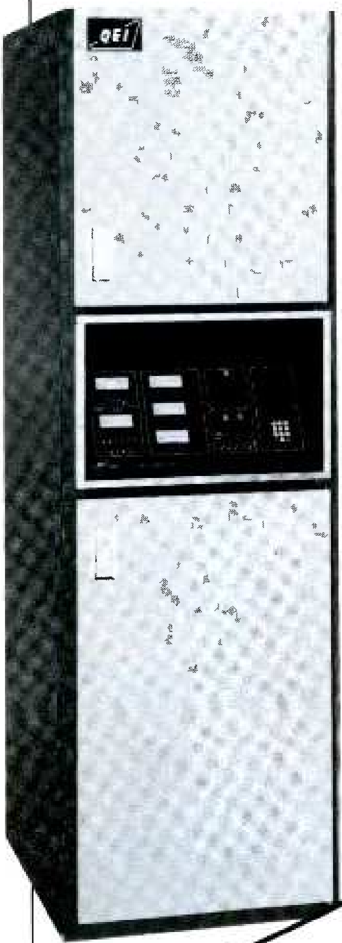

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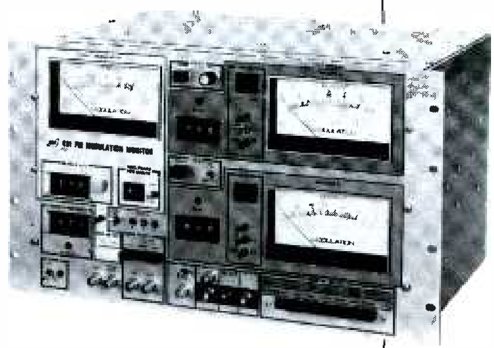

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Mics and equipment

Audio-Technica has announced the ATUS series of microphone stands and booms; and the ATM5R miniature unidirectional fixed-charge condenser microphone.

The ATUS series features floor stands, boom assemblies and combinations. The two floor stands extend from 35 inches to 62 inches in height. The AS500-C is chrome-plated and the AS500-B is matte-black. The bases are diecast metal with fold-out legs. The two boom assemblies extend from 16½ inches to 32 inches. The AB500-C is chrome-plated and the AB500-B is matte-black. The two floor stand/boom combos include the ASB450-C (35 to 62½ inches), chrome-plated stand with a 33-inch single-section boom. The ASB510-B low-profile stand (12½ to 24½ inches) is matte-black.

The ATM5R condenser mic has low impedance (200Ω nominal). The mic will accommodate phantom power from 9V to 52V dc. The mic is 5 1/16-inches long with a head diameter of 1½ inches and a body diameter of 35/64 inches, weighs four ounces and includes a 25-foot cable.

Circle (374) on Reply Card

Loudspeaker intercom station

HM Electronics has introduced the RL742, a 2-channel, rack-mounted loudspeaker intercom station. It is compatible with all HME 700 series products and other 3-wire intercom systems. The unit features simultaneous talk/listen via a headset or handset, an automatic loudspeaker mute function and phantom power, which can be supplied to electret microphones via an internal switch for use with lightweight electret headsets.

Circle (375) on Reply Card

Interconnect line products

Cetec Raymer has added the TSA telephone station access paging adapter; the TAP trunk access paging adapter; and the TRG telephone tone ringing generator to its line of interconnect accessories.

The TSA telephone station access paging adapter allows station access from a PABX, or Centrex CU, to a paging amplifier. Phone-line powered, the unit connects via a standard modular jack to a dedicated station line in place of a telephone instrument.

The TAP trunk access paging adapter provides access to a paging system from Centrex CO, PABX or PBX, using rotary or tone instruments. It operates on 120Vac, 50Hz to 60Hz.

The TRG telephone tone ringing generator produces a bell-like warble tone in cadence with ringing voltage present on the phone line. No other power source is required. Connecting TRG output to an input of a paging system allows speakers to serve as a ringing source in place of mechanical ringers.

Circle (376) on Reply Card

Videocassette line and anti-stat system

3M has introduced a line of master broadcast videocassettes (MBR); a snap cap hanger bar system; and a Scotch anti-stat system.

The MBR line of ¾-inch videocassettes have heavy-duty stabilized backing. The videocassettes also have a control wind back treatment that prevents tape slippage. The Scotch anti-stat system protects the component parts, shell and leader. A color plus oxide formulation produces improved color-noise and signal-to-noise ratios.

Circle (99) on Reply Card

The snap cap hanger bar system stores ½-inch videocassettes storage for Betacart and other multiple-event playback systems. The system has holders made of ABS plastic and can house up to 280 cassettes in a 4'x8' area.

The Scotch anti-stat system minimizes static electricity buildup. The surface treatment is applied to the cassette shell and protects the component parts and leader. There is no interference with the dimension fit or operation of cassette parts. The system operates by rendering the half life of an electrostatic charge so short that plastic parts cannot retain it. The process is permanent for the life of a cassette.

Circle (377) on Reply Card

Audio and video routing switchers

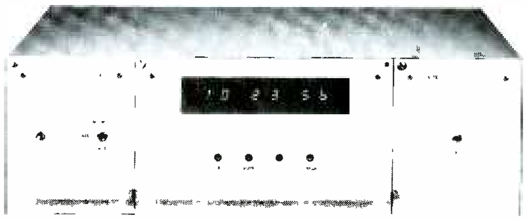
HEDCO has announced the HD-12 and HD50 routing switchers. The HD-12, 12-input, 12-output audio and video switcher series features the HD-12V video switcher housed in a two rack-unit frame with power supply and RS-232/RS-422/RS-485 serial control card. The HD-12A audio frame houses either single 12x12 audio or stereo 12x12 audio.

The HD50 series audio and video routing switchers is based on a 50x20 matrix and is contained in four rack units. It is expandable by inputs or outputs to a maximum size of 500x600. The switcher features a 35MHz bandwidth.

Circle (378) on Reply Card

Signal generator

Rohde & Schwarz has announced the signal generator SMG, a synthesizer with universal sweep capabilities, low-noise signal source, crystal-reference signals in the range from 0.1 to 1,000MHz with 1Hz resolution and output level adjustable between −137dBm and +13dBm in steps of 0.1dB.



High frequency stability and resolution, low residual FM (<1Hz at 250MHz) and sweep operation with phase-continuous frequency changes permit measurements on narrowband test items and SSB receivers. The generator offers AM, FM, PM, pulse and FSK modulation with versatile test capabilities.

Circle (379) on Reply Card

Eraser/splice locator

International Tapetronics Corporation/3M has introduced the ESL V eraser/splice locator, which eliminates manually bulk erasing cartridges and visually locating tape splices. The microprocessor-controlled locator may be used with NAB type A and AA cartridges, including conventional formulation tapes and high output, low noise tapes. The locator provides erasure and 1-step 30ips splice locating. Individual erase or splice locate functions may also be selected.

Circle (380) on Reply Card

Uninterruptible power system

Nova Electric has announced its 3kVA MinTaur uninterruptible power system with batteries and one-quarter cycle transfer switch in a 14-inch high module. Rated at 3kVA, the unit can operate at 150% of rating for short time periods. For high-inrush type loads the system can provide up to 10 times overload through automatic operation of the static transfer switch which returns to normal operation automatically when the overload condition has been overcome and the load is within the system's designed power capability.

Circle (381) on Reply Card

Portable distribution center

Union Connector has introduced a 12,000W portable distribution center. The 100A single phase input supplies six 20A and one 60A breaker-protected circuits. The 20A circuits are available with stage pin, U ground and twist-lock receptacles. The 60A output can be used to feed downstream to smaller amperage outputs. All circuits have indicator lights to monitor activity.

Circle (382) on Reply Card

Digital time base corrector

JVC Company of America has announced the SA-T100U digital time base corrector. It features 8-bit digital sampling at a rate of four times the subcarrier frequency plus comb filter for improved resolution and S/N ratio.

The unit offers full-frame memory with freeze-frame and field functions. Included is an RS-170A sync signal generator for system timing, a gen-lock function, adjustable vertical blanking, built-in dropout compensator and subcarrier feedback, and it can be used during playback for tape duplication.

The unit contains a built-in processing amplifier. It also is compatible with VCRs that have only external sync inputs.

Circle (383) on Reply Card

Power supply

B&K Precision has introduced the 1610 dc power supply model with a 0V to 30V, 1Adc power supply with regulation and low ripple characteristics. The unit features regulated outputs for volts and amps; built-in metering; two current ranges for full or half output; pre-regulator to limit internal dissipation; isolated output so either polarity may be floated

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or grounded; and reverse polarity protection to prevent damage to power supply from external voltage of reverse polarity.

The unit also has fully adjustable current limiting (from 5% to 100% of maximum output current) protects circuit under test and power supply. The unit can be hooked up in series or parallel with another model 1610 for 0V to 30V, 2A, or 0V to 60V, 1A operation.

Circle (384) on Reply Card

Broadcast transmitter remote control

Gentner RF products division has introduced the VRC-1000 voice remote control. It operates on a standard dial-up telephone line. Features include voice synthesis and optional digital data reporting; fully automatic transmitter operation with 116 possible functions; automatic alarm reporting to multiple locations; 16 metering channels, each with four tolerance limits; 16 status channels; and 32 command outputs, momentary or latching; and user-defined access codes.

Circle (385) on Reply Card

Recorder carrying case

K and H Products has announced the Porta-Brace carrying case for the Sony BVU-150 recorder. The case features a see-through top cover, top construction that keeps its shape around access openings; a cassette access door secured with a zipper to eliminate sag; and a zipper around the bottom of the case to facilitate loading. Other features include cable holders, two front pockets, microphone holster, leather handle, waist belt sleave and two pen pockets.

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REMOTE TRUCK: 1979 12' Dodge Cube, Air Conditioner, 2 IKE 350's, 2 Fluid Head Tripods, Panasonic 4600 Switcher, WFM, Vectorscope, 6-5" B&W's, Tapco 6x2 Mixer, 110 or 220 Power, Multi Conductor Video & Audio Snake, Any Reasonable Offer, Video Productions, South Portland, Maine. (207) 774-4480. 4-86-1t

WELL-MAINTAINED OLDIES BUT GOODIES: Skypans w/Pantagraph; RCA TK-44s w/spares; RCA TR-70s; RCA TPR-10 VTRs; RCA TK-760, 76B, 76s; RCA FM Ant., 14 Bay 102.9 MHz; RCA TK-22 B&W Camera; RCA TFU 46K Ch. 44 Ant.; RCA TCR-100s w/extras; Sony BVU-110 ¾" VTRs w/extras; RCA TR-60s. Contact George Merrill or John Reinfeld at (612) 646-5555. 4-86-1t

MICROTIME GENESIS-1 digital special-effects system. Brand new with warranty. New factory-warranty Hitachi CM-182 broadcast color monitors. New, guaranteed EECO timecode generator. Acoustic Research AR-3 loudspeakers. Sacrifice. SounDesign, Box 921, Beverly Hills 90213. 4-86-1t

CAMERA SALE: 2 Panasonic AK920 color cameras, 3 tube Plumbicon Canon 15-150mm with 2 extenders & filter wheel, manual zoom lens, RCU's with 50 feet Multi core cable, Quick set counter balanced pedestals. Also: 2 Hitachi FPC 1007P color cameras, 3 tube Plumbicon Fujinon 16-160mm manual zoom lens, CCU;'s with Multi core cable, Gibraltar 6450 bases. Call (301) 363-6413. 4-86-1t

WANTED TO BUY

WANTED: Pre-1923 radio equipment and tubes. August J. Link, Surcom Associates, 305 Wisconsin Ave., Oceanside, CA 92054, (619) 722-6162. 3-76-tf

HIGHEST PRICES for 112 Phase Monitors, vacuum capacitors and clean, one kw or greater powered AM and FM Transmitters. All duty and transportation paid. Surplus Equipment Sales, 2 Throncliffe Park Dr., Unit 28, Toronto, Canada M4H 1H2, 416-421-5631. 3-86-tfn

EMPLOYMENT OPPORTUNITIES

10,000 RADIO AND TV JOBS a year for men and women are listed in the American Radio job market weekly paper. Up to 300 every week. Engineers, DJs, Newspeople, Program Directors, Production, Sales. All markets, all formats. One week computer list, $6.00. Special bonus 6 weeks, $14.95. You save $21.00. American Radio Job Market, Dept. 3, 1553 North Eastern, Las Vegas, Nevada 89101. 7-84-tfn

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HELP WANTED

ASSISTANT CHIEF ENGINEER FOR FACILITIES: KRON-TV in San Francisco seeks an Assistant Chief Engineer for Facilities in the Engineering department. Individual will be responsible for all station facilities including building maintenance, remodeling projects, and new facility planning. The person will also be responsible for planning and project management for a new broadcast facility in San Francisco. Candidates must have construction management experience and be familiar with all phases of television engineering operations. Send resume to Human Resources, P.O. Box 3412, San Francisco, CA 94119. KRON-TV is an equal opportunity employer. 4-86-1t

IMMEDIATE OPENING for qualified maintenance engineer. Must have minimum of 2 years studio maintenance experience, and FCC license. RF experience a plus. Send resume to: KNMZ-TV, P.O. Box 580, Santa Fe, New Mexico 87501. Attn.: Director of Engineering. 2-86-3t

TELEVISION ENGINEER: Major corporation has immediate opening for an experienced TV Engineer to design, install and repair state-of-the-art color television studio and field equipment. Candidate must be able to troubleshoot both analog and digital communication equipment. Experience with C and KU satellite systems a plus. Minimum requirements are a BSEE or related degree. Should have a minimum of five years experience in television operation, installation and maintenance. Send resume including salary requirement to: PACIFIC BELL, 140 NEW MONTGOMERY, RM. 508, DEPT. MM, SAN FRANCISCO, CALIF. 94104. Women and minorities are encouraged to apply. 4-86-1t

REGIONAL SALES MANAGER: A TBC manufacturer seeks Sales Manager in New York and Los Angeles area. Sales experience or technical background in TBC is needed. Please contact: Hotronic, Inc., 1210 S. Bascom Ave., #128, San Jose, CA 95128, (408) 292-1176. 4-86-1t

TELEVISION BROADCAST FIELD ENGINEER

TV transmitter systems manufacturer has several immediate openings for the permanent position of engineer/technician within a growing field operations department. Experience with UHF TV transmitters using klystrons preferred. Domestic and some foreign travel will be required. Salary commensurate with prior experience. Send resume to:
Comark Communications, Inc.
P.O. Box 229
Southwick, MA 01077
ATTN: Engineering Manager

MASTER CONTROL/VIDEOTAPE OPERATOR needed for UHF PBS station. Minimum two years experience in operations. Additional experience in studio and/or transmitter maintenance preferred. FCC General Operators License. Union position, competitive salary, benefits. Send resume, references, salary requirements. Personnel, KCPT/19, 125 E. 31st Street, Kansas City, Missouri 64108. (816) 756-3580. Equal Opportunity Employer. 4-86-1t

MANAGER OF RADIO OPERATIONS: WNYC has recently completed the construction of new radio facilities in its lower Manhattan location which are state of the art. We are presently looking for a Manager of Radio Operations to join a strong management team in maintaining and utilizing this facility to its full capacity. The responsibilities will include: directing, training and supervising less experienced technical personnel in a total preventative maintenance program, acting as second in command of Engineering Department and hands-on maintenance of radio broadcast equipment. Requirements include: at least five years experience in the full range of radio broadcast engineering duties including mixing consoles, recorders, turntables, transmitters, etc., two years experience at a managerial or supervisory level, a BSEE or related degree, a valid driver's license and a First or General Class license. Salary will be $33,000 to $38,000 commensurate with experience. If interested, please submit resume and cover letter to Personnel Directory—WNYC, 1 Centre St.—32nd Floor, N.Y., N.Y. 10007. EOE. No phone calls please. Please indicate position on envelope. 4-86-1t

MAINTENANCE ENGINEER: San Jose, CA ABC net affiliate has a current opening. Applicants must possess a strong state of the art broadcast maintenance background. Experience working with some of the following equipment preferred: GVG-300, 1600-7K, & automated MC switchers, HK-322, HL-95 cameras, 1", 2", ¾", & ACR-25B videotape machines, ADO and the latest Sony ENG equipment. Excellent salary with paid medical, dental, retirement, plus. Send resume salary history to Dick Swank, C.E., KNTV, 645 Park Ave., San Jose, CA 95110 (408) 286-1111. KNTV is an E.O.E. 4-86-1t

BROADCAST ENGINEER: WBGO-FM/JAZZ 88 has an opening to perform studio equipment repair and maintenance in new facility, assist in remote music recordings, and undertake special projects. Send resume to: Robert Ottenhoff, WBGO, 54 Park Place, Newark, New Jersey 07102. 4-86-1t

AM RADIO MULTI CABLE SYSTEM needs engineer. Broadcast, studio, transmitter and cable TV experience. Good salary, profit sharing, paid benefits. 213-384-1575. 3-86-2t

HELP WANTED (CONT.)

ASSISTANT CHIEF ENGINEER: Major market PBS affiliate has opening for A.C.E. Familiarity with studio and VHF transmitter necessary. Excellent salary, excellent benefits. Chicago residency required. Send resume to Chief Engineer, WYCC-TV, 7500 S. Pulaski Rd., Chicago, Illinois 60652. City Colleges of Chicago is an Equal Opportunity Employer. 2-86-3t

TELEVISION MAINTENANCE ENGINEER: One of the nation's leading television production centers seeks qualified Maintenance Engineer with strong electronics background. Thorough knowledge of television camera, VTR, switching, audio, digital effects, computer editing and terminal systems. Secure future with tremendous growth potential for right candidate. Send resume to: Scene Three, Inc., 1813 8th Avenue South, Nashville, TN 37203, Attn: Mike Arnold. 3-86-2t

MAINTENANCE ENGINEER FOR KTVK-TV: Requires two years maintenance experience on state of the art production equipment. Send resume or call Bill Lawrence, Box 5068, Phoenix, AZ 85010 602-263-3356. 3-86-4t

MAINTENANCE TECHNICIAN—KRIV-TV, Houston, is seeking qualified studio and transmitter technicians. Must have minimum of three years experience and a FCC license. Send resume to: KRIV-TV, P.O. Box 22810, Houston, Tx. 77227. Attn: Wendell Wyborny VP/CE. E.O.E. 3-86-2t

TELEVISION/HELP WANTED ASSISTANT CHIEF ENGINEER. Supervise day to day technical operation. Must have two years technical school or equivalent, five years engineering supervisory experience in commercial Television Station. Must have excellent skills in theory and maintenance of broadcast studio and transmitter equipment. Resume to: John Simmons, Chief Engineer WRBL, Box 270, Columbus, Georgia. 31994—EOE. 4-86-1t

E.J. STEWART has an opening for an experienced maintenance person. Qualified applicant should have working knowledge of Sony 1" and ¾" VTR'S, MIRAGE, BOSCH CCD FILM CHAIN, RCA TK-47 CAMERAS, GVG SWITCHERS. Send resume to Eric R. Address. E.J. Stewart, Inc., 525 Mildred Avenue, Primos, PA 19018 (215) 626-6500. EOE/MF. 4--86-2t

WANTED FOR MAJOR REMOTE PRODUCTION COMPANY—REMOTE UNIT SUPERVISOR. DUTIES: Coordinate the maintenance and operation of a 45' Remote Truck. EIC on remote productions, work with clients before and during contracted productions, perform maintenance on television equipment. **REMOTE UNIT MAINTENANCE SUPERVISOR**—DUTIES: Maintain all television equipment on 45' Remote Truck, must be fully versed in the maintenance of the following equipment: Ampex tapemachines, Grass Valley switchers and terminal equipment, Chyron CG's, Ikegami cameras. REQUIREMENTS: 4-6 years experience, First Class License or equivalent. Must be willing to travel. CONTACT: Director of Finance, WYES-TV, P.O. Box 24026, New Orleans, LA 70185. NO CALLS PLEASE! Deadline April 3, 1986. 4-86-1t

TELEVISION TRANSMITTER SUPERVISOR: We have an immediate opening for an experienced transmitter engineer with a minimum of 5 years of fulltime VHF TV experience. A thorough knowledge of RF systems, audio, video and microwave as applied to television broadcasting is required. This is a hands-on position. You must be able to troubleshoot equipment to component level. First or General Class FCC radio/telephone license is preferred. We offer an excellent starting salary and a full range of company benefits. Send resume in confidence to: Larry Pozzi, KMGH, P.O. Box 5007, Denver, CO 80217. Equal opportunity employer, M/F. 4-86-1t

CHIEF ENGINEER. FOR AM PUBLIC RADIO STATION IN SOUTH CENTRAL ALASKA. Responsibilities: studio, transmitter, satellite receiving equipment. Oversees move to new AM tower and 10KW transmitter this fall. 3 years broadcast engineering experience and proficiency equivalent to FCC 1st class required. AM experience preferred. Sick leave, vacation, insurance benefits. Salary: 24,000-29,000 adjusted DOE, AA/EOE. Open until filled. Send resume to KBBI-AM, 215 E. Main Court, Homer, Alaska 99603. 4-86-1t

TELEVISION HELP WANTED—TECHNICAL: Expanding production facility in TAMPA, FLORIDA with multi-format edit suites has a need for a quality-oriented Chief Engineer with good design and maintenance skills. Competitive salary with excellent benefits. Contact Larry R. Hart, General Manager, Florida Production Center, 4010 N. Nebraska Avenue, Tampa, Florida, 33603. (813) 237-1200 or 1-800-237-4490 outside Florida. 4-86-1t

AMEK announces the "soft" solution.

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And, in keeping with the **APC** concept, **AMEK** has introduced the **BCII,** a cost-effective open architecture console system for all broadcast or production applications, featuring audio-follows-video capabilities. The **AMEK BCII** is customizable for your operation, yet is totally user reconfigurable.

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